

**THE SURVIVAL OF THAI SUGAR
PRODUCERS AND STAKEHOLDERS IN
THE WAKE OF WTO-ENFORCED
CHANGES TO THE THAI SUGAR
REGIME**

**Thesis submitted for the degree of Doctor of Philosophy
in Agricultural, Environmental and Food Economics**

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Declaration

I confirm that this thesis is my own work and the use of all material from other sources has been properly and fully acknowledged.

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Abstract

Thailand has become the world's fourth largest sugar cane producer and second largest exporter. While there have been a number of drivers of this growth, the primary driver has been wide-ranging government support measures. In 2016, Brazil filed a request with the WTO for consultations with Thailand regarding alleged breaches of WTO rules by the subsidy regime applicable to Thai sugar sector. In an effort to avoid being challenged at the WTO, the Thai government has initiated a process of policy reform, as part of a broader industry restructuring, to bring the sector up-to-date with developments in the international sugar market. While the impacts of large-scale policy reform of the Thai sugar regime are likely to be significant, to date there have been very few empirical studies of potential impacts. This thesis attempts to address this research gap by investigating the likely responses of both cane producers and millers to a suite of alternative policy regimes.

Three reform scenarios were designed in consultation with policy makers and academics working in the cane sector. Scenario 1 captures the current Thai 'government proposal' for policy reform. This scenario removes certain domestic production subsidies but seeks to maintain as much support as is permissible under current WTO rules. Scenario 2, the 'protectionism' scenario, maintains all existing internal market producer supports, but otherwise complies with international (WTO) commitments. Scenario 3, the 'libertarian scenario' removes all production support and market interventions. These three policy scenarios overlap to some degree, i.e., they include specific policy instruments that were deemed by the majority of stakeholders to be essential for the survival of the Thai cane sector. These policy instruments are labelled as the non-discriminatory group, and include cheap loans, revenue-sharing (between producers and millers) and sugar market allocation systems. A discriminatory group of policy instruments varied between at least two of the scenarios. These policy instruments were domestic sugar price and cane price support measures, direct payment to farmers, and import regulations. A Priori, it was anticipated that the most important driver of producer behaviour under all of the scenarios would be producer price of cane. The cane price is obviously highest under the Protectionism scenario, and lowest under the Libertarian scenario.

To test cane producer responses to the policy regimes a survey was carried out through face-to-face interview using a structured questionnaire. Quota sampling was used in sample selection based on a farm size and region stratification. The resulting sample was divided into three balanced sub-groups of approx. 150 farms each on the basis of farm size and one of the three policy scenarios was presented to 50 farms in each of these size sub-groups. As a means to understanding the drivers and barriers to farmers continuing in cane production, the Theory of

Planned Behaviour (TPB) was used as a conceptual framework along with a large number of socio-economic factors in a two-stage ordered probit regression modelling exercise. The expectancy-value approach was used to determine changes in cane production area and output volumes produced by active producers under each of the three scenarios. The study demonstrated that farmers across all size groups and regions are less likely to continue in cane production under the 'libertarian' scenario than the other two scenarios. All three TPB dimensions were found to be significant determinants of intention to continue producing cane for all scenarios, implying that farmer's intentions are influenced by (a) their attitudes towards the policy regime (beliefs about the impact of policy on their farm), social pressure, and their belief in their own ability to successfully farm cane under the new sugar regimes. However, the dominant determinants of farmers' intention to remain in cane production were demographic and socio-economic factors. It is somewhat surprising that no demographic and socio-economic variables were found to be significant determinants on intention in all three scenarios. This result may be explained by the fact that as the scale of revenue losses increases, new factors become important in determining intention. The findings from expectancy-value modelling demonstrated that, under conditions of policy reform, Thai cane farmers would make binary choices about future cane production, i.e., to either remain in production, or quit altogether, but rarely contemplate varying their production area. The libertarian scenario is likely to result in the greatest losses in terms of both cane production volume and number of farmers producing cane. Those least likely to quit cane farming were the larger farmers and those most specialized in cane production. Therefore, if the government hopes to sustain cane production volumes, they need to maintain the number of cane producers through policies that encourage efficiency improvement, through either specialization in cane production. However, if the government goal is just to maintain the number of active cane farmers, then partial diversification or provision of off-farm income opportunities become alternative options (to prevent loss of producers from farming) depending on each farm's agronomic factors. Government will also need to provide more reassurance to farmers that they can offset the removal of direct government supports with indirect supports, in the form of technical training and advisory services, as well as access to low-cost loans. Further reassurance can be offered that there will be a transition period during which direct support will be only gradually withdrawn, to allow for adjustment and the arrival of the more sustainable and long-term benefits resulting from structural enhancements. Effort should also be directed at increasing level of knowledge transfer to farmers through peer-led support groups.

The response of cane millers to the three policy scenarios, which included the farmer responses, was assessed by means of a questionnaire-based survey of over 67% of all Thai sugar millers. This survey demonstrated that, overall, the majority of millers prefer the 'protectionism'

scenario, which they believed would not cause negative impact to their business. The majority millers believed that the ‘libertarian’ scenario would be highly detrimental to their sugar business, as they would be unable to compete with leading rivals. However, about 60% of millers said they would remain in business even under this scenario because of: (i) the need to service existing bank debt; (ii) or by realizing efficiency gains through increased investment. About 10% would close down their business and a few would reduce the scale of sugar production. More than 75% of millers believed that their business could operate very well under the ‘protectionism’ scenario, with many indicating they would increase the scale of production. To investigate the impact of existing levels of competitiveness on the attitudes of millers to the reforms, a company competitiveness index was constructed. As expected, it was the millers achieving the very highest competitiveness rank scores that were most likely to support the ‘libertarian’ scenario, believing they can take market share from rivals. From this it is obvious that if the government wishes to prevent the milling sector from becoming oligopolistic, the ‘libertarian’ scenario should not be promoted.

An obvious conclusion arising from this study is that any type of reform of the policy regime is going to drive dramatic change for the majority of Thai cane farmers, but the degree of impact will be uneven. This thesis addresses the gap in empirical research on the Thai sugar industry in the context of policy reforms and therefore will be very useful for informing future Thai sugar policy formulation. Farmers and millers can also use the results from this research to help manage their business strategy if they know which policy is going to be undertaken. As a result, it will be possible to point out the survival options for farmers and millers to policymakers and stakeholders to maintain the competitiveness of the Thai sugar sector and, perhaps remain a major player in the world sugar market, even if there is an enforced change in policy regime.

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List of Abbreviations and Acronyms

AEC:	ASEAN Economic Community
AMS:	Aggregate Measurement of Support
AoA:	Agreement on Agriculture
ASEAN:	Association of Southeast Asian nations
BAAC:	Bank for Agriculture and Agricultural Cooperatives
CCS:	Commercial Cane Sugar
CSFs:	Critical success factors
ERT:	Extraction rate
EU:	The European Union
FRP:	The Fair and Remunerative Price
GAIN:	The Global Agriculture Information Network
IQR:	Interquartile range
Kg:	Kilogram
LB or lb:	Pound or pound-mass
MT:	Metric ton
OCSB:	The Office of the Cane and Sugar Board (Thailand)
OCSF:	The Office of Cane and Sugar Fund
OECD:	The Organisation for Economic Co-operation and Development
PSE:	Producer Support Estimate
R&D:	Research and Development
SAPs:	State Advisory Prices
TAFTA:	Thailand-Australia Free Trade Agreement
TCSC:	The Thai Cane and Sugar Co.,Ltd

ToRA:	Theory of Reasoned Action
TPB:	Theory of Planned Behaviour
TRQs:	Tariff rate quotas
TSMC:	The Thai Sugar Millers Corporation Limited
URAA:	The Uruguay Round Agreements Act
USD:	US Dollar
USDA:	United States Department of Agriculture
WTO:	The World Trade Organization

Chapter 1

Introduction

1.1 General background

1.1.1 Global sugar production

For decades, sugar has been one of the world’s most traded commodities. Sugar is derived from two key crops: sugarcane and sugar beets which are grown in different climates. Nearly 80% of world’s sugar is supplied from sugarcane which is grown in tropical and sub-tropical climate zones such as Brazil, Thailand, Australia, and parts of Asia-Pacific. The list of world leading sugarcane producing countries is shown in Figure 1.1. The remaining 20% comes from sugar beet which is grown mainly in temperate zones such as in the EU, and parts of the United States, and China.

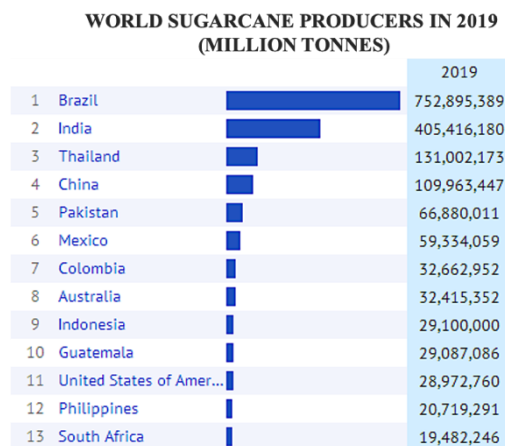


Figure 1.1 Sugarcane producing countries (Knoema, 2019)

Currently, sugar is produced in over 120 countries. In 2020/2021 crop year, global sugar production was approximately 179 million tonnes and is estimated to reach 186 million tonnes for 2021/2022 crop year (USDA Foreign Agricultural Service, 2021). Table 1.1 provides global statistics on sugar production. Global sugar production and trade is dominated by few influential countries, such as Brazil, India, the EU, Thailand, China, and the US. As shown in Table 1.1, the top ten sugar producing countries accounted for nearly 80% of global output.

The average volume of sugar traded internationally during MY2016/17-MY 2021/22 is 61.2 million tonnes. The top 3 sugar exporters are Brazil, Thailand and India which are accounted for 60% of total volume of sugar traded. As regards imports, the major sugar importers are China,

Indonesia, Bangladesh, and the US. Figure 1.2 presents the world major sugar exporters and major importers.

Table 1.1 Global statistics on sugar production (Source USDA (2021))

	2016/17	2017/18	2018/19	2019/20	2020/21	May 2021/22
Production						
Brazil	39,150	38,870	29,500	30,300	42,050	39,920
India	22,200	34,309	34,300	28,900	33,760	34,700
European Union	15,505	19,508	16,750	16,556	14,717	15,800
Thailand	10,033	14,710	14,581	8,294	7,570	10,603
China	9,300	10,300	10,760	10,400	10,500	10,600
United States	8,137	8,430	8,164	7,392	8,436	8,446
Pakistan	6,825	7,225	5,270	5,400	6,010	6,840
Mexico	6,314	6,371	6,812	5,596	6,175	6,158
Russia	6,200	6,560	6,080	7,800	5,750	6,100
Australia	5,100	4,480	4,725	4,285	4,335	4,400
Egypt	2,270	2,320	2,405	2,740	2,780	2,855
Turkey	2,500	2,500	2,700	2,750	2,800	2,800
Guatemala	2,719	2,865	2,966	2,764	2,622	2,700
Colombia	2,300	2,500	2,400	2,350	2,220	2,400
Indonesia	2,050	2,100	2,200	2,250	2,130	2,200
South Africa	1,607	2,064	2,257	2,295	2,106	2,174
Philippines	2,500	2,100	2,100	2,150	2,100	2,100
Iran	1,770	2,190	1,575	1,180	1,750	1,950
Argentina	2,050	1,870	1,570	1,750	1,830	1,550
Ukraine	2,156	2,180	1,753	1,638	1,134	1,399
Peru	1,238	1,080	1,262	1,197	1,265	1,300
Cuba	1,800	1,100	1,300	1,200	900	1,100
United Kingdom	897	1,364	1,133	1,191	900	1,000
Vietnam	1,520	1,540	1,300	850	810	890
Japan	720	830	780	820	800	830
Other	15,277	14,827	14,525	14,237	14,405	14,722
Total	172,138	194,193	179,168	166,285	179,855	185,537

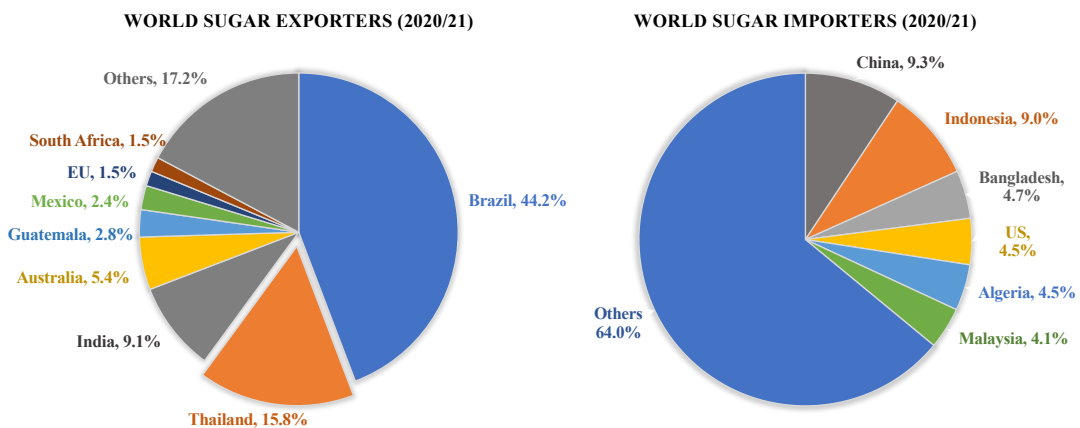


Figure 1.2 World major sugar exporters and importers (Source USDA,2021)

1.1.2 The Thai sugar sector

Thailand's economy has historically relied heavily on its agricultural sector. Thailand is one of the major agricultural exporters in the global market. Exports of sugar, rice, rubber, and prawns generate a huge amount of income for the country. Sugarcane is important for the Thai economy as a raw material for sugar production for both domestic consumption and export, bringing significant revenues into the country each year.

At present, Thailand is the world's fourth largest sugar cane producer and second largest exporter, as shown in Figure 1.2. With over 430,000 cane farming households, total cane and sugar productions in 2017/18 was around 134.9 million tonnes and 14.7 million tonnes, respectively. According to the Bank of Thailand database, during 2016-2020, on average, the value of Thai sugar was around 89,490 million baht (1,942 million GBP), representing 17 % of processed agricultural processing sector's contribution to GDP (BOT, 2020). The total revenue generated annually from sugar and other related businesses is around 250,000 million baht, representing, 21% of GDP in the agricultural sector (Preecha et al., 2017).

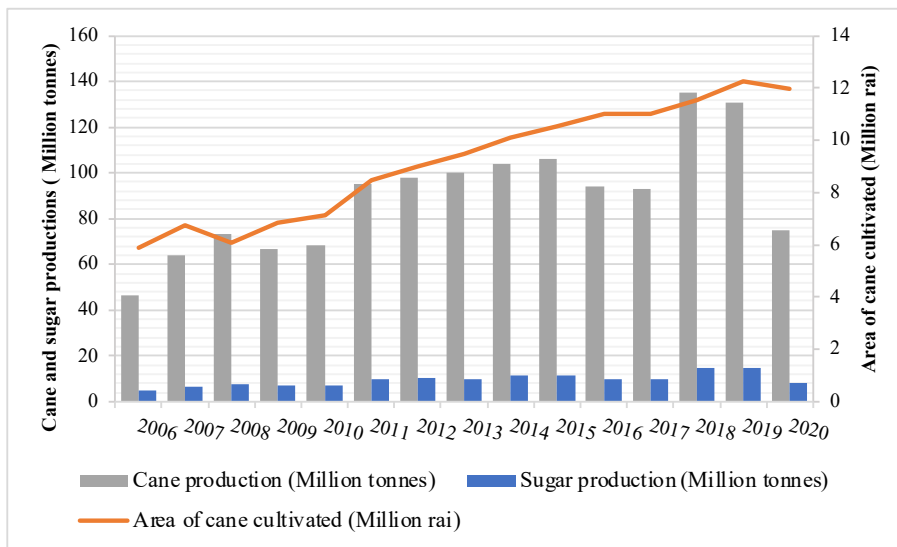


Figure 1.3 Development of cane and sugar productions in Thailand (Source OCSB database)

Because of Thai government policies encouraging farmers to grow cane, a high value crop, cane production in Thailand has continuously increase over past decades as a result of expansion of the cultivated area (Figure 1.3). As shown in Figure 1.4, cane is now grown in most regions of the country, except in the south of Thailand, and now can be found in 47 of 77 provinces across in the northern, northeastern, eastern, and central regions.

At present, there are 57 sugar refining factories operating in Thailand. There are 22 factories in Northeastern region, 20 factories in Central region, 10 factories in Northern region and 5 factories in Eastern region (Figure 1.4). 9 of these milling plants are owned by independent sugar milling companies (owning a single plant), while the rest are owned by 15 sugar mill groups. The four largest groups are Thai Roong Ruang Group (10 plants), Mitr Phol Group (7 plants), KSL Group (5 plants) and Wang Kanai Group (4 plants). The largest factory is Kaset Thai with capacity of 53,265 tonnes of cane crushed per day while the smallest one is New Kwan Soon

Lee with a capacity of 3,889 tonnes of cane crushed per day in 2019. Thai sugar production is dedicated to exports (75%) while 25% is for domestic consumption.

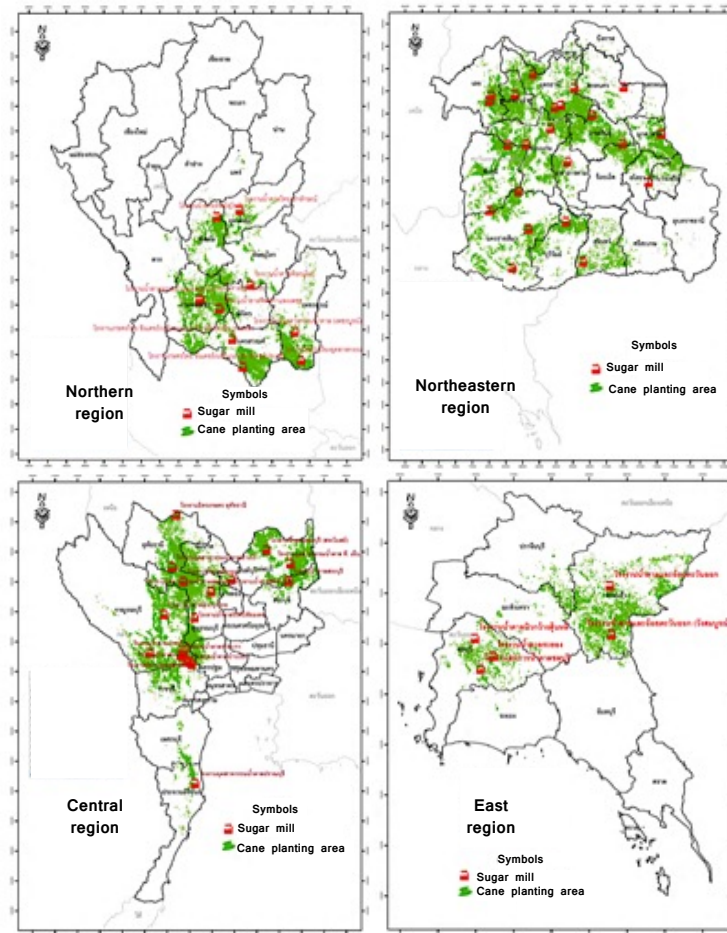


Figure 1.4 The distribution of the millers and cane planting area across four regions in Thailand

1.2 Problem statement

While there have been a number of drivers of huge expansion of cane and sugar productions in Thailand such as Thailand's favourable geographical location, climate and high value crop, the primary driver has been wide-ranging government support measures. Extensive government intervention has always been a major driver of sugar industry expansion in many sugar-producing countries, making sugar one of the most highly protected agricultural products worldwide. Major sugar producing countries, such as the EU, India, the USA and Thailand, have historically, heavily regulated their sugar sectors, and also provided substantial subsidies to producers. However, these support policies have had, and continue to have, major distortionary effects on the global sugar market, i.e. depressing world sugar prices (ABSugar, 2019, Petchseechoung, 2016).

Thailand, itself has been recognized as having one of the world’s most protectionist sugar regimes, with government intervention in nearly all aspects of its sugar industry. From 2011-2014, the world sugar prices fell by 40%, whereas sugar exports from Thailand increased by 70%, leading to the Thai sugar industry becoming the world’s second biggest exporter. Meriot (2015), a sugar expert with the American Sugar Alliance (ASA), explained that the Thai government has been closely involved with the Thai sugar sector for over decades, promoting the expansion of output irrespective of conditions in the global market. According Meriot (2015), at least \$1.3 billion has been spent annually as government support to Thai sugar producers. In 2013/14, about \$775 million was spent for indirect support subsidies through price pooling system and approximately \$500-525 million per year is also paid out for direct payments provided to cane farmers. In addition, Thai government has made providing soft loans and input subsidies available to all agriculture including to cane farmers. As can be seen in Figure 1.5, the *de minimis* threshold for sugar in 2013/14 was around \$376.2 million and the Thailand’s WTO limit on AMS¹ is approximately \$634 million. What stands out in the figure is the extremely high level of dependency of Thai sugar producers on government support where the government support for sugar industry in 2013/14 alone exceeded the AMS limit by considerable margin.

Calculation of <i>de minimis</i> threshold for sugar for MY 2013/14 (up to 10% of the value of cane production)¹	
Value of production : 108.13 million MT ² x \$34.79/MT ³	\$3.762 billion
De minimis threshold (10%) : \$3.762 billion x 0.10	\$376.2 million

**** Thailand’s WTO limit on trade distorting subsidies under the URAA (Total AMS limit) is 19.028 billion bath or \$634 million**

¹ Using De minimis calculation methodology as prescribed by the URAA.

² MY2013/14 Cane production volume (Source: GAIN Report TH4032, Thailand Sugar Annual (USDA,2014))

³ MY2013/14 Administered cane price (Source: GAIN Report TH4032, Thailand Sugar Annual (USDA,2014))

Figure 1.5 Calculation of de minimis threshold for sugar for MY2013/14

¹ The Aggregate Measure of Support (AMS, sometimes called the Amber Box) is a key indicator employed by the WTO to assess domestic support for agricultural products. In general, WTO members have had non-exempt domestic support during the base period and therefore reduction commitments specified in their schedules. The reduction commitments are expressed in terms of a “Total Aggregate Measurement of Support” (Total AMS) which included all product-specific support and non-product-specific support in one single figure. Any domestic support by member country not covered by one or another exemption categories must be maintained within the relevant “product-specific” and “non-product-specific” *de minimis* levels. In other words, the data on AMS support must not exceed the prescribed minimum threshold in terms of value of production (i.e., the *de minimis*).

Recently, Thailand has been subject to intense international pressure over its sugar policies. In April 2016, Brazil filed a request for WTO consultations with Thailand regarding an alleged breach of WTO agreement over subsidies applicable to Thai sugar sector. They argued that this support, both for domestic sugar producers and exporters, had allowed Thailand to increase market share at the expense of Brazil. Brazil also argued that these subsidies have decreased the world price of sweetener. Brazil's case is based on the claim that this government intervention is inconsistent with the international trade agreement with WTO to which Thailand is a signatory (WTO, 2016). Consequently, to settle the dispute, Brazil offered several options for changing the Thai sugar regime which, if met, would allow Brazil to withdraw their complaint.

The threat of WTO enforcement has been the key driver forcing the Thai government to introduce policy reforms to bring the sector into line with the international commitments. In responding, recently, the Thai government has emphasized the need for policy reform as part of a broader industry restructuring to bring the sector up-to-date with the current and future developments in the international sugar market. The Thai government attempting to structural reforms and reforms ongoing process, therefore has led to several challenges for policy implementation. In respect to international pressures, Thai system would be pushed toward a freer market and trade environment. As a result, in October 2016, the Thai government made a prompt response to Brazil's challenge by approving a restructuring plan for the cane and sugar industry, a set of policy reform proposals, where the government has begun to the amending process on the current Cane and Sugar Act B.E. 2527 (1984), eliminating the sugarcane price support programme, the domestic sugar price controls, and the sugar sale administration as a response to Brazil's WTO petition. However, the problem of this immediate response by the government is that these proposals were devised without any formal ex ante assessment of their likely impact on sugar sector. While this set of policy reform proposals have not yet been fully implemented, there might be some other suite policy settings available for Thai government to undertake to achieve its policy goals such as maintaining the competitiveness of Thai sugar sector, building the industry's sustainability, and perhaps remain a leading player in world sugar market in the wake of policy-enforced changes to the Thai sugar regime.

However, because the Thai sugar sector has become so reliant on government support, significant change to the level and nature of that support is likely to have a very significant impact on the fortunes of Thai cane farmers and sugar millers.

1.3 Motivation of research and research gap

While the impacts of large-scale policy reform are likely to be significant, to date there have been very little analysis of this in the context of the Thai sugar sector, or even in the context of developing countries. A number of gaps have not been explored in the study of the Thai sugar industry in the context of policy reforms. There are four main gaps in this research: knowledge gap, empirical gaps and gaps in data and theoretical gaps.

1.3.1 Knowledge gap

Although it has been understood for some time that the Thai sugar policy regime will change, key questions remain unanswered, i.e., what possible types of policy are available for the government to adopt, how will sugar producers respond to different policies under different policy environments, what would be the impacts of these responses on cane and sugar supply, and what would be the likely adaptation strategies for domestic sugar producers.

1.3.2 Empirical gap

With regard to empirical evidence, analysis of agricultural policy scenarios, in terms of understanding trade and market responses, have mostly been investigated in the context of removal of market distortions, i.e. movement toward market and trade liberalisation (Elobeid and Beghin, 2006, Frandsen et al., 2003, Van der Mensbrugghe et al., 2003, Vissers, 2017). However, there is a lack of academic analysis of policy scenarios that pays attention to retaining maximum permissible government support in which government support instruments, such as tariffs at the border, quotas and direct payments remain partially in place where these supports help accelerate the rate of income growth and encourage price stabilization in agriculture. Therefore, it is very important to consider a range of policy scenarios, representing a spectrum of policy approaches on the libertarianism-protectionism dimension because both of these extremes provide pros and cons to particular groups of stakeholders in the sugar industry.

1.3.3 Data gap

In terms of data gaps, there has been the lack of primary data collection by means of an intention survey of Thai farmers and millers. Policy analysis in the Thai sugar sector, particularly in relation to producer responses has never been attempted before. In addition, much of the published quantitative analysis of policy impacts in this sector has limited to the use of secondary

data. To perform possible policy simulations to determine economic impacts, most research on the sugar sector policies on country producers generally tended to focus on data of trade flows, trade policy and supply-demand elasticities, often involving general or non-spatial or/and partial equilibrium models, and spatial price equilibrium models (Devadoss and Kropf, 1996, Elobeid and Beghin, 2006, Grethe et al., 2008, Nolte, 2008, OECD, 2007, Vissers, 2017). So far, however, there has been no detailed investigation of the likely impact of sugar policy reform incorporating the stated actions of real-world agents. This thesis, therefore, attempts to explore this gap by trying to elicit the future likely response plans of both cane farmers and sugars millers in Thailand from the information given by these producers themselves through intention surveys. Although it is not a very common approach due to the fear that the answers may not be reliable, the producers' surveys allow the collection of critical information of agents' confidence in the sector. It is worth noting that some scholars adopting intention surveys insist upon their reliability being tested by demonstrating that the majority of these agents surveyed actually implemented their intended behaviour (Douarin et al., 2007, Harvey, 2000, Tranter et al., 2004).

1.3.4 Theoretical gap

Regarding the limitation to macro-economic focus of extensive quantitative research on analysis of policy impacts on farmers which many of which only use secondary data; thus, this thesis also considers the implications of gaining more understandings about other significant micro-level factors affecting farmers' intention about future farming. However, from a theoretical point of view, there is still a gap in the literature as most previous studies of this nature in the context of agricultural policy challenge predominantly tend to put central importance on background factors and socio-economic drivers of change, with lesser emphasis on the non-economic dimension such as psychological factors that may also affect farmers' behavioural intention. To fill this gap, research extend the literatures by applying the Theory of Planned Behaviour (Ajzen, 1991) as theoretical framework with a good deal of socio-economic factors to enhance our understanding of the factors which determine cane farmers' intention to continue cane production.

1.4 Aim, objectives, research questions, and research hypotheses of the thesis

The main aims of this study are (i) to explore the effects of different policy scenarios on the number of farmers remaining in cane farming, cane and sugar supply, and structural change in the industry and (ii) To find out which policy, and position on the libertarianism-protectionism continuum, is most likely to meet government's stated objectives for the reform process.

To account for the main research aims, three specific research objectives have been considered. Previous research has suggested that if researcher has an expectation of how research question will be answered or expected outcome, it is essentially to develop hypotheses when testing a theory or predicted outcome (Bryman, 2016, Mourougan and Sethuraman, 2017, Ruth and Kent, n.d.). Therefore, for each research objectives, a set of questions and hypotheses have been devised based on past studies, economic theories, and observations or logical expectations to guide the research process. For example, to investigate Thai cane farmers' likely responses to a set of possible future policy regimes, we developed hypotheses based on the Theory of Planned Behaviour (TPB) (Ajzen,1991) which predicts intention and behaviour using the following constructs: attitude, subjective norms, and perceived behavioural control. Moreover, we extended this model by adding other relevant variables such as socio-economic and demographic information which have been used in the past studies (e.g. Borges and Lansink, 2015, Daxini et al., 2018, Donati et al., 2015, Rezaei et al., 2019, Stojcheska et al., 2016) to investigate their influence on farmers' intention. Tables 1.2-1.4 provide mapping of each research objective with research questions and hypotheses.

Table 1.2 Objective no. 1 and hypotheses

Objective1: To identify a suite of alternative policy scenarios for Thai sugar industry, reflecting a range of market philosophies, that are also in compliance with WTO rules and commitments	
Research questions	Hypotheses
Q1.1: What are three types of policy reform scenarios on protectionism- libertarian spectrum available for the Thai sugar industry, in relation to parameter settings of 10 key policy instruments?	H1: There are significant differences in policy maker's perceived impact of the three scenarios on market signals, supply, and trade.
Q1.2: What about the policy settings of each scenario?	
Q1.3: How would these various scenarios influence market aspects such as producer prices, production volume, and cross-border trade?	
Q1.4: Which is the most favourable policy scenario and associated position on the libertarianism-protectionism continuum, for the Thai sugar sector, according to key policy actors, academics and stakeholders who have influence on the industry's policy formulation?	H2: From the perspective of key policy actors, academics and stakeholders, the protectionism is optimum scenario whereas the libertarian scenario is most damaging in present Thai context.

Objective1: To identify a suite of alternative policy scenarios for Thai sugar industry, reflecting a range of market philosophies, that are also in compliance with WTO rules and commitments

Research questions	Hypotheses
Q1.5: How likely is it that each of the three scenarios would actually be implemented ?	<p>H3: It is 'very unlikely' that the 'libertarian' scenario would be implemented in the near future.</p> <p>H4: It is 'very likely' that the 'protectionism' scenario would be implemented in the near future.</p> <p>H5: It is 'neither likely or unlikely' that the 'government proposal' scenario would be implemented in the near future.</p>

Table 1.3 Objective no. 2 and hypotheses

Objective2: To investigate Thai cane farmers' likely responses to a set of possible future policy regimes	
Research questions	Hypotheses
Q2.1 How does each new policy scenario influence farmers' intention to continue in cane production?	H6: The policy scenarios themselves are the primary determinant of intention, but there are also secondary socio-economic and demographic influences.
Q2.2 What are the drivers and barriers to farmers continuing in cane production and do these vary by scenario?	H7: Farmer decisions regarding continuing in cane farming are likely to be influenced by not only the socio-economic and demographic factors but also the TPB dimensions.
Q2.3 To what extent are farmer responses to the different policy scenarios determined by structural, locational, socio-economic characteristics and TPB dimensions?	
Q2.5: What are the impacts of these reform scenarios on the structure of the cane producer sector and the volume of cane produced?	H8: All three policy scenarios will have negative effects on the number of active cane farmers and volume of cane produced but the degrees of impacts are uneven.
Q2.6: Do farmers from different classified groups i.e. farm size and degree of specialisation in cane farming have different business responses toward policy scenarios? And how?	<p>H9: There are differences in business response to the reform scenarios among farmers in different farm size class.</p> <p>H10: There are differences in business response to the reform scenarios between farmers with high degree of specialisation in cane farming and those who are more diversified.</p>

Table 1.4 Objective no. 3 and hypotheses

Objective3: To investigate Thai sugar millers' likely responses to a set of possible future policy regimes	
Research questions	Hypotheses
Q3.1: Is there much variation among Thai sugar millers' competitiveness? What is the nature of the competitive advantage (i.e. important facilitating or limiting factors) of leading millers?	H11: There are significant differences in the degree of competitiveness among Thai sugar millers in respect of productivity, input, and business structure and level of business differentiation dimensions.
Q3.2: What are the impacts of scenarios on Thai millers' business positions and their profitability?	H12: There are significant differences between the impact of the three scenarios on three business position dimensions (i.e. likelihood of business survival, ability to compete with leading rivals, and ability to obtain greater market share).
Q3.3: Are there differences in millers' likely business responses across the three scenarios?	H13: There are differences in millers' likely business responses between the 'protectionism' and other scenarios.
Q3.4: To what extent are millers' policy expectations and likely business responses to the different policy scenarios determined by competitiveness ranking?	H14: Millers who achieve the very highest competitiveness scores are most likely to support the 'libertarian' scenario than those with lower competitiveness.
Q3.5: What are the impacts of these reform scenarios on the structure of the sugar refining sector and size of production?	H15: The three scenarios will not cause significant sugar refining sector restructuring, in terms of causing the closure of milling factories.
Q3.6: What are millers' preferences for future policy regime and mixture of policy elements?	H16: Millers are more likely to favor the 'protectionism' scenario than the other policy scenarios.

1.5 The Contribution of this research

This thesis hopes to contribute an on-going discussion about possible scenarios of change to Thai sugar regime by providing the empirical evidence about how the industry is likely to responses to different policies, and therefore will be useful for informing the future direction of Thai sugar policy. Another object of the thesis is to show the government what would happen in the sector if each of the scenarios was to be implemented, so the government can recognize where further readjustment might be needed. Farmer and miller sectors can also use the results

from this research to help manage their business strategy if they know which policy is going to be undertaken.

1.6 Thesis outline

In addition to Chapter 1 Introduction, the remainder of the thesis consists of five other chapters. Chapter 2 demonstrates a brief historical overview and trajectories of cane and sugar policies and regulations and their impact on Thai sugar production (pre-WTO challenge) and pressure for Thai regime reform, in particular key policy issues. This chapter also presents the overview of the regulations of sugar markets, past sugar policy reforms and their impacts in other countries, in particular the key market players such as Australia, the EU and India. As a policy choice framework was built on the spectrum of policy approaches on libertarian-protectionism dimension, this chapter also contains the debate on agricultural policy approaches under both sides of the spectrum. Chapter 3 describes a stakeholder consultation to identify a range of possible policy reform scenarios. Chapter 4 is a farm survey study based on quantitative analysis in investigating the likely responses of Thai cane farmers to different alternative policy reform scenarios. Chapter 5 presents a survey of the miller sector to investigate responses to scenarios. Chapter 6 synthesizes all lines of evidence, discusses practical implications, and policy recommendations for implications for policymakers. The limitations of this study are acknowledged and recommendations for future research are also discussed.

Chapter 2

Literature Review

2.1 Introduction

The previous chapter provided background information related to the Thai sugar sector, the pressures for Thai sugar policy reform and the significance of this research. Aligned with the research goals stated in Chapter 1, the first part of this chapter (Section 2.2) aims to review the structure of the Thai sugar sector, with a particular focus on cane producers and sugar refiners within the supply chain network, the strength and competitiveness of industry, and sugar policy mechanisms. This overview will be largely based on key official datasets and reports produced by the OCSB, the Bank of Thailand, Krungsri Research and USDA GAIN reports.

With regards to sugar policy, Section 2.3 reviews previous studies of interventions of the governments in world sugar markets and the development of global sugar policy. To gain insights into the complex processes of sugar policy reforms, there is a review of policy reform in Australia, the EU and India, these being recognised as having had pivotal role in the evolution of the world sugar market.

Finally, as the aim of this research is to evaluate possible policy reform options for the Thai sugar industry, Section 2.4 reviews past research covering the range of market philosophies on the libertarian-protectionism continuum to understand the political and socio-economic rationale behind these market philosophies.

2.2 Overview of Thai Cane and Sugar Industry

2.2.1 Producers, production, and the structure of the sugar supply chain

An overview of sugar supply chain in Thailand is shown in Figure 2.1.

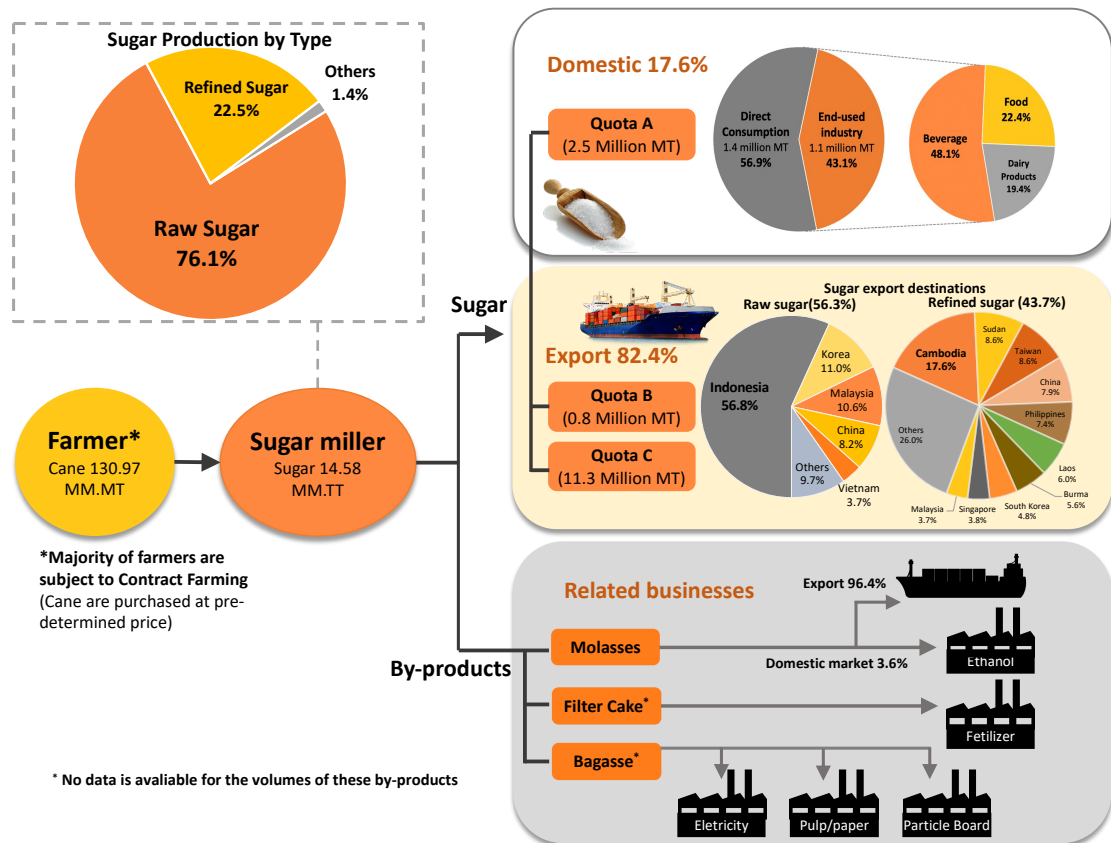


Figure 2.1 The supply chain of Thai sugar industry (2019)- Adapted from Sowcharoensuk (2021)

i) Cane production

In 2019, there were approximately 1.96 million hectares of sugar cane, or 8% of agricultural land of whole Kingdom of Thailand. Production was spread throughout 47 provinces in the Central, Northern, Northeastern, and Eastern regions of the country, employing over 300,000 cane farming households, or about 430,000 cane farmers (OAE, 2021, OCSB, 2020). The first- and second-largest growing regions are the Northeastern and the Central regions, which host 70.3% of the total planted area, due to their geography, climate, and the high concentration of sugar mills (OCSB, 2020, Sukyai et al., 2016). According to OCSB (Various dates), Thai cane production increased by 95% between 2008/09 and 2018/19. Over that period, despite the sharp increase in cane production, there have been no improvements in average crop yield or average commercial cane sugar percentage (CCS%). The average crop yield and CCS during this ten-year period were 10.80 tonnes/rai and 12.14 CCS. This view, as shown in Figure 2.2, is supported by Arjchariyaartong (2007), Meriot (2015) and Athipanyakul et al. (2020) who note that the growth in Thai cane production volume is because of the expansion the planted area rather than an increase in cane yield or quality improvements.

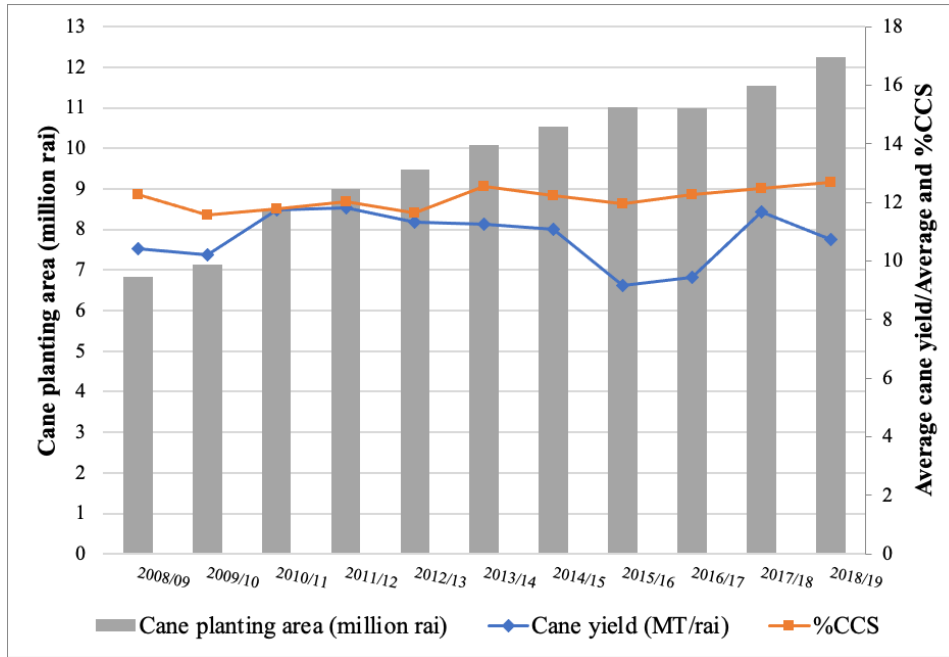


Figure 2.2 Thai cane production (OCSB, Various dates)

Cane farms in Thailand are typically small-scaled (with land of less than 10ha) and medium-scaled (with land of between 10-80 ha) while only 10% are large-sized farms (OCSB,2019). Cane farms are mostly operated by independent farmers, rather than by sugar millers, as happens in some other countries (Polyorat, 2011). According to Manivong and Bourgois (2017) and Athipanyakul et al. (2020), almost half of the smallest farms are in the northeastern region while high proportions of medium- and large-scale farms are situated in the Central and Northern regions. An investigation into the competitiveness of cane production in Thailand by Arjchariyaartong (2007) found that the costs of cane production, including costs of ratoons, labour and harvesting, are lowest in the Northeast while farms in the Central region have the highest levels of profitability and gross margin, followed by the North and Northeast respectively.

Several recent studies of Thai cane farming have demonstrated that increases in average costs of cane production and poor management practices on the farm are two of the key factors hindering both yield and quality improvements (Athipanyakul et al., 2020, Kaewtrakulpong, 2008, Sawaengsak and Gheewala, 2017, Tukaew et al., 2016). According to Athipanyakul et al. (2020), more than 50% of total cane production costs went on labour and materials. Kaewtrakulpong (2008), showed that 66% of total labour costs are due to cane harvesting. The labour-intensive nature of harvesting operations is compounded by other associated problems, such as high wage rates, and labour shortages. Many authors have highlighted the usefulness of adopting mechanised planting and harvesting in cane farming operations to resolve these issues, at the

same time, enhancing land and labour productivity, reducing drudgery and supporting timeliness of operations (Chaya et al., 2019, Pongpat et al., 2017, Sawaengsak and Gheewala, 2017, Usaborisut, 2018).

To achieve higher cane farming productivity (i.e. higher yield and quality improvement), Tukaew et al. (2016) has suggested the need to focus on better crop husbandry and farm management practice, including the areas of fertiliser application, pest and soil fertility management, irrigation, and harvesting. Concerning harvesting management, although cane burning during harvesting has been a common practice in Thailand for long-period of time, this practice has a major impact on both the quality of cane (CCS level) and rate of recovery of sugar (Sukyai et al., 2016). A study conducted by Tukaew et al. (2016), found that only 31.5% of cane farmers had fully adopted green harvesting, whereas 25% of farmers were harvesting wholly by burnt harvesting. About 44% of farmers adopted both techniques. Recently, the Thai government has responded to the problem of burning cane in cane fields by reducing the producer price of burnt cane, while increasing the price of freshly cut cane. Despite these financial incentives, according to the OCSB report on cane and sugar production for the year 2019/20 (OCSB, 2020a), burnt cane still represented about 50% of total cane being processed. The main reasons for adopting burnt cane harvesting are shorter harvesting time and lower labour requirements (Tukaew et al., 2016), thereby increasing the productivity of manual harvesting, which continues to be widely practiced (Prasara-A and Gheewala, 2021), due to constraints on the use harvesting machines, i.e. high costs and conditions in cane fields (Chaya et al., 2019).

In an analysis of the influence of production practices on yield and CCS level, Tukaew et al. (2016) found that small farm size, i.e. less than < 8 ha, positively influenced cane yield, suggesting that small-scaled farmers in Thailand were able to manage their farm more closely than moderate-size and large farms e.g. better management of weeds, plant diseases and insects and higher rate of fertiliser application. A number of other studies also confirm that small farms tend to outperform larger farms in terms of crop yield and productivity (Barrett et al., 2010, Ricciardi et al., 2021). Cornia (1985) and Rosset (2000) suggest that smaller farms are likely to make more efficient use of land and resource input per hectare than large estates. Moreover, small farms also have the benefit of timely, adequate application of inputs, better weed and ratoon management, with these factors known to be major determinants of cane productivity (Dlamini and Masuku, 2012). Rosset (2000) also suggests that very large farms can be inefficient in terms of management and labour. Currently, the average gross yield of cane per hectare in Thailand during 2015-2020 (62 tonnes per hectare) is still relatively lower in comparison with competitor cane-sugar producing countries such as Brazil and Australia which produce with 74-85 tonnes per hectare (ASMC, 2021, OCSB, Various dates, Statista, 2021). Although farm size

is found to have an impact on cane yield, Tukaew et al.'s study (2016) found no variation in average CCS level (this being a determinant of cane quality) between three farm size groups, with an average CCS level of 11.7-11.8. In their study, they found that crop age and length of cane transportation period from farm to mill are the key determinants. Many studies on post-harvest losses conclude that time taken for loading and transportation affects sucrose, level which decreases rapidly after harvesting, leading to deterioration of sweetness quality of cane (Hussain et al., 2018, Solomon, 2009). Currently, cane delivered to sugar mills in Thailand still has relatively low CCS level (11-12%) in comparison with competitor cane-sugar producing countries such as Brazil, Australia, and the U.S. which produce with 12-13% CCS level (Chunhawong et al., 2018, Meriot, 2015).

ii) Sugar processing

Sugar mills are usually located geographically close to the cane planting areas, thereby reducing transportation costs and post-harvest losses, making it easy to source cane according to production plans, and easy to communicate with cane farmers to offer assistance (Sowcharoensuk, 2021). At present, there are 57 sugar mills in Thailand, situated in four different regions. These mills are owned and operated by 24 companies (9 independent companies and 15 sugar groups). The top 5 companies produced nearly 60% of all sugar produced in Thailand. During the period MY2008/09-MY 2018/19, Thai sugar production increase by 102% in parallel with cane production.

In respect of industrial performance, some authors claim that excessing crushing capacity is one of the characteristics of Thai miller sector (Meriot, 2015, NaRanong, 2000, Sukyai et al., 2016). Of the 57 sugar mills, crushing capacity is around 983,500 tonnes of cane/day. The cane crushing period could potentially reach 150-180 days, but is usually between 100-120 days which refers that the full potential of sugar production in Thailand is not attained due to a lack of cane supplied to the sugar mills (Meriot, 2015, Sukyai et al., 2016). According to NaRanong (2000) the rate of overall industrial capacity utilization is around 65-85% of the installed-capacity.

The average recovery rate of Thai sugar industry over the past 10 years is around 10.6%, meaning that 1 tonne of cane could produce around 106 kg of sugar. According to Meriot (2015), Thai recovery rate is relatively low in comparison with other major leading countries with the same cultivars yielding as much as 12% in Brazil and Australia. Sugar beet has an even higher sugar extraction rate, for example in the EU at between 14-15%.

iii) Utilization of sugarcane, valorisation of by-products and research and development

a) Utilization of sugarcane, valorisation of by-products

Sugar millers can generate revenues not only from processing and selling sugar but also from valorising of the residues of sugar production, such as molasses, bagasse, and filter cake. These by-products can be used as raw material for biomass fueled electricity, ethanol, fertilisers and pulp paper products. Kaewtrakulpong (2008) and Sriroth et al. (2016) highlight that nowadays sugar millers do not focus solely on sugar production, but also on diversification through full utilization of products and byproducts to maximise process efficiency

Bagasse, the dry pulpy residue left behind when cane stalks are crushed, is a by-product that is utilized by nearly every mill. According to the OCSB report on electricity generation in the Thai sugar sector in 2018, 54 mills use bagasse as fuel in biomass boilers used in the sugar production process, for both heat and electricity generation. In addition to burning as a fuel, bagasse has also been used as a substitute for wood pulp in the production of paper and particle board by Wang Kanai Group, Kaset Thai group and Mitr Phol group (Sriroth et al., 2016).

The second most important residue of sugar production is molasses. According to data in 2019 collected by Krungsri Research (Tunpaiboon, 2019), 11 factories utilise molasses as raw material for ethanol production, which can be used as fuel for vehicle and machinery, with capability of 2.68 million liters/day. The four ethanol-producing factories operated by Mitr Phol Group have the highest production capacity in Thailand at 1.25 million liters/day. Despite not being a common practice at present, filter cake, the residue that is eliminated during the cane juice decantation process in sugar production, is currently produced by a few mills as alternative fertiliser (Sriroth et al., 2016).

Although there has been a continuous growth of the Thai sugar industry, Preecha et al. (2017) and Kanjanavisut (2019) suggest that presently there is still big development gap, as the industrial supply chain is still limited to the downstream of refining sector via the utilization of residues from sugar milling. The more complex and advanced industries which would produce much higher-value products, such as biotechnology, bio-chemical and pharmaceuticals, are still at the laboratory scale. To expand the sugar industry into these middle- to downstream industries, more investment in research and development is needed. Much research has confirmed that sugar mills that are able to generate additional revenue streams from a more diverse range of value-added activities, will have a competitive advantage over rivals (Kanjanavisut, 2019, Ndung'u Gladys Wanjira and Wanjere, 2018, Vargas-Hernández et al., 2018, Wilfred et al., 2014).

However, there are several key barriers that prevent the Thai sugar sector becoming a fully integrated sugar, agro-industry complex. The first obstacle is high investment costs of establishing the industry where mass-scale adoption is required (Kanjavisut, 2019). The second barrier is the law under current regulation, i.e. the Cane and Sugar Act of 1984, which limits the utilization of cane juice/syrup for ethanol production there is no such restriction on the use of cane syrup in Brazil (Silalertruksa et al., 2015). Brazil's sugar industry has been successfully interconnected with their ethanol-blended fuel industry. As a result, this action has allowed Brazil to reduce its reliance on international price of sugar as a single product (FAO, 2004, Vargas-Hernández et al., 2018) providing Brazilian sugar mills the choice of whether to produce sugar or ethanol from cane depending on price (Larson and Borrell, 2001).

According to several works, diversification through value-adding activities using by-products could sustainably recover Thai sugar market conditions amid the volatility of world sugar prices. For instance, several authors highlight that value addition from use of sugar byproducts is an essential requirement to sustain the sugar industry in the face of falling sugar processes (Srivastava, 2020, Sukyai et al., 2016). Furthermore, in addition to recovering the impact from volatility of world sugar price, Kanjavisut (2019) suggests that the new markets from value-addition of cane and sugar will help alleviate the negative effect from high volumes of cane and sugar produced amid to price fluctuations.

b) Research and Development

Given the increasing need of R&D in order increase competitiveness of sugar millers, in both domestic and global sugar markets, there are still very few factories in Thailand that are able to undertake their own private research such as The Mitrphol Group, The ESC Group, The Thai Roong Ruang Group, Buriram Sugar Public Company Limited and the Erawan Sugar Co.,Ltd. For example, The Mitrphol Group is the first company that has been able to establish its own research centre, i.e. the Mitrphol Sugarcane Research Centre (RDI) in 1997, networking with many universities and other institutions (Sukyai et al., 2016). The projects under this center cover the areas of cane production, sugar technology and bio-based chemical and energy (Mitrphol, 2021).

2.2.2 Market size, structure, and international trade

As shown in Figure 2.3, the annual domestic sugar consumption in Thailand has remained relatively stable over the last two decades, with an average consumption of 2.28 million tonnes

during 1997-2020. In 2019, about 57% of domestic sugar supply was sold to end-consumers for direct consumption, while 43% was sold to industry as input to other products (indirect consumption) (Sowcharoensuk, 2021).

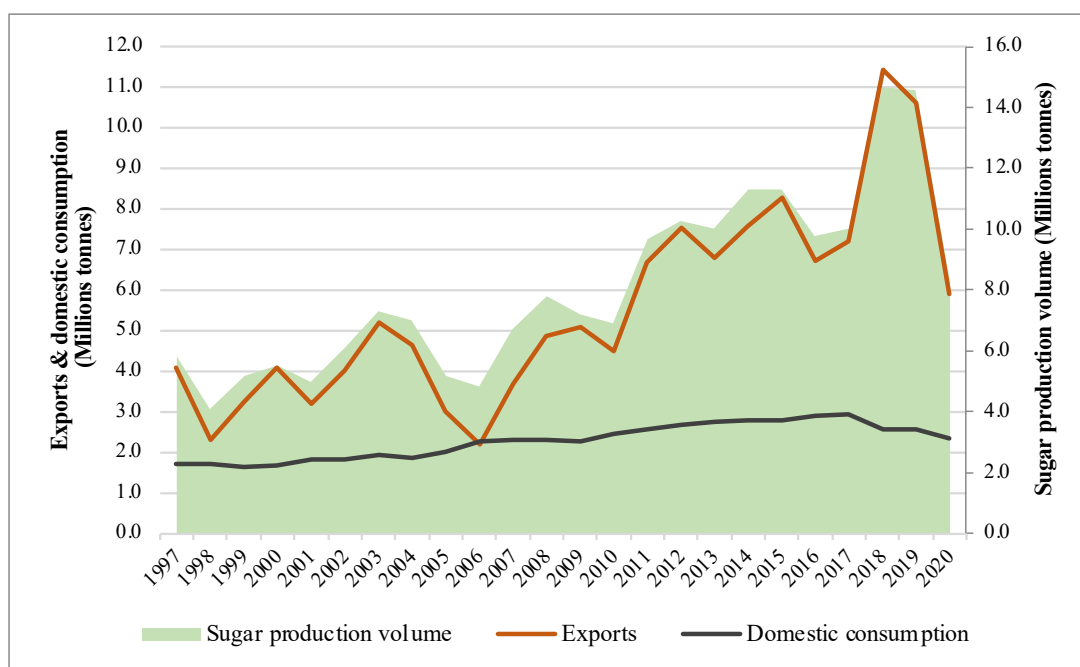


Figure 2.3 Thai Sugar Production and markets (Source: OCSB (Various dates) and USDA GAIN reports (Various dates))

As shown in Figure 2.1, in 2019, Thai sugar industry exported about 82% of total sugar production. According to USDA (2020), more than 95% of Thailand’s sugar exports are sold in Asian markets. Raw sugar accounted for 56.3% of all sugar exports, while refined sugar constituted of 43.7%. Indonesia, China, South Korea, Cambodia, and Taiwan are Thailand’s the top five export markets (USDA Foreign Agricultural Service, 2020). About 96.4% of molasses, or about 0.64 million tonnes are exported to Philippines, South Korea, and Japan for use in ethanol production, while the remainder 3.6% are used in related domestic industries (Sowcharoensuk, 2021). Sugar imports have remained marginal over the last two decades due to excess domestic sugar supplies (USDA Foreign Agricultural Service, 2020).

As the Cane and Sugar Act of 1984 stipulates that the annual export volume is determined by deducting the domestic consumption figure from the total sugar production, and as domestic demand for sugar is quite inelastic, Kanivichaporn (1997) concluded that sugar production is directly the most important determinant of export availability.

2.2.3 Thai sugar policy

2.2.3.1 A brief historical overview and trajectories of cane and sugar policies and regulations and their impact in Thailand (pre-WTO challenge)

Historically, the Thai government has had an iron will to reduce the impact of market realities on the sugar industry and on the cane farmers. Over decades, the Thai cane and sugar industry has been highly regulated and controlled by the government, primarily through the Cane and Sugar Act of 1984. This legislation determines: benefits allocation, sugarcane price setting, and administration of sugar sold through quotas. Despite the fluctuation in world sugar prices, the Act fixes the domestic sugar price above the world sugar prices. For these reasons, Thai sugarcane production, sugar manufacture and exports have grown dramatically over the past two decades (see Figure 2.4). The sugar sector is monitored and coordinated by a governmental body, the Office of Cane and Sugar Board (OCSB), under the administration of the Ministry of Industry.

As will be elaborated below, in addition to legislation under the Cane and Sugar Act of 1984, there is a broader policy and management regime outside of the 1984 Act, including re-directing cane payments, setting domestic sugar prices, providing direct payments and ‘soft’² loans to cane farmers, and cross subsidisation through high domestic sugar prices (Meriot, 2015)

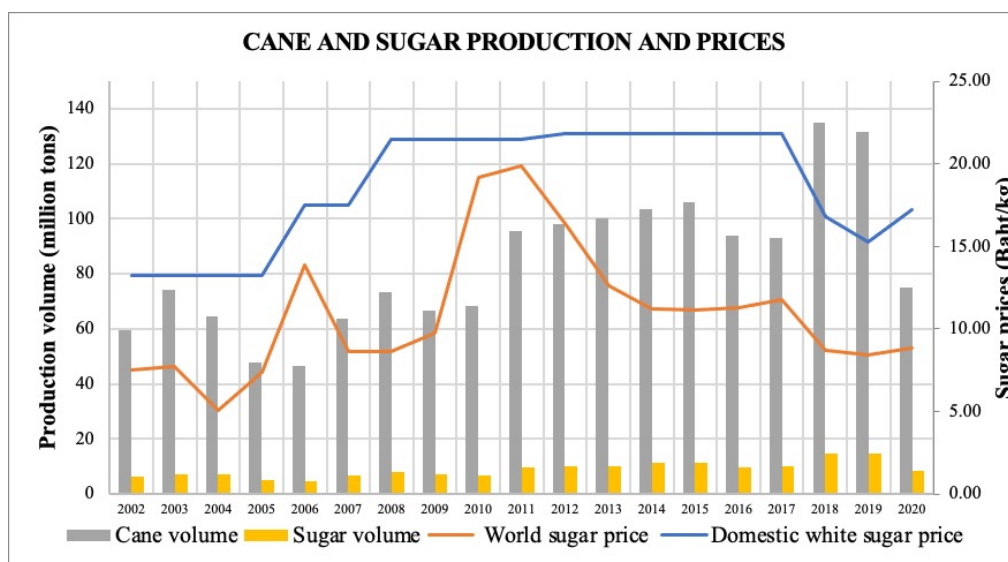


Figure 2.4 Cane and sugar production and prices (Source OCSB (Various date))

² Soft loans in this context means a loan with a below-market rate of interest which is provided to increase farmers' access to credit to support their agricultural production.

2.2.3.2 Features of Thai sugar policies and regulations

i) Thai Cane and Sugar Act of 1984

Like the European Union Sugar regime pre-2006 reform, a single piece of foundational legislation, i.e. The Thai Cane and Sugar Act, formed the backbone of the industry. The Act was founded on five pillars:

1. Controlling the number of sugar producers in the sector

Sugar mill operators are required to obtain permission and licenses from the authorities if they wish to situate a new sugar mill, or to expand their existing factories. A requirement for factory licensing also requires that the facility be a minimum distance of 50 km between any new and existing sugar mill. According to Krungsri Research (Chuasuwat, 2018), Since 2010, The OCSB issued just three permits new mills, i.e. twice in 2010 and again in 2015 resulting in raise in number of sugar mills from 46 to 57. The majority of new mills are operated by existing players in the sector, rather than new investors.

2. Contract farming

Unlike some other sugar producer countries, the majority of cane in Thailand is grown under contract to sugar millers. In general, the Thai sugar industry adopts a “resource- providing contract farming’ arrangement. There are two variants of this (Figure 2.5). The first involves millers signing a contract directly with independent cane farmers. In this case, millers provide both financial resources and materials to their contracted farmers i.e. in terms of equipment, mechanization services, short-term loan financing and production inputs such as cane varieties and fertilisers. The second approach is where millers sign a contract with a “Quota Head”³ for cane farmers. The Quota Head is typically a large-scale cane farmer who is responsible for

³ Quota Head is a large-scale cane farmer who signs a quota contract with a miller and manages the cane quota contract. The head of quota can be both farmer and cane collector at the same time. A farmer Quota Head commonly farms cane around 100 rai or more and generally owns machinery such as trucks, tractors etc. He or she resorts to wage labour for cane plantation, crop care and harvest. The Quota Head allocates any excess quota to small-scaled farmers and manage them the same way as millers do.

managing and supervising “look rai”⁴, i.e. contracting farmers in his network. In this case, crop care, harvesting etc. is managed by the Quota Head.

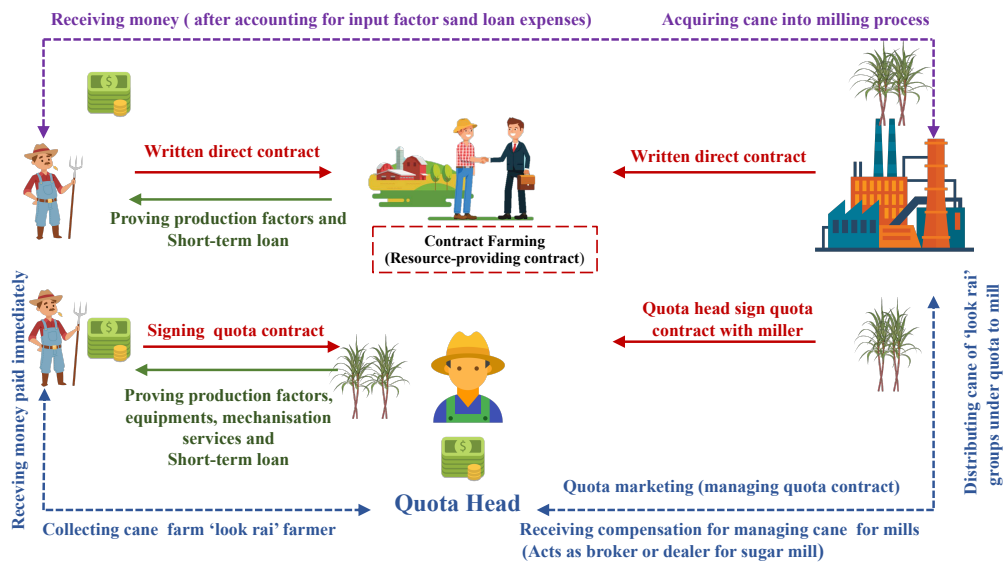


Figure 2.5 Contract farming system of Thai sugar sector (Source Bank of Thailand by Preecha et al. (2017))

3. Revenue-sharing system and cane price support mechanism

The core of this system was based on the South African model of the 1980s (NaRanong, 2013) where sugar revenues are shared between farmers and millers according in fixed proportions. The revenue from sugar sales in both the domestic and export markets is divided 70:30 with cane farmers receiving 70% and millers 30%.

The market revenue that farmers receive comes in two installments. First, there is an initial payment, the value of which is based on an estimate of likely future revenue from the sale of sugar, which farmers receive this payment upon the supply of cane to the mill. This estimate is determined on an annual basis by the OCSB and announced in October which is prior to the cane harvesting season. This is called the “preliminary price”. The second payment is based on the “final cane price” which is calculated at the end of sugar production cycle (i.e. in May) when the OCSB re-evaluates the revenue from the total sale of sugar and announces the final cane prices. If the final price of cane is higher than the earlier preliminary price, the millers must pay a supplementary amount to farmers to make up the difference. However, if the final price of cane

⁴ “look rai” are small-scaled cane farmers who depend upon the Quota Head for farm inputs such as capital and fertiliser and hired services including tractor service for land preparation, labour for harvesting and trucks for cane transportation to mill.

is lower than the preliminary price, farmers do not get a second payment, but neither do they have to repay the over-payment. Under these circumstances the government compensates the millers for their overpayment to farmers. This price support arrangement ensures that farmers receive at least 70% of the full domestic market price and, in some years, above 70% market price.

4. Export regulation and Quota System

Every year, the Thai government controls the volume of sugar produced for domestic and export markets through a three-part quota system:

Quota A: refers to all refined sugar sold domestically. This quota amount is allocated to mills by the Government at the start of each season, on the basis of production capacity. The sugar is sold to approved wholesalers at a fixed price, usually at some margin higher than the world price.

Quota B: Amounts to 800,000 tons of raw sugar, derived, on a proportionate basis, from all millers and held by the Thailand Cane and Sugar Corporation (TCSC). This sugar is export by the TCSC on behalf of millers and revenues are paid back to the millers.

Quota C: refers to the exportable surplus of sugar production in Thailand after Quotas A and B have been filled. Under this quota, the miller groups who target the export market from their production must meet their Quota A and B targets can export the rest of their sugar under Quota C. However, millers must pay the cane farmers at least 70% of the Quota B price set by the TCSC. Export sales are handled by authorized exporting companies. There is no limit in terms of quota C production dedicated to export, once quotas A and B have been fulfilled. The quota allocation and revenue-sharing mechanisms are shown in Figure 2.6.

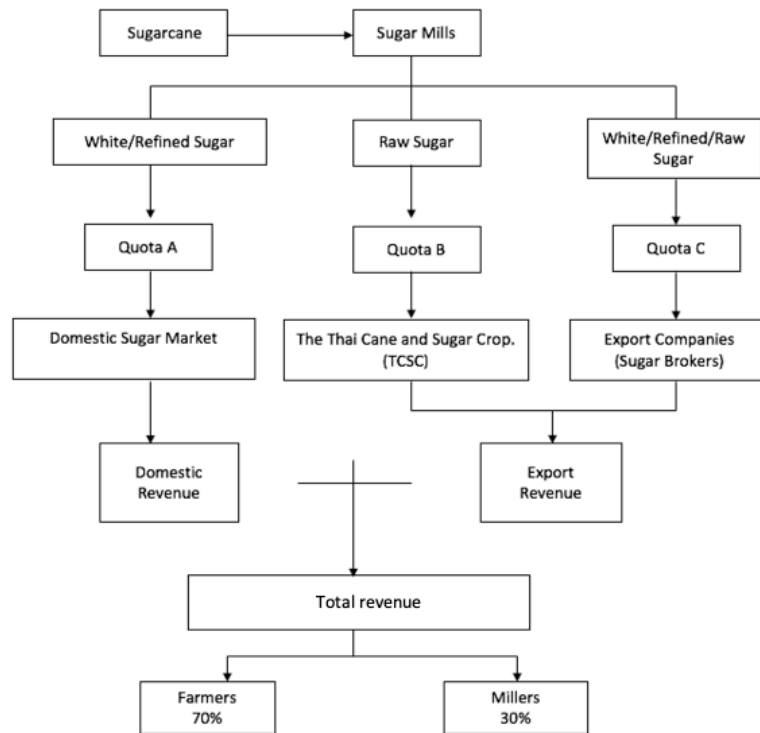


Figure 2.6 Sugar quota allocation and revenue-sharing system in Thailand: adapted from Petchworakul (2001)

5. Boarder protection mechanisms

In respect to trade, there are some particular rules and boarder protection mechanisms.

The Thai government has imposed Tariff Rate Quotas (TRQs), apply to all WTO members, i.e. two -levels of tariffs that limit import volumes. As in-quota, low tariff, rate of 64% applies to a maximum of 13,760 tonnes of sugar imported under ‘permitted quota’, while a 94% (high) tariff rate is set for ‘out-of-quota’ imports.

However, sugar imports from ASEAN members enter Thailand duty free under the ASEAN Economic Community (AEC) Free Trade Agreement and do not count toward the import TRQ. Sugar imports from Australia also enter Thailand tariff free under the Thailand -Australia Free Trade Agreement (TAFTA). However, for Australia, the in- tariff rate quota, applying to 1,376 tonnes, was due to be reduced to 0% with no quantitative limits in 2020.

Sugar imports from the non-WTO members and, non-ASEAN and non- TAFTA members, are restricted from as specific duty for sugar of \$107 tonnes ton for both beet and cane sugar.

6. The Cane and Sugar Fund (OCSF)

The OCSF was established according under section 23 of the Cane and Sugar Act of 1984 as a private corporation. The major roles determined for the OCSF are policy formulation, self-governance according to the law and market management in order to maintain economic stability and protection of the interests of cane farmers and sugar millers to ensure the stable growth of the industry based on fairness among producer stakeholders. The grand strategies of the OCSF are to maintain industry stability, including effective debt management, providing supports to cane farmers and sugar millers in accordance with governmental policies and managing system revenue for maximum of benefit. In practical terms its most important role is to compensate sugar millers whenever the final cane price falls below the preliminary price, which millers pay to farmers in advance for purchasing their cane.

ii) Other regulations and policy measures (outside of the 1984 Act)

Apart from regulations built under the Cane and Sugar Act of 1984, government also intervenes to help strengthen the domestic sugar sector in the following ways:

1. Financing soft loans support to cane farmers

The government supports cane farmers indirectly through a state-owned bank, the Bank for Agriculture and Agricultural Cooperatives (BAAC), through loans with low interest rates, known as 'soft'. These soft loans are provided to farmers to fund purchase of farm machinery, sugarcane harvesters, and farm operating activities to facilitate the improvement of productivity.

2. Controlling the domestic sugar price

The OCSB specifies domestic pricing and authorised the 5 baht/kg tax on domestic sugar sale collection into the Office of Cane and Sugar Fund (OCSF) which fixing the domestic sugar price approximately 5 Baht/kg above the world price announced by the Department of International Trade. The OCSF receives this 5 baht/kg tax on domestic sugar sales payment and uses some of this payment to compensate both cane and sugar producers in difficult circumstances.

3. Supporting the sugar sector by abolishing support that was dedicated to other crop sectors.

Cane is a higher value crop than other competitive crops. Therefore, the official goal was to increase cane production from 100 million tonnes of cane produced in during 2012-2013 to 150 million tonnes of cane by 2020. As most of the arable land in Thailand is already used for crop growing, attempting to increase cane-growing inevitably means persuading growers of other crops (e.g. cassava, rubber and rice) to switch to cane production. In order to stimulate this switch, the government promotes the sugar industry by ending the support that was dedicated to other crop sectors.

2.2.4 The competitiveness of Thai cane and sugar industry

The Thai sugar industry has been highly competitive in the world sugar market for a long time. The strengths of its market structure are based upon low production costs, proximity to export markets, and most importantly, strong intervention by government.

The cost of sugar production in Thailand has always been lower than the world average. According to Chuasuwan (2018), Thailand's cane production costs are approximately 1,050 Baht/tonnes (about 13.6 USD cents/lb.), second only to Brazil's with costs of about 11.2 USD cents/lb.

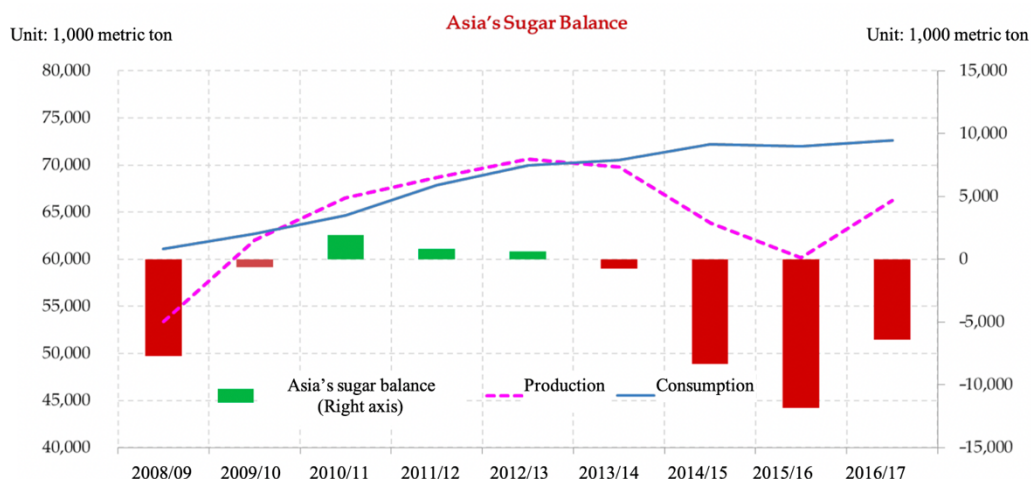


Figure 2.7 Asia's Sugar Balance (Source Bank of Thailand by Preecha et al. (2017))

Thailand is situated in a net sugar importing region, particularly Indonesia and China where demand for imported sugar has continuously rising (Manivong and Bourgois, 2017), which reduces the possibility of world price imports from these countries. Above all else, Thailand has

advantages over competitors especially Brazil and Australia in terms of proximity of the Asian market, so the transportation costs are lower (Figure 2.8). As shown in Figure 2.7, it is evident that Asia's sugar production has yet to meet its own domestic demand. Demand for sugar in these countries continues to grow due to relatively high levels of economic growth in countries such as India and China. Because of frequent sugar deficit in this region, Thailand has a great opportunity for export expansion in Asian due to its potential for consistent sugar exports (Preecha et al., 2017)

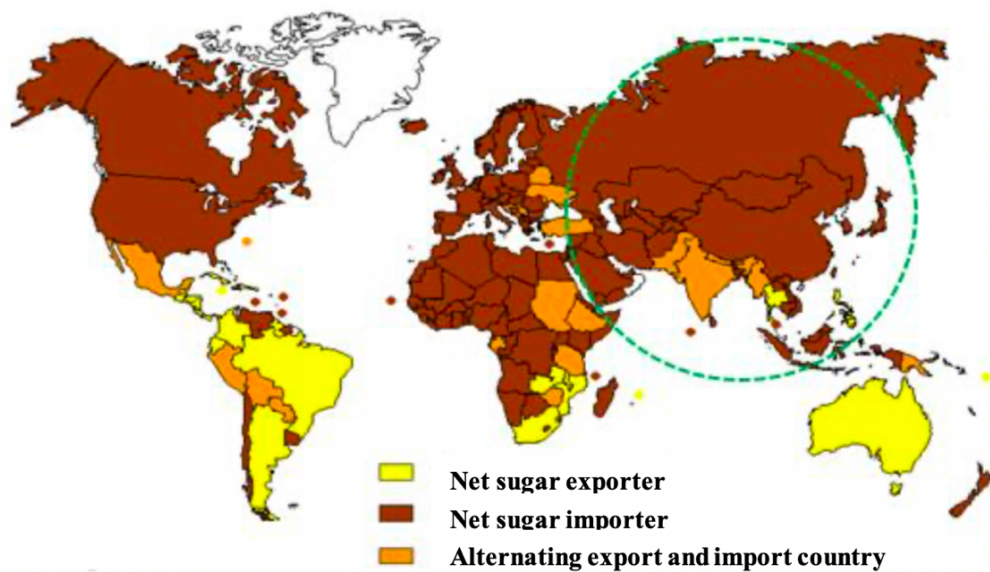


Figure 2.8 Net sugar exporters and net sugar importer (Source Bank of Thailand by Preecha et al. (2017))

The export markets of the major sugar exporters: Thailand, Brazil and Australia are rather independent for each other based on the basis of transportation distance, as there are few overlapping markets. Since sugar is one of the true commodity products, the standard of sugar between countries does not differ much. Therefore, the world sugar price seems to be the most important factor determining the demand of sugar from importers. Arjchariyartong (2007), who studied the competitiveness of the Thai sugar industry, suggested that despite being situated in the same net import area, Thailand has an advantage over Australia because of Australia's relatively high freight costs.

Among the various drivers of the industry's strength, the primary driver must be the wide-ranging supports provided by the Thai government (see Sections 2.2.3.1 and 2.2.3.2). These support policies and regulation allow Thai cane and sugar producers to maintain their profitability even during the period of depressed sugar price in the world market.

The interrelation between the government’s sugar policies and Thai sugar producers’ natural advantages clearly has significant implications for the growth of the industry. Due to this distinct sector model, the industry has become very attractive to both farmers and sugar millers. Both cane farmers and sugar millers benefit by the systematically safeguarding government policy in the following ways:

1) Benefits from the domestic price scheme (known as Home Price Mechanism)

Sugar is categorised as a controlled product under the Cane and Sugar Act of 1984 in which the quantities and prices of sugar sold domestically, or to the export market, by each miller, is determined through the quota system set by the market regulating authority. As explained in Section 2.2.3.1, the logic behind this sugar distribution system is that every mill gets the same proportion of A, B and C quota, on the basis of the average sugar capacity of each mill over the previous three years. As a result, the sugar distribution and market share of all millers is strongly protected (Manivong and Bourgois, 2017). The government policy of fixing the price of sugar for the domestic market (Quota A) above the world sugar price is known as the “home price scheme”. One of the consequences of this scheme is to drive up producer prices at the expense of domestic consumers who always pay more than world prices, albeit that these prices are more stable. A significant discussion on the subject was presented by Meriot (2015), who described the Thai sugar industry as obtaining a sugar price pooling advantage through its controlled quota system. Figure 2.9 illustrates an example of price pooling advantage with the values of sugar on the internal market in 2014, as amplified in Meriot (2015).

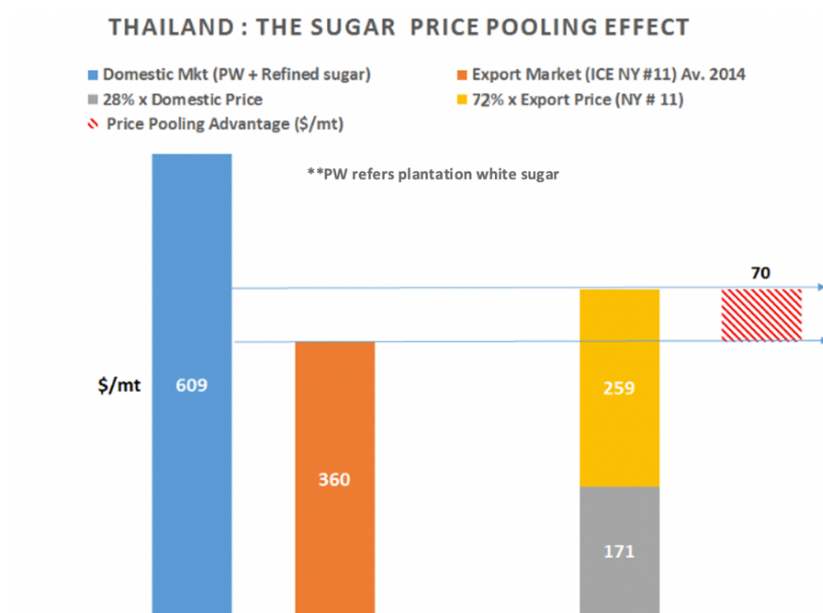


Figure 2.9 The sugar price pooling effect (Source Meriot (2015))

As shown in the Figure 2.9, the blue bar and orange bars represent the price of sugar in domestic and exported market in \$ per tonne of sugar, respectively. The Grey bar represents the value of domestic sugar, which is calculated by the multiplication of 28% of sugar production supplied to domestic market and the domestic price. The yellow bar represents the value of exported sugar, which is based on 72% of sugar production linked to world sugar market and the export price. This revenue blending provides the industry an advantage compared with the world market prices. In the case of market in 2014, the value of this price pooling system to Thai producers from this cross-subsidy mechanism was about \$70 per tonne of sugar which contributed the total of about \$ 775 million to Thai cane and sugar producers in 2014.

To better understanding the effects of this mechanism, in another study, Preecha et al. (2017) analysed the impacts of government's market intervention on exported sugar by adopting the International Economics Theory and Policy of those of Krugman and Obstfeld (2009) as shown in Figure 2.10

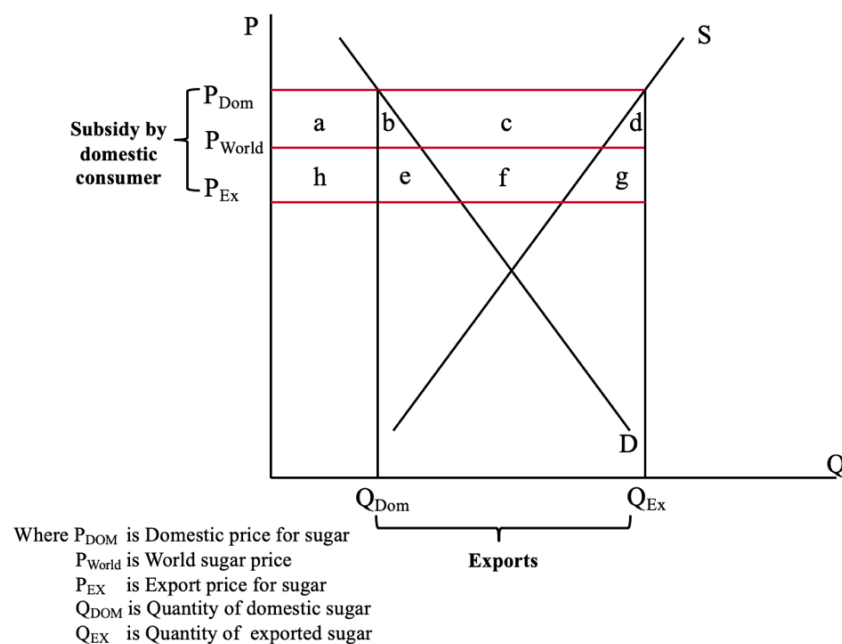


Figure 2.10 Impact from setting sugar export quota on domestic sugar market (Source Bank of Thailand by Preecha et al. (2017))

Preecha et al. (2017) concluded that the effects of the Home Price Mechanism are: (i) consumer loss equals to area $(a+b+h+e)$, (ii) subsidy by domestic consumer to producers equals to area $(a+h)$, (iii) producer gain equals to $(a+b+c+h+e+f)$ and (iv) efficiency loss or deadweight loss equals to $(d+g)$. Chuasuwat (2018) also pointed out that the higher domestic sugar price, compared to the world price, helps to maintain an elevated level of income for Thai cane and sugar producers and keep them profitable.

2) Benefits from sugar mill licensing requirement

In consequence of the government's control over both total number of sugar mills and the national production capacity, existing players are favoured by this regulation as their income is protected from competition from new entrants (Chuasuwana, 2018). In the same vein, Pitakpaibulkij et al. (2015) argues that the Thai domestic sugar sector is highly regulated with little competition where over 60% of domestic sugar sales are taken by five major groups of sugar operators.

3) Benefits from contract farming arrangement and revenue-sharing system

Cane farmers benefit from contract farming arrangements because they are provided with a guaranteed market, production inputs (e.g., short-term low interest loans (from their buyers) and fertiliser), market information and long-term planning. All these benefits minimize farmer's risk in cane cultivation (Piewthongngam et al., 2011, Polyorat, 2011).

Thanks to the 70:30 revenue-sharing system of cane farmers and millers in which the net revenue from sugar sold domestically and internationally are shared between the two parties in fixed proportion, the industry benefits from guaranteed supply chain since prices (Chuasuwana, 2018, Sowcharoensuk, 2021).

4) Benefits from the cane price support mechanism

Meriot (2015) points out that despite the gradual decline of world sugar prices during 2011-2015, Thai preliminary cane price did not follow the same trend and so remained at relatively high levels (Figure 2.11). Meriot (2015) suggests that a strong signal in terms of cane prices established through the cane price support system has been a good incentive for cultivating, so driving up the cane cultivated area, but not driving farm productivity gains.

Since the revenue-sharing system helps to reduce the risk of cane price fluctuation, sugar millers are favoured by the stable and relatively predictable gross profit and are able to manage costs better through the stability of cane supply (Chuasuwana, 2018).

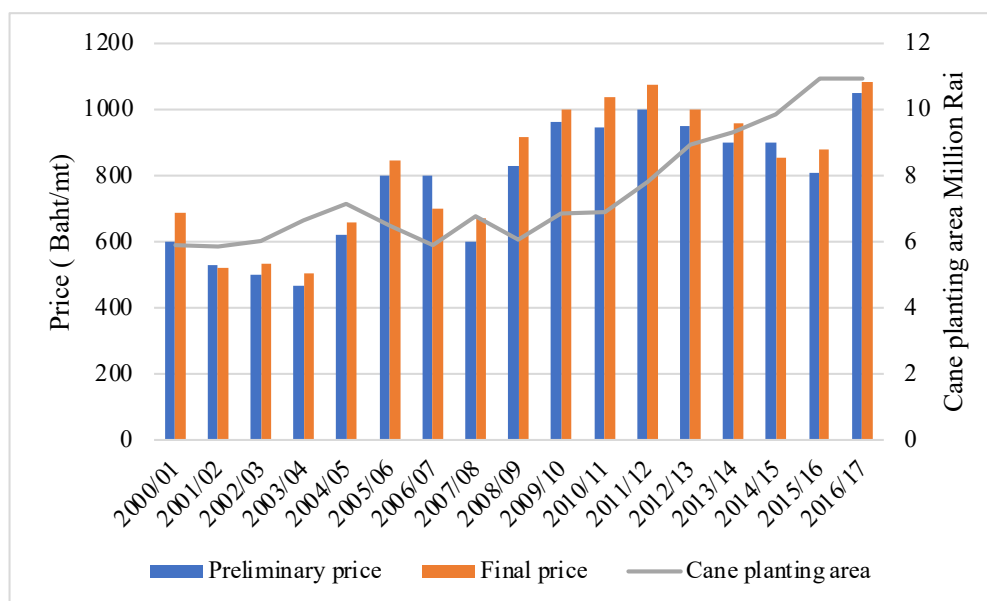


Figure 2.11 Cane prices and cane planting area (Source: OCSB (Various dates))

5) Benefits from border protection

Much more importantly, border protections (import tariffs and TRQ Scheme) contributing to high prices on the domestic market relative to low world prices helps to protect the profitability of cane and sugar production (Meriot, 2015). Even though sugar can be imported to Thailand under the quota of 13,760 tonnes since 2004, actual sugar imported has been insignificant (see Table 2.1) due sufficient available domestic sugar supplies (USDA, 2019).

Table 2.1 Actual sugar imported and tariffs applicable under TRQ quota regime set by WTO (Source: Arjchariyartong (2007) and USDA GAIN (Various dates))

Year	Quota (tonnes)	Actual imported (tonnes)	Tariff quota (%)	Tariff out of quota (%)
1998	13,323	17.3	65	100
1999	13,396	20.0	65	99
2000	13,462	0.0	65	98
2001	13,542	6.4	65	97
2002	13,614	5.4	65	96
2003	13,687	100.0	65	95
2004	13,760	2.1	65	94
2005	13,760	0.0	65	94
2006	13,760	0.0	65	94
2007	13,760	0.0	65	94
2008	13,760	0.0	65	94
2009	13,760	0.0	65	94
2010	13,760	0.0	65	94
2011	13,760	5.0	65	94
2012	13,760	5.0	65	94
2013-20	13,760	0.0	65	94

2.2.5 WTO complaint and pressure for Thai regime reform

Recently, Thailand has been subject to intense international pressure over its sugar regime. In 2016, Brazil filed a request for WTO consultations with Thailand regarding an alleged subsidy regime applicable to Thai sugar sector. Brazil argued that this support, both for domestic sugar producers and exporters, had allowed Thailand to increase market share at the expense of Brazil. Brazil also argued that these subsidies have decreased the world price of sweetener. Brazil's case is based on the claim that this government intervention is inconsistent with the international trade agreement with WTO to which Thailand is a signatory (WTO, 2016).

The Thai sugar regime is patterned after the old EU sugar system, a key aspect of which was declared illegitimate by the WTO in 2005 (Meriot, 2015). The WTO determined that sugar exports operated by the EU system benefitted from prohibited domestic and export subsidies in which all the EU subsidiary programs caused weak sugar prices and surplus of supply on the sugar world market. The WTO panel challenged the EU to undertake the voluntary restructuring to cut its production quotas and other support measures and reduce price support. In responding to the WTO's enforced change, The EU reformed its sugar regime in 2006.

WTO consultations, however, allow the parties an opportunity to discuss the matter and to find a satisfactory solution without proceeding with the litigation. Consequently, Brazil has challenged Thailand for a dispute settlement by offering several options for changing the Thai sugar regime which, if met, would allow Brazil to withdraw their complaint.

In an effort to avoid being challenged at the WTO, Thailand has been set to overhaul its entire sugar production and distribution system through the proposed reforms to its local sugar market, something the government has resisted for more than 30 years. In response to this pressure, the OCSB has published a set of reform proposals. These proposals included options to revoke the current 70:30 revenue-sharing system and abolition of the sugar quota system and the floating of domestic sugar prices. Several challenges and significant changes would likely emerge, such as increase in producer income volatility, if these reforms are fully played out, some of which would be intentional.

First, with a floating domestic sugar price, the fixed domestic sugar price will cease to exist. As a result, the sugar price will align closely to the world sugar prices. Chuasuwan (2018) pointed out that this may lead to unwelcome effects on producer's income generated from domestic market. Second, the elimination of the 5 Baht/kg collection from factory-gate sugar prices collected into the OCSF would lead to the end of the use of such funds as a price stability tool. Third, the cancelling of the sugar quota system would freely allow sugar millers to decide the

volume of sugar they sell into domestic and international markets. Subsequently, millers' revenue would vary on the basis of the ability of each firm to anticipate movements in world prices (Sowcharoensuk, 2021).

Although the government issued an order announcing support for structural reform of the sugar industry, it is not yet clear whether which new policy measures would be applied to replace those that were terminated and it is still uncertain whether the new measures would be sufficient to prevent the consultations at the WTO from moving forward.

2.3 The regulation of sugar markets and global sugar policy reform

The global sugar price volatility intensified by market and policy factors adopted by sugar producing countries has increased interest on the regulation of sugar markets in many countries. Given the importance of sugar sectors, there are surprisingly few empirical studies on this subject.

Sugar sectors are among the most regulated sectors in world agriculture, being subject to strict government regulations, controls and interventions, including import restrictions, subsidies and quotas mechanisms (Mpapalika, 2019). According to Pop et al. (2013), the global sugar market is among the most volatile of any commodity, posing a challenge for governments in coping with price instability. Many studies observed that these strict controls over sugar sectors have create inefficiency and distortion in the global sugar market, which has also created a challenge to the competitiveness of sugar sectors in a number of countries (Devadoss and Kropf, 1996, Larson and Borrell, 2001). Mitchell (2004) and Elobeid and Beghin (2006) have claimed that many governments have offered their sugar sectors some form of protection, such as import duties and subsidies which distort price signals at the expense of local consumers. As noted by OECD (2007), the characteristics of sugar production which distinguish it from other arable crops is the reason that standing government interventions are commonplace in sugar markets and have been adopted by most sugar producing countries. These characteristics are, first, sugar is produced from two fundamentally different cultivars, i.e. cane and sugar beet, which are grown in different climates and topographies. The second reason is the perishability of both cane and sugar beet which need to be processed within a relatively short period of time after harvested because sugar content quickly declines and its value is based on sugar content. Third, there is significant variation in costs of sugar production between countries even with the same cultivar. For instance, costs of sugar produced from cane is often lower than sugar beet. In addition to characteristics of sugar production, Larson and Borrell (2001) emphasize other factors leading

to volatile markets, such as fear of shortages, historical trade arrangements, and conflicting interests between farmers and sugar mills.

Although government intervention to protect domestic sugar markets have become widespread among sugar producing countries, Zimmermann and Zeddies (2002) point out the protection levels imposed through sugar regulations vary across countries. For instance, based on the producer support estimates (PSE) generated by the OECD, the highest domestic price support level of investigated countries is found in the EU with the PSE of 54% followed by the U.S. (52%), while the lowest protection level, at 5%, is found in Australia, partly because its sugar prices are based on the world sugar market (Zimmermann and Zeddies, 2002). As noted by Larson and Borrell (2001), several market protection regulations were imposed by most of large sugar producers. For example, almost all governments have used restrictive trade protection policies, import tariffs and quotas in particular, to protect their domestic market. In addition, production quotas were widely used in most large sugar producing countries such as the EU and the United States, whereas Mexico and Thailand used a market share sales quota approach. Revenue-sharing arrangements between farmers and millers, mandated by government, aimed to solve conflict between farmers and millers, were also used in many countries such as the U.S, Thailand, Fiji, Philippines, and Mexico. Table 2.2 provides further details of the type of policies and supports to sugar industries used by a range of countries during 2002 (Hudson, 2019).

Table 2.2 Policy mechanism used by selected sugar producing/exporting countries from 2002 to 2019

Country	Export Tariff/Quota		Import Tariff/Quota		Market Share Sales Quota		Production Quota		Cane Price Support		Income Support		Input Subsidies ¹		Ethanol Mandates		Debt Financing ²		Other Non-Price Support ³	
	2002	2019	2002	2019	2002	2019	2002	2019	2002	2019	2002	2019	2002	2019	2002	2019	2002	2019	2002	2019
Brazil ⁴			X	X							N/A		X	X	X	X				
Thailand			X	X	X	X			X				X	X	X	X				
Australia ⁵			X	X					X	X					X	X	X	X	X	X
EU ^{6,7}	X		X	X			X		X	X ⁷	X	X ⁶			X	X				
China ⁸			X	X					X	X	X		X		X				X	X
Columbia	X	X	X	X	X	X				X	X			X	X				X	X
Cuba			X	X						X	X								X	X
Guatemala			X	X																
India ⁹	X	X	X	X					X	X	X	N/A	X	X		X	X	X	X	X
Japan			X	X					X			X								
Mexico		X	X	X	X	X			N/A	X	X		X	X			X	X	X	X
Russia			X	X									X				X	X		
South Africa			X	X	X	X				X	X		X				X	X	X	X
Turkey			X	X			X	X	X	X	X		X		X				X	X

Note:

1. Includes crop pre-financing, irrigation and harvesting provisions, land maintenance, and inventory financing
 2. Includes low interest loans, interest rate subsidies, debt relief and debt rescheduling
 3. Includes R&D funding, state ownership of sugar mills, state trading-enterprises and single desk selling.
 4. Brazil provides direct subsidies (income support) to producers in North/Northeast regions.
 5. Australian sugar sales and exports were handled by a single desk called Queensland Sugar Limited (QSL) until 2006. Since deregulation in 2006, marketing through single desk has been voluntary and determined through commercial negotiation between millers and marketers (Raw Sugar Supply Agreements (RSSAs)). Indirect support programs for cutting costs of growers (i.e., package called 'save the industry') are implemented.
 6. The EU provides an income support subsidy to sugar refiners prior to 2006 reform and replace with restructuring fund paid to both refiners (90%) and growers (10%).
 7. Despite the reduction due to the 2006 reform, the minimum buying price of sugar beet and reference price for sugar are maintained.
 8. State-trading enterprises accounted for 70% of domestic sales in China
 9. India use a policy of high government-set cane prices on both federal (Federal Fair and Remunerative Price (FRP)) and state (State Advised Price (SAP)) levels and provides export subsidies.
- N/A refers no information available found.

Source OECD (2007), Hudson (2019), and USDA GAIN database (Various dates)

The shift towards free markets for sugar are not supported by everyone. Some works in development argue, based on development theories, that government interventions are essential in prompting agricultural market development, especially for developing countries. Protectionist policies have been argued to be inefficient and ineffective, especially if benefits and incentives are not redirected towards the domestic firms to boost their efficiency and competitiveness (Mpapalika, 2019). Given the awareness of the downsides of strong regulation, the regulations in the sugar sectors have been consistently easing and many countries have begun to move towards the reforms their sugar sector since the implementation of the Uruguay Round Agreement on Agriculture (AoA) in the 1990s. For instance, in 1996, Brazil's government began to reform its sugar and ethanol market by removing the export tax on sugar and deregulating the market for a cane-based alcohol blended with gasoline (anhydrous alcohol). Moreover, the Brazilian government also shifted away from the cane-sugar subsidy to alcohol production and moved away from taxing sugar producers in high-cost production areas at lower rates toward establishing a uniform tax (Larson and Borrell, 2001). Meanwhile, the Indian government began to liberate its sugar sector in 1998 when the licensing requirement for new sugar mills was abolished. According to Rangarajan (2012), the installed capacity of Indian sugar sector grew nearly 7% annually between 1998-2012 which was more than double compared to 1990-1998 as a result of delicensing.

Despite these reforms, regulations in sugar sectors have persisted in most countries. The sugar policy reform of some key market players in the world market and its impacts are presented in the following section.

2.3.1 Sugar policies of key market players, their reform and its impacts

Thailand is not alone in having to adjust its sugar policies to react to WTO pressures and world market conditions. While many regulators around the world appear to be choosing different approaches for their sugar industry, they all have to remain within a rules-based framework presided over by the WTO.

i) Australian policy and its reform

Australian policy reforms began in the 1990s and was fully deregulated in 2006. Before reforming its sugar policies, its sugar industry was considered to have one of the most restrictive regulatory regimes in Australia. Australia maintained stringent production and marketing

controls through an embargo on imports of sugar and regulation of domestic sugar prices controlled by a two-tier sugar pricing system which placed a higher price on sugar sold domestically, but lower prices on sugar sold into the export market. During this time, Australian cane and sugar producers tended to rely heavily on a wide range of government periodic assistance, but they lacked freedom to operate in a commercial environment where new practice and innovation could occur. Then, the initial driver toward reform emerged from a growing awareness by government agencies that the highly regulated nature of its industry was impeding industry development and responsiveness to a dynamic and complex international trading environment. In response, the Australian government eliminated import tariffs in 1997 (Larson and Borrell, 2001) and in 2004-2005 abolished the regulated collective bargaining with compulsory arbitration between farmers and millers and replaced this with a voluntary marketing arrangement without regulatory intervention (Parliamentary Committees, 2015). To accompany the regulatory changes, a programme of industry adjustment assistance was set up providing up to \$ 444.4 million in income support, exit grants and funding for regional capacity building to assist industry stabilization and support during reform process. (Parliamentary Committees, 2015). However, the cane pricing arrangement, which is calculated through a formula which links the cane to the sugar price, has been continued, on the grounds that it is a grower price risk management mechanism operating in a fully deregulated market. This deregulatory approach has allowed cane and sugar producers to continue to develop into more commercially orientated and internationally responsive sugar industry.

ii) The EU reforms

The highly protected sugar markets of developed countries are extremely lucrative for developing countries, especially when the domestic sugar price in those markets is higher than the world market price. A good example of such a developed market was the EU. In the past, prior the reform of its sugar regime the EU's held the position as the world leading sugar exporter. The EU's production capabilities were heavily regulated by production quotas and heavily protected by imports controls (Frandsen et al., 2003, Judzińska, 2012). Clearly, the EU's success in achieving this world leading position was not the result of having comparative advantage in sugar production but because of domestic policy. The key characteristics of its sugar regime were: (i) a price support mechanism, in conjunction with through a quota system, which set a minimum price for growers and guaranteed prices to millers set at a level significantly above the world price; (ii) setting quota volumes to cover European needs, plus a margin of safety; (iii) export subsidies to facilitate export of surplus production out of the EU;

and (iv) tariffs and tariff quotas on imports from developing countries. The key protection mechanism of the EU sugar regime was that there was no ceiling production. Therefore, it was possible for growers to over-produce and any surplus to domestic market needs would be exported. This excess production did not benefit from the higher community price, but was sold at international prices. This type of regime is known as the double quota system and is a form of export subsidy for over-quota production, where the volume under quota is higher priced but production in excess of the quota remains possible (Agriculture Strategies, 2019). As a result of heavy criticism of its sugar policy by developing countries, in 2005 the EU sugar regime was declared illegal by the WTO, and a process of reform began in 2006. The 2006 reform was done on a voluntary restructuring and incentive basis to cut the internal production quotas and to reduce support price, as well as scaling back government aids through buying back quotas and compensating for plant shutdowns (Agriculture Strategies, 2019, Nobel, 2012). While the European Commission agreed with removal of production quotas for sugar, it suggested maintaining some market measures, in particular, continuation of border protection through high tariffs, a reference price for sugar, compulsory written contracts for beet growers, and private storage aid to protect against market imbalance (Nobel, 2012). As pointed out by Benešová et al. (2015) and Řezbová et al. (2015), who assessed the impact of the EU quota system, the reform led EU market became more effective and forced the less efficient producers, i.e. both beet growers and sugar companies, to leave their business. In consequence of an increase in the level of competitiveness in post-reform, it has created greater market concentration, together with more effective production. However, the study of Szajner et al. (2016) on the EU sugar sector in the wake of the 2006 reforms concluded that the reforms brought a significant change to the EU sugar markets, including a decline in production. In consequence the EU is now not self-sufficient in sugar and has become a net importer rather than an exporter. Other impacts include a change in the level of competition between sugar refiners, where the oligopolistic structure of EU sugar sector due to more intense concentration which would result in greater difficulty for new entrants into the milling sector.

iii) Indian sugar reform

India is the second largest sugar producer and has been an episodic sugar exporter to the world market. Despite a major step to liberate its sugar sector in 1998 through the abolition of licensing requirements for new sugar mills, various domestic support measures for sugarcane and sugar producers have been maintained, such as (i) price support through a ‘dual-price’ scheme with which is organized by the Federal Government (i.e. Federal cane price called Fair and

Remunerative Price (FRP⁵) on one hand, and the State Government on the other hand (i.e. State Advised Prices (SAPs⁶)). (ii) a minimum selling price for sugar in the domestic market; and (iii) additional measures that provide financial assistance to sugarcane producers, including production subsidies and soft loans provided to sugar mills to offset sugarcane price arrears, and subsidies to maintain buffer stocks (WTO, 2019b). In addition to domestic support measures, controls on both exports and imports are imposed after taking into account domestic demand and sugar availability, and the cane price (Rangarajan, 2012). According to Meriot (2016), the predominant government intervention in Indian sugar sector is its cane price support system. The Federal Government intervenes to maintain the minimum cane price by authorising the FRP price, the first level of pricing, which is set as a mandated price floor. Meriot found that the FRP price paid to farmers increased almost 60% between the 2010/11 and 2014/15 seasons. In addition to FRP price, the State Governments are allowed to increase the price of cane for cane traded in their state through the SAPs, a second level of pricing, which is generally 30-50% higher than the FRP. The key highlight of this dual-price scheme is wherever the SAPs are declared, it takes precedence over the FRP, irrespective of market prices. Resultant high cane prices have allowed the cane farming area in India to stabilize at around 5 million hectares since 2010/11, despite a decline in world sugar prices.

India also operates a price sharing system, between producers and millers, very similar to that of Thailand Revenue is split at a ratio of 70:30 (farmer: miller). Indian growers receive their first payment based on the pricing system indicated above. The balancing payment depends on the final sugar price that sugar mill sells at. The only difference between Thai and India policy is that Indian sugar revenue based on both primary and by-products sales while in Thailand only revenue from sugar and molasses is taken into account.

Since 2019, India has been under investigation by the WTO into its sugar subsidy regime which, it is claimed contributes to a glut in the international market and causes a significant drop in world sugar market prices. However, the Indian government stands firm in defense of its domestic producer subsidies, as it argued that these measures were aimed at preventing

⁵ Fair and Remunerative Price (FRP) for cane is annually fixed by the central government which is also known as minimum price paid by millers to farmers.

⁶ State government can also intervene in cane pricing with a State Advised Prices (SAPs), a second level of pricing for cane, to strengthen farmers' interests. The SAPs are generally 30-50% higher than the FRP price. SAPs are supportive of the overly high cane prices for political reasons.

exploitation of over 35 million vulnerable, low income, resource-poor cane farmers, and to enable them to have a just and equitable share in economic development (WTO, 2019a).

2.4 Agricultural policy approaches: the Protectionism - Liberalisation continuum

The first goal of the research was to identify a suite of alternative policy options for use in surveys of farmer and miller intentions. These policy scenarios have to be compliant with WTO rules and commitments, and they have to represent a spread of positions on the libertarian-protectionism continuum. Liberalisation and protectionism are the two fundamental alternatives facing governments when determining policy regimes for industry sectors when accounting for foreign trade policy. A review of relevant literature has therefore been carried out to gain an understanding of these alternatives.

2.4.1 The liberalisation of trade policy – An overview

The nature of the benefits and impacts for economic growth from liberalisation of policies has been the subject of intense debate since the time of Adam Smith, a founder of modern economics. Adam Smith advocated a system of natural liberty in which individuals are free to pursue their own interest, while the government has only one role, that of providing the legal framework within which the economic activity takes place. As he states: “Free exchange made without restrictions and regularity is always advantageous, although not equally advantageous for both parties”. Smith’s (1962) idea of free competition and freedom of action is supported by Friedman and Friedman (1990), who state that: “Free trade would not only promote our material welfare, but it would also foster peace and harmony among nations and spur domestic competition”. John Stuart Mill analysed the advantages associated with free trade in more detail. He highlighted that the expansion of the marketplace beyond the national boundaries leads to better division of labour and intensive use of machinery and facilitates people working harder to meet their new wishes through opening up to outside trade and hence to improvement in the production process (Prelipean and Bucătar, 2019). A number of empirical economic literatures (Edwards, 1998, Frankel and Romer, 1999, Sachs et al., 1995) have postulated a convergence between free trade and economic growth which have concluded that a policy of trade liberalisation favourably affects growth. Scholars have concluded that countries that engage in freer trade receive more benefit than countries that engage with protectionist policy. Among the most powerful evidence in support of this view is a study by the World Bank published in 1987 which looked at the correlation between trade policies and economic performance for 41

developing nations during 1963-1985. The analysis found that countries with a strong policy of liberalisation enjoyed greater economic performance and outperformed countries with either moderate or strongly restrictive policies. The study concluded investments tend to be more productive in freer trade environment, contributing greater economic output and efficiency (World Bank, 1987).

However, these empirical studies of classical liberalism⁷ have been subject to substantial criticism. Kaempfer et al. (2004) point out that there is no proof that everyone gains from free trade and liberalisation, even when there are no market failures. Kaempfer et al. (2004) argue that the only thing it proves is that the gains from free trade in “money” terms in total are larger than the losses. However, transfers from winners to losers in a society may mean that not everyone is better off even in a growing economy. P. Samuelson points out the existence of limits to the virtues of free trade. He argues that when economies confront dysfunctions, it is difficult to determine if countries would benefit from liberalisation or not (Prelicean and Bucătar, 2019). A study by Rodriguez and Rodrik (2000) who used the data used by the World Bank and other relevant studies on policy of liberalisation topic showed that the findings of these studies are highly fragile. They argue that the indicators of liberalisation that are used in many studies are unreliable because they are not wholly related to trade policy while there are reflections of other factors related to institutional structure and other macroeconomic policies. Several studies have further investigated the topic, following the criticism by Rodriguez and Rodrik (2000), and have concluded that geography and institutional structure are the predominant influences on country’s economic growth while there is no direct impact from trade policy (Alcalá and Ciccone, 2004, Easterly and Levine, 2003, Rodrik et al., 2004)

2.4.2 Liberalisation of agricultural policy

The debate on agricultural policy of liberalisation and protectionism has continued to rage in recent years, focusing particularly on the liberalisation of agricultural markets. The principle of “learning by doing”, unfair competition and national security have been proposed over the years to justify the use of protectionism (Yeo and Deng, 2019). Liberalising agricultural trade regimes have been a primary objective of the WTO, with the aims of minimizing state intervention,

⁷ Classical liberalism is a political ideology and a limb of liberalism that advocated free market and securing the freedom of individual with a primary emphasis on limited power of the government, economic-political freedom.

developing free-market forces of supply and demand, and boosting trade and development in poor countries in particular. One prominent argument in favour of liberalisation suggested by Citizen's Assembly (2017) is that liberalisation increases the size of the economy as a whole and allows goods to be produced more efficiently. Protectionism, on the other hand, is defined as national policy restricting international trade in order to provide internal markets protection from international competition and usually implemented with the goal to improve economic activity within the domestic economy (Yeo and Deng, 2019). Through protectionism, governments are able to artificially push down costs for local producers and drive-up competitive ability, while artificially raising the costs of imported products and so limiting foreign producer's access to the domestic market (Abboushi, 2010, Bussière et al., 2011). Protectionist policy, according to Nicita and Gourdon (2013), refers to the policy measures carried by the government to promote domestic industry in the face of international competition. Baldwin (1970) describes protectionism as any policy measure, public or private, that is devoted to production of goods to be allocated in such a way as to lessen potential real-world income. Tariffs, import quotas, state aid, guarantees and agricultural subsidies to domestic industries are some of primary policy tools many governments have used in enacting agricultural protectionism (Abboushi, 2010, Bussière et al., 2011).

While the WTO has been historically successful in liberalizing markets for agricultural products, there are recent signs of reversal of trend. Indeed, the literature analyzing the benefits of full liberalisation is extremely rich with substantial work having been achieved on the theoretical and empirical effects. Hypothetically, in perfect world, a full policy of liberalisation leads to economic growth as a whole, as it allows agricultural products to be produced more efficiently through best use of natural resources, infrastructure and skills, resulting in poverty alleviation at global level (Citizen's Assembly, 2017, Ingco and Nash, 2004). Consumers also benefit, both in terms of increased choice and better prices (Berg and Krueger, 2002, Maitra, 2012, Natale, 2020). An increase in productive efficiency creates efficient allocation of resources, more jobs, improvements in wages and livelihood conditions, which would increase a nation's wealth, thus domestic industries boom (Lee, 2005). The benefits can be viewed with a Stolper-Samuelson theorem, which states that liberalisation of commodity markets will raise the real return to the production factors used intensively in that industry, resulting in a rise in relative price of labour-intensive products and relative wages as well as demand for employment. The Stolper-Samuelson theorem is, however, based on the assumption of perfect competition in all markets and zero policy distortion, which is not the case in every developing country, where labour mobility of each country is not similar or uniform (Maitra, 2012).

Whether liberalisation can hurt countries, especially developing and poor nations is a matter of great debate. In the real world, complete trade openness still remains moribund, i.e. to date, no country has completed a transformation to a free market where imports of certain products are freely allowed, because at least small degree of protectionism always exists. The uniformity of the benefits of a free market and liberalisation can therefore still be questioned. Moreover, because different modelling studies have used different modelling approaches, these generate conflicting projections. Because the WTO encompasses asymmetric countries, in the sense that they have considerable difference in sizes with different levels of economic development, including natural endowments such as location of presence of natural resources and technical resource and difference in political strength, it has been universally accepted that gains from trade liberalisation, for example resulting from of the Doha Agreement on Agriculture, will not be distributed equally, both between countries and economic agents (typically agricultural producers and consumers). Where countries are trading freely, where the countries have significant differences, in initial level of economic efficiency and economic development, free trade may even create a man capital drift from least to most developed countries (Bureau et al., 2006, Panitchpakdi, 2001, Schneider and Kernohan, 2006, Valdes, 1991). A well-grounded criticism of the case for free market policies often includes the subject of income distribution. Although many trade models such as the Heckscher-Ohlin model (H-O) and the generic modelling technique, confirm that economic efficiency increases at the aggregate level, they do not indicate how benefits are likely to be spread across individuals. What these models do reveal is that liberalisation results in an income redistribution where some individuals will gain from the free market whereas others will lose (Suranovic, 1997). A common solution suggested by economists in relation to the gainer-loser issue is to evoke the compensation principle, i.e. redistributing the economic efficiency gains from the sum of gain by the winner to eliminate the sum of losses to the losers so that, at last, everyone gains (Natale, 2020). However, in today's complex world, where there are thousands of different sectors producing thousands of different products, it would be impractical to attempt such an approach. Although economic analysis demonstrates that gains and losses will eventually be spread out over a period of time, where some industries or individuals will lose initially but will be better off in the long run, some will never gain or lose, because of the fact that a string of microeconomic factors, specialization patterns, labour market situation between countries, are not static. This means that market openness is very likely to cause unfair losses to some countries (Suranovic, 1997) and some individuals. Therefore, in the "short run", liberalisation may cause some industries to lose their strength by exposing vulnerable producers in developing countries to "unfair competition" which tends to displace domestic production and create an uneven playing field between

domestic and imported production (Schneider and Kernohan, 2006). In the short term this would cause increased unemployment and increase in poverty of people of the nation where the livelihood of vast majority of citizens is heavily relying on that sector (Maitra, 2012).

To date, a number of studies have attempted to identify the important factors that determine country, sector or individual's preference about public policy choice between liberalisation and protectionism. Some studies have found that trade policy preferences often depend on an individual's skills in that sector. Beaulieu et al.'s study (2005) of Latin American countries, found that unskilled workers, regardless of country, are more likely to oppose free trade. Gabel (2009) points out that people with lower educational level, anywhere in the world, may be less flexible and less able to deal with the rigors of markets, thus are less likely to support policy of liberalisation. Mayda and Rodrik (2005) observe that both trade exposure and sector of employment does shape personal trade policy preferences, with individuals employed in sectors with a comparative disadvantage more likely to be in favour of protectionist policy than those working in non-tradable sectors. They also observe that in addition to economic determinants like factor endowments (i.e., employment, relative income, and countries size), non-economic factors in the form of socio-demographic background of people within the sector, values, identities and attachments also play very importance role in explaining the variation in attitude of people or countries towards liberalisation-protectionism. For example, with respect to demographic variables such as age, gender, and education, Melgar et al. (2013) found that women, elderly, and less educated people are more likely to favour protectionism than men, younger and more educated people wherever they live. They also found that fear of adjustments costs outweighs the any positive effect that liberalisation could bring, through a resource reallocation for countries with unstable macroeconomic conditions.

A number of public opinion surveys found that a majority of people in industrialised nations appear to support governmental protection measures for agricultural industries (European Commission, 2016, Nguyen et al., 2021). For instance, the Eurobarometer in 2016 survey shows that a vast majority of Europeans view the level of financial support the EU provides to famers, either as average or even as too low, whereas less than 15% consider the financial support for farmers to be excessive (European Commission, 2016). Like other existed studies (Jensen and Shin, 2014, Naoi and Kume, 2011), Nguyen et al. (2021) elucidates several reasons why citizens in these countries find agricultural support acceptable, despite such policy a copy of the Examiners' report benefitting only a small part of society, i.e. farmers, while imposing high costs for protective measures on the rest of population in the form of taxpayers and consumer prices. First the agricultural sector contributes to broader national interests, or example food security.

Agricultural exceptionalism encompasses the thought that the farming sector is different from other industries, as it produces food, which is basic essential for human survival and more demand inelastic than other products. Second, the agricultural sector requires and deserves special support given its unique market and production conditions, being influenced, as they are, by uncontrollable factors such as natural weather and pest fluctuations and market price instability.

Similarly, Rosset (2006) pointed out that fully liberalised agricultural markets, without any subsidies, would hurt farming and rural society in developed economies, because it would make all but large-scaled industrial farming impossible. As Rosset argues, “Food is different. It is not just any merchandise or commodity. Food means farming, and farming means rural livelihoods, traditions and cultures, and it means preserving, or destroying, rural landscapes” (2006).

It is a matter of fact that agricultural markets have been quite distorted, compared to the liberalised model, because agriculture in various countries is dependent on some degree of protection. Indeed, some observers claim that agriculture should have a different status to other sectors in the world marketplace and that agricultural markets should not be liberalised. Many governments provide subsidies to their local farmers for many reasons, such as to help their farming sector be more profitable and provide security against bad harvests and price fluctuations (Wager, 2009). Moreover, protection such as import tariffs on agricultural products has been widely used to make imported products more expensive and to increase the competitiveness of local agricultural sector relative to imports in domestic markets (Aksoy and Beghin, 2004).

Advocates of free markets in agricultural products argue that such policies should be removed because they allocate resource in inefficient ways, promoting incompetence by restricting competition from more efficient producers, and therefore distorting the global agricultural market (Maitra, 2012, Wager, 2009). In purely economic terms, it would be expected that agricultural liberalisation would cause some geographical redistribution of farming. For example, economists would expect agricultural production to be concentrated in the most favourable climate and topography, where most resources were available for farming and where the best agricultural expertise was located.

With this in mind, full liberalisation, with consequent abolition of agricultural subsidies and import tariffs, would lead to a significant reduction in levels of agricultural production in less competitive countries that lack natural advantage. For example, a reduction in subsidies, i.e. direct payments in particular, to South Korean rice farmers has resulted in a dramatic decrease

of the South Korean rice farming, causing a great number of rice growers going bankrupt (Schuman, 2005). Thus, even though protectionist policy is likely to cause inefficiency in resource allocation and distort global agricultural markets, many countries such as Japan and South Korea, which heavily subsidize their domestic agricultural sector, have defended their protectionist policies for the reasons that the sustainability of their food security is their primary concern, and domestic production provides crucial insurance against risks, trade disruption and bad harvests in exporter countries, etc. These countries also argue that consumption of staple food is price inelastic, which implies that food consumption is not at risk from artificially high local prices as long as the population can afford it, whereas the consequence from other risks such as a trade disruption is potentially much more damaging (Japan and the Republic of Korea, 2000).

Some proponents of further agricultural liberalisation argue that a fully liberalized, properly functioning, global marketplace is a reliable means to provide food security for national populations. It is also suggested that if countries, especially in the developing world, liberalise their own agricultural sectors, the effect would be benefits to producers i.e. higher commodity price levels for producers, increased price stability and output (Schneider and Kernohan, 2006). In consequence, on average, it is likely to decrease overall poverty and vulnerability of agricultural sectors (Winters et al., 2002). This view is supported by Berg and Krueger (2002), who write that liberalisation generally leads to the betterment of poor farmers in developing countries. This may be true on the long run, but there is no convincing evidence that it will do so in the short run. Moreover, this view seems to assume that the world has become economically, environmentally, and politically much more stable and predictable than before (Wager, 2009).

Some studies forward the view that agricultural liberalisation could be a successful mechanism in fighting poverty, but only when societies on the basis of culture and economics are not too polarized. Timmer (2002) suggested that in societies where the income gap between rich and poor is more than double the average income, the outcomes from freer agricultural markets would not be of much benefit to the poor. This observation may undermine the view that freer agricultural markets would effectively reduce poverty, especially for the poorest, small-scale farmers. In the short run, there is evidence that the vulnerable, poorest, smallest-scaled farmers are likely to be less well placed to protect themselves against adverse shocks and take advantage of favourable opportunities from policy reform toward liberalisation. As reported by Polaski (2006), poor and small-scale farmers are not generally competitive in the global agricultural marketplace. For example, if small farmers relied on official supports such as loans to cover the

cost of input purchases, secured against future outputs, that private agents or banks would not provide, the abandonment of these supports as a consequence of liberalisation would likely to cause such farmers to suffer substantial income losses, even if the output prices have increased substantially. Moreover, Lopez and Stanton (1995) found that individual producers in Mexico, especially small farm households, with low levels of capital inputs and key productive assets and those who had problem accessing credit, and were less educated, were on average, less responsive to price incentives than those with higher levels of these factors. Similar results have been found by Deininger and Olinto (1999) for Zambia and by Heltberg and Tarp (2002) for Mozambique.

In addition to its negative impact on farm incomes, it is often argued that agricultural liberalisation increases the vulnerability of poor households to negative shocks. For example, some studies indicated that poor farm households may be unable or unwilling to undertake new potentially profitable actions to their farm operations, such change in cultivation patterns and agricultural investments, as a result of risk aversion (Kurosaki, 1995, Rosenzweig and Wolpin, 1993, Winters et al., 2002). In consequence, this could undermine potential gains from agricultural liberalisation among the poor farms and result in poverty traps (Winters et al., 2002).

In summary, although most economists accept that open economies perform far better in general than the protected ones and that relatively liberalised policies contribute considerably to development in the long run it could hurt poorer producers in the economy even in the longer run, i.e. successful, open regimes may leave many farmers and agricultural producers behind. Accepting this, some scholars have suggested a way that liberalisation may effectively, actively assist countries' agricultural sectors, in developing countries in particular, that avoids many of the negative outcomes identified above. Winters et al. (2002) raise the importance of introducing complementary policies, to accompany trade reform, that help strengthen social protection for the 'losers' and to improve the ability of poorer agricultural households to exploit potential gains, for example policies that allow deferred payment, or providing subsidized inputs. Heltberg and Tarp (2002) and Deininger and Olinto (1999) also highlight the importance of complementary policies targeted at small and poor farmers, for example, policies that enhance access to credit, foster asset accumulation and provide extension services. Polaski (2006) suggests that forms of agricultural liberalisation need to be adopted that would allow developing countries necessary policy space to protect their farming sector, including ensuring an acceptable level of domestic food production and encouraging agricultural investment. Finally, such regulated and controlled liberalisation strategies could generate opportunities for farmers and improve domestic agricultural performance. A good example of the adoption of such an approach is the EU. The

aim of the EU regulated liberalisation is to create a balance between economic efficiency and ensuring the provision of public goods (Jacobi and Kowalsky, 2002). Given the uncertainty associated with unfettered liberalisation in agriculture, Clapp (2014) suggests that considering the development of agricultural trade policy through multilateral, regional and bilateral trade arrangements could be one solution that helps to create a balance between efficiency goals and other social objectives such as securing local farmer livelihoods, realization of the right to food, all of which are no less important than efficiency goals.

In Thailand, while government policy intervention is required to ensure sustainable livelihoods for cane farmers and to protect the local economies more generally, above all, the new policy regime must be fair for all stakeholders, i.e. it must provide a level playing field and encourage strong competitive industries, from farming to sugar production, to help revive the ailing Thai sugar economy in the face of current economic and political pressures.

Chapter 3

Identifying alternative policy options and future policy directions for Thai cane and sugar industry based on the account of stakeholder consultation

3.1 Introduction

This chapter presents preliminary information about policy options and future policy directions of Thai cane and sugar sector from the sugar policy-making stakeholders' point of view obtained from policy consultation. The main objectives of this study are: 1) to identify a suite of alternative policy scenarios for Thai sugar industry, reflecting a range of market philosophies, that are also in compliance with WTO rules and commitments and 2) to explore direction of future policy reform and extent of libertarianism (i.e. deregulation) that currently is appropriate for Thai sugar sector based on stakeholder judgement.

The presentation of this chapter is in 5 main parts. The first part, the methodology (Section 3.2), describes the process of undertaking policy consultation including: 1) the recruitment of participants attained the in-depth interview session, 2) the use of mixed data collecting method tool, by means of semi-structured interview and structured questionnaire, 3) interview guide, and 4) analysis of interview data. Section 3.3 presents the results based on the combination of qualitative and quantitative analysis. The result part consists of three main sections which were analysed in line with research questions: 1) parametrisation of each policy instruments under the three board policy scenarios based (Section 3.3.1), 2) stakeholders' judgement on the level of libertarianism evident in sets of policy regimes (Section 3.3.2), and 3) the anticipated impacts of the policy reform scenarios on market signals, supply, and trade (Section 3.3.3.). Finally, this chapter ends section 3.4 and 3.5, which are the discussion of main findings in comparison with literatures and conclusion to this chapter.

3.2 Methods

To serve the aim of this study, the stakeholder consultation was undertaken. The methodology of this study was a combination of qualitative and quantitative (mixed) method, collecting data by means of semi-structured interview and structured questionnaire. The research design developed for stakeholder consultation process, as a conceptual framework, is shown in Figure 3.1.

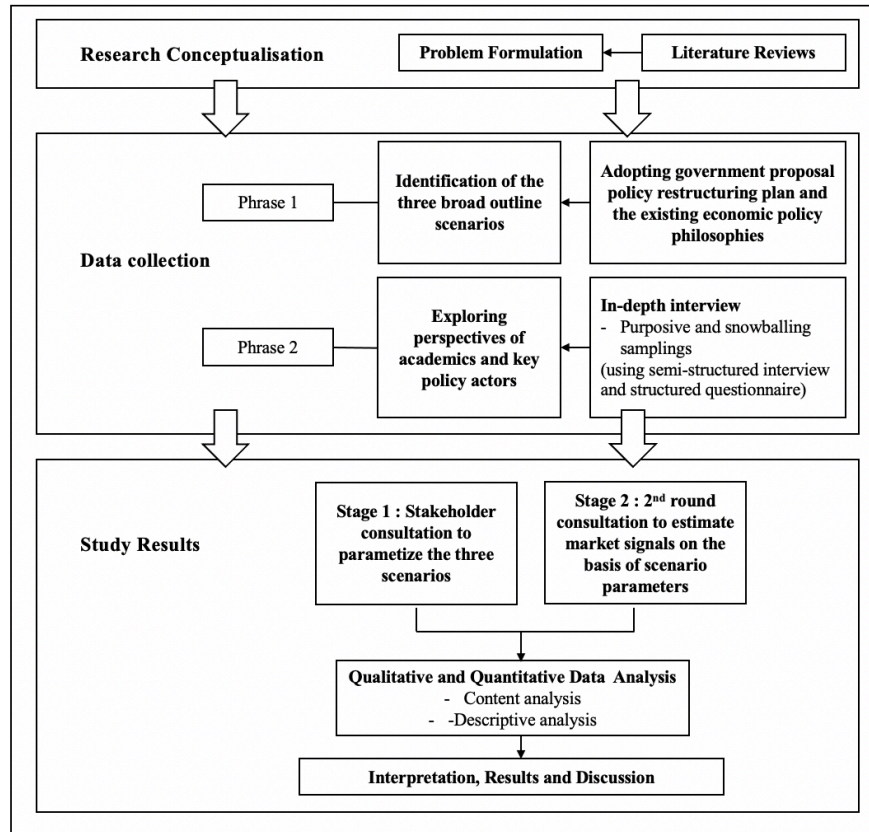


Figure 3.1 Methodological framework/model of the research design for this study

3.2.1 Identification of the three scenarios to use as a framework

The scenarios created in this study represent a framework, capturing the range of policy options available to the Thai Government for the development of the Thai cane sugar sector. These broad policy types were developed through the use of the expert knowledge and judgment of stakeholders, combined with data from existing theoretical and applied research literature related to policy regarding market philosophy by perception on protectionism - libertarian spectrum. However, once these broad policy typologies were identified and adopted, further detail had to be added to share them into more detailed and nuanced policy scenarios. This was achieved using information obtained from the stakeholder consultation interview exercise.

The resulting scenarios had different dynamics and the policy features, consistent with the economic philosophy of each scenario. However, all scenarios aimed to achieve the same common terminal goal, i.e. to bring the sector's policy regime in line with the WTO commitments and sustainable development of Thai sugar sector. The first scenario, the 'Government proposal plan', was designed around the government proposal for policy reform addressed in the Office of Cane and Sugar Board annual report (OCSB, 2017). The other two scenarios, called 'Libertarian' and 'Protectionism', were designed as policy alternative to the

government proposal plan scenario, consistent with alternative policy philosophies, i.e. offering either more or less protectionism.

Scenario 1: Government proposal plan scenario

The Government proposal plan scenario captures the current Thai ‘government proposal’ for policy reform on the entire system of Thai cane and sugar industry in response to the WTO’s enforcement. Under this scenario, certain domestic production subsidies and mechanisms that have been the subject of complaint at the WTO are removed, while government still seeks to maintain as much state support for the sector as is permissible under the current WTO rules. Against the backdrop of these WTO-driven policy reforms, the aim of this government proposal plan is to retain sufficient protections and market regulations to ensure a level of playing field for all producers, allowing the maximum number of producers to remain in business.

The specific reforms of the Thai Cane and Sugar Act of 1984 that are incorporated into this policy scenario are (OCSB, 2017, USDA Foreign Agricultural Service, 2018);

- The repeal of the sugar quota system
- Abolition of the domestic sugar price setting mechanism (Domestic sugar price float)
- Abolition of the fixed rate 160 Baht per tonne direct monetary support to cane farmers
- Cancellation of government mandates for sugar pricing – eliminating the special 5 baht/kg tax on domestic sugar sales
- Abolition of direct subsidies to cane farmers from the Thai government in the form of low interest lines of credit for the purpose of financing their farm operation and purchasing of agricultural machinery
- Ending of support under Section 56 of the 1984 Act related to ‘preliminary’ and ‘final’ cane price payments by removing the process of making compensation payment when final price is below to preliminary prices

Scenario 2: Libertarian scenario

The libertarian scenario is designed by applying a theoretical ‘liberalisation’ paradigm, as discussed in chapter 2, i.e. reforming trade in the sector and to make policies more market-oriented, while remaining in compliance with WTO’s broad objectives. This scenario will be a move towards a freer market but keeps some essential controls that are in line with WTO’s rules

and regulations that ensure fairness among producers. Having a free market will obviously make sugar production more market orientated. This policy regime aims to make sure that the most efficient producers survive, while encouraging the least efficient producers, i.e. those with persistently low yields, or high production costs, to leave the industry and concentrate on other agricultural activities that more suited to their area. Sugar users and consumers should benefit from a free market and more competition, as these should be linked to the world market not politically manipulated to ensure strong producer support and allowing the industry to flourish and compete freely on the world sugar market.

The basis of the libertarian scenario is therefore to encourage full market liberalisation by removing all production support and market interventions, i.e. all trade and domestic consumption distorting mechanisms. These include:

Market access

- Abolition of domestic sugar import restrictions

Domestic support

Abolition of subsidies and other producer support programmes provided by government, including those that raise or guarantee farmgate price and farmers' incomes, such as

- Providing direct payments
- The cane price support system
- Providing low interest rate lines of credit to cane

Export subsidies

Abolition of sugar export cross-subsidy methods used to make export artificially competitive, such as

- The quota system
- Fixed domestic sugar prices

Scenario 3: Protectionism scenario

The Protectionism scenario is designed by adopting a theoretical 'protectionism' paradigm, as discussed in Chapter 2. This scenario seeks to maintain all existing internal market producer supports to help protect cane farming and sugar business to the extent that this is possible under

international (WTO) commitments. Implementing this policy regime will allow ‘a soft landing’ for the sector through minimal removal of supports. This would allow more time for the less efficient cane farmers and sugar millers to become more competitive in the free market. This scenario would also prevent free market competition between sugar millers. This scenario exploits the exemptions allowed by the WTO, for example, allowing countries to use some non-tariff measures such as import quotas, and to subsidise, while at the same time finds other alternative measures to replace the current support programmes that are found prohibit the WTO’s commitments. The goal set for the stakeholders in the consultation was to elaborate this scenario in such a way as to maintain the maximum level of support possible while still complying with the WTO’s rules through their eyes.

3.2.2 Qualitative research approach

This part of the study employs an exploratory qualitative approach to undertake an in-depth exploration of the viewpoints of relevant stakeholders. According to Creswell (2009), the qualitative approach is often the best available method if the purpose of the research is to explore participants’ experiences of a certain phenomenon, and what it means to them. In addition, the qualitative approach allows researchers to investigate the meanings of individuals’ actions based on their own perspectives. These meanings can include experiential, ideological and symbolic outlooks which are, as a matter of fact, policy-relevant (van Bavel and Dessart, 2018).

The Qualitative approach has been widely used in many policy-oriented research studies (Jain, 2011). According to the study by Walker (1985), the use of the qualitative approach in policy-oriented research can offer researchers theories of social action grounded on the experiences of the same policy-makers’ who will play a significant part of the real-world policy solution and so provides a policy development basis. In the context of this study, taking this approach provides a deep understanding of social phenomena in a natural policy setting and provides a window on meanings through the views of all the participants in the research (Pope and Mays, 2006). Therefore, this approach, involving primary data collection via expert in-depth interviews on the subject of the effectiveness of reforms to policy, legislation and implementation issues, is by far the most appropriate. In this study, the transcripts of in-depth interview with Thai cane and sugar policymaker stakeholders are used to explore and capture ranges of possible policy options and determine the sensible sets of policy instruments and regimes that is most suitable for near-future reform of the Thai sugar industry, where the impacts of such reforms are otherwise difficult to predict.

3.2.2.1 Research tool: semi-structured interviews and structured questionnaire

There are four broad types of interview technique: structured, semi-structured, unstructured and group interview (May, 2011, Scapens, 2004). The groups interview or focus group is considered unsuitable for this research, as the objective here is to be able to distinguish the views of individual participants, not arrive at a collective view resulting from a group dynamic. Moreover, according to Kaomuangnoi, (2014) who carried out an evaluation of policy development and implementation in Thailand, the particular culture of Thai officials means that they are more likely to prefer to be interviewed one-to-one rather than being asked to provide their views in a group context.

The interviews with the majority of the participants were conducted using the in-depth semi-structured interview technique, following an “interview guide” that was prepared prior to the interview sessions. According to Harrell and Bradley (2009), the semi-structured interview is frequently adopted in policy research because where the interview guide is used to ensure that the key questions and topics are covered, but there is also the opportunity to probe more deeply into specific topics as the need arises.

The interview guide consists of lists of questions and topics that the researcher desires to cover during the interviews. In the case of the current study these are important issues in relation to Thai cane and sugar policy reforms and implementation of policy approaches (See section 3.2.4). However, the list of questions is only a guide, and the ordering of questions can be varied, and new questions added as required on the basis of participant’s earlier responses, thereby allowing the researcher to discover some undisclosed elements in relation to the topics (Bryman, 2016, Zhang and Wildemuth, 2009b).

For a small number of respondents, and at their request, unstructured interviews were undertaken. These non-government stakeholders had long-standing expertise of both the Thai and international cane and sugar industry. This technique allows person-to-person discussion which can induce better insight from individuals’ thoughts on salient issues and it encourages participants to relate experiences and viewpoints that are relevant and talk at length about problems and subjects of interest of the study, at the same time, not losing the sight of the purpose of the study and key scope of topics (Burgess, 2003, Fife, 2005, McNabb, 2015). The interview guide was sent to all participants at least a week prior to the interview.

Structured interview technique is most appropriate particularly when researcher wants to gain specific answers from very specific questions and categories that are similar. Because of mass

public viewpoint surveys, this interview type is quite widely recognized in the political science research field (Leech, 2002). In this study, across all policy consultation interview sessions, a set of structured closed questions were presented to stakeholders at the very end of each interview. The purpose of these questions was to get participants to rate the responses of the scenarios on market signals based solely on their own view of what the scenarios should look like.

3.2.3 Participants, recruitment, and sampling method

All 22 face-to-face, in-depth interview sessions were conducted by the researcher herself. The characteristics of stakeholders contributing to policy scenario design is presented in Appendix E. Potential participants were recruited using both purposive and snowballing sampling based on contacts identified in publications (printed and web-based) of the Office of Cane and Sugar Board (OCSB) and professional experts in this field. The sample was structured to provide a broad range of perspectives and views on policy development and reform. Targeted for recruitment were heads of various non-government organisations, government agencies at national and regional scale, pressure groups and academics.

Interviews were conducted in person between April and May 2019 in Thailand. Participants were initially invited to take part in this research by email. A recruitment letter was sent providing a brief overview of the study, together with the interview guide. Twenty-two persons agreed to participate, including two pilot interviews carried out through Skype call. The summary of the sample and sampling criteria are illustrated in Table 3.1. The summary descriptions of the organisations from which participants are drawn can be found in Appendix E.

Table 3.1 Summary of the sample and sampling criteria

Respondent	No. of participants	Sector represented	Sampling technique	Criteria for inclusion
National scale: Government sector				
The Deputy Permanent Secretary of Ministry of Industry	1	Government	Purposive	Have experience relating to Thai cane and sugar policy and engage in authorising policy settings
Government officials in the Office of Cane and Sugar Board (OCSB)	8	Government	Purposive	Have experience in the formation and/or implement and/or engage in introducing and shaping the policy on in national context
National scale: Non-government sector				
Non-governmental organisation agents	3	Sugar miller	Purposive	Headship of NGO in the Thai cane and sugar sector with some influence on policy formulation
Independent organisation agents	1	Sugar Trader	Purposive	Have long experience relating to Thai cane and sugar sector at both international and national scales and being a committee member of the OCSB
Committee member in the Office of Cane and Sugar Board (OCSB)	1	Sugar Miller	Purposive	Have experience working as committee member of the OCSB representing miller group
Academics	4	Government/ Cane farmer	Purposive/ Snow balling	Have experience working with the OCSB on Thai cane and sugar policy related issues and/or have experience in cane farming
Regional scale: Government sector				
Government official in the Department of Agriculture Extension	4	Government	Snow balling	Have experience working as subject matter specialist to monitor Thai cane and sugar policy to the OCSB and/or have strong experience working closely to farmers and/or have experience in cane farming

All interviews were audio recorded and notes taken during the interview sessions. All interviews were at a time and place convenient to the participants. Most interview took place in the participant's workplace while one interviews were conducted at the participant's home and two pilot interviews were conducted via Skype call. The pilot interviews revealed that no changes were needed to interview questions, as participants were able to elaborate on their ideas and share their point of views in each case. Therefore, the topics in the interview guide were not revised. All questions in the interview guide were developed in English and translated to Thai to facilitate the communication between researchers and participants. All face-to-face interviews were carried out verbally in the local language. The interview recordings were transcribed verbatim by the researcher, who is a Thai native speaker.

The main goal of this study was to investigate the views of Thai cane and sugar policy-making stakeholders on a set of experimental policy scenarios. Because high levels of sector knowledge

were required, it was not appropriate to use random sampling in sample construction because a number of participants that were not knowledgeable, or directly involved in the policy design process, would be included (Silverman, 2002). As Schutt (2006:313) states in his work, “researchers should try to select interviewees who are knowledgeable about the subject of the interview, who are open to talking and who represent a range of perspectives”. In regard to this assumption, a purposive sampling, i.e. a non-probability technique, was employed, where participants were purposively selected based on the basis of their knowledges, association and positions with Thai cane and sugar policy, settings as well as their potential ability to provide information on issues ((Patton, 2002). Historically, the purposive sampling technique has been adopted commonly in contexts where the number of people with expertise in research area is limited (Rasawong, 2015).

Afterwards, snowballing sampling was used, i.e. a process where informant participants point out other possible candidates for survey inclusion who fit the selection criteria (Marshall, 1996). By using this technique in addition to the purposive sampling the researcher was able to reach more important people and to get more participants that were equally important but were not initially identified (Grix, 2018). New participants were included in sampling through snowballing technique until several criteria were met: (i) no new data emerged from the additional interviews; and (ii) enough information was available to permit replication if this study. This is the point where data saturation of this study was reached (Walker, 2012). By taking these criteria into account, along with other factors, such as research timeframe and resourcing, the sample of 22 expert participants used in this study is quite appropriate for the study purposes.

3.2.4 Interview guide

The interview questions were developed and structured into six sections. In the first section, participants were asked general information about themselves and their organization, i.e., role and responsibility in Thai cane and sugar sector and their experience working in this sector. Secondly, participants were asked regarding their personal opinion about the unreformed regime under the Thai Cane and Sugar Act of 1984 and their opinion about reforming this, e.g., what issues and regulations under this regime must be reformed in light of the WTO complaint. The third section focused on the ‘Government Proposal Plan’ for policy reform. Participants were asked about their views on the strengths and weaknesses of this scenario, its consequent impacts on sugar producers, both farmers and millers, and the likely potential responses of these groups. Participants were also asked to rate this (and the other) policy reform scenario(s) on a number of metrics. The first was on an 11-point rating scale from 0 (Fully protectionist) to 10 (Fully

libertarian) representing level of libertarianism; The second captured the likelihood of implementation of the government proposal scenario, from 5 Likert-scale question ranging from 'Very likely' to 'Very unlikely'. The questions for the remaining scenarios followed the same pattern as the first. The fourth section focused on the 'Libertarian' scenario. Here, participants were asked to provide their views on whether this scenario would benefit or damage to the industry, particularly in terms of specific policy measures determined under this scenario, including the removal of import restrictions, ending domestic sugar price setting, removal of the quota system and monetary supports. As above, participants were asked to demonstrate their point of views regarding consequent impacts on sugar producers and their likely responses and to rate the score of libertarian scenario on the same 5-point Likert-scale as well as to indicate the likelihood that such a scenario would be implemented. The fifth section covered the 'Protectionism' scenario. Here the focus was on specific policy measures such as increasing level of domestic supports (that are allowed under the green box), the abolition of direct payments to producers and the special interest rate, while increasing monetary payments to producers in order to develop farm and environmental management. This scenario retains the highest import tariffs allowed under the market access condition and end only the mandated pricing in domestic market (Quota A) but still mandates in term of quantity required for Quota A. The final section asked participants what kind of policy reform they would prefer to see, if they were able to start from a blank sheet. Participants were asked to provide their best alternative plan and then rate this using the same 5-point Likert-scale for level of protectionism and likelihood of implementation. The final question in this interview guide was "Irrespective of any enforced-change in Thai sugar policy regime, what would you suggest as the survival options for policy-makers and stakeholders to maintain the competitiveness of Thai sugar sector, perhaps remain a major player in sugar market?"

Prior to the ending of the interview sessions, all participants were asked to complete a set of structured questions. Presented in table format, at the end of every section, here they could quantify the impacts of each scenario on different market signals. These market signals include exports, imports, cane and sugar production, and cane and sugar prices. For most participants, they were allowed to complete these parts after the interview sessions had ended and scan or send the original document back to the researcher by email, or post, before the last week of May, when the data collection period for this study ended. The full details of interview questions can be seen in the Appendix A.

3.2.5 Analysis of interview data

According to the interview guide (Section 3.2.4), two types of data were obtained from policy stakeholder interviews. First was qualitative information related to, first, the identification of the three broad outline scenarios and second, determining the settings for policy instruments representing each scenario. Second was quantitative information including (i) the anticipated impacts on prices, market signals, supply and trade volumes for each scenario and its policy settings, (ii) rating of each policy reform scenario on two metrics i.e. the level of libertarianism expressed in each of scenario and their likelihood of implementation.

3.2.5.1 Analysis of qualitative data

Both qualitative and quantitative exercises were performed in analysis of qualitative interview data as indicated below.

3.2.5.1.1 Qualitative content analysis

Qualitative content analysis was used to look at respondent narrative data responses related to (i) the defining of the scenarios in terms of the settings of policy instruments and (ii) capturing illustrative materials indicating why policy makers made the choices they did.

Most qualitative data are non-numeric and text-based and exist in the form of narrative scripts where words convey meanings, but meanings must be categorised and interpretations must be considered to reach conclusions. Hence, qualitative data analysis is often less prescriptive and less “linear” but more iterative than quantitative analysis (Suter, 2012).

In general, the data analysis in qualitative research is distinguished by “a process to bring order, structure, and meaning to the mass of collected data” (Marshall and Rossman, 1999). According to Dudovskiy (2016), a range of approaches are available to do this, such as grounded theory, narrative analysis, discourse analysis, framework analysis and content analysis. Content analysis is an analytical approach suitable for mapping policy change over time that has been widely used by researchers in empirical studies of policy learning and related fields, such as agricultural policy (See for example, Alons, 2017, Chinseu et al., 2018, Igudia, 2017). The aim of content analysis is to obtain knowledge, new insights and understanding of the phenomenon under investigation (Downe-Wamboldt, 1992, Krippendorff, 1980), where Patton (2002) has defined

content analysis as “any qualitative data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and meaning”. Content analysis enables the structured breakdown of textual material, which may range from media productions to interview data, by creating codes, categories, and conceptual map to aid interpretation of meaning and practical guide to action (Bauer, 2000, Elo and Kyngäs, 2008, Flowerdew and Martin, 2005). Hsieh and Shannon (2005) identified three distinct approaches to content analysis based on the degree of involvement of inductive reasoning, namely conventional content analysis, directed content analysis and summative content analysis. The difference between these three content analysis approaches is outlined in Table 3.2.

Table 3.2 The differences between the three content analysis approaches (Adapted from Hsieh and Shannon, 2005)

Type of content analysis	Study begins with	Timing of setting out codes or keywords	Source of codes and keywords
Conventional content analysis (Inductive)	Observation	Codes are identified during data analysis	Codes are derived from data
Directed content analysis (Deductive)	Theory	Codes are identified before and during data analysis	Coded are derived from relevant research findings or theory
Summative content analysis	Keywords	Keywords are defined before and during data analysis	Keywords are derived from interested stakeholders and literature reviews

Based on the purpose and objectives of the current study a combination of conventional and directed content analyses of interviews was considered appropriate as the work and the data requires both inductive and deductive analysis. The evidence from the studies by Elo and Kyngäs (2008), Kondracki et al. (2002) and Zhang and Wildemuth (2009a) confirm that these two types of content analysis are not mutually exclusive and, in practice, can be combined for use in a single study. Adopting a pure induction approach, with no prior theory, may prevent the research benefiting from existing theory, while applying a purely deductive analysis might prevent the researcher from developing new useful theory (Perry and Jensen, 2001). According to Parkhe (1993), to generate a well-integrated picture of a phenomenon, the continuous interplay between the two approaches is required for the process of ongoing theory advancement.

In this study, deductive analysis was used to pre-determine the interview questions and thereby the topics and issues covered. In this case, the researcher sets a predetermined context (i.e. the set of policy instruments that define the scenarios) for the data analysis (or data collection) based on existing theory and related literature and the stakeholders are used to provide data from

interviews to set values for each of the market-based metrics used in the scenarios. This analytical stage of the research process that researcher applies is supported by the study of Perry and Jensen (2001) where this process provides a “flying start” to the study through development of pre-categories from other existed theories or studies before deployment of sampling and coding processes in order to help researcher to be initially aware of a number of key elements of the phenomenon to be covered in the study.

Once the core methodology of coding, categories and themes for the policy scenarios had been designed, through assignment of each deductively-derived category, code etc. to passages of text that fit the existing framework, the inductive content analysis was adopted. In this second stage of interview data analysis, the aim is to design the policy scenarios by populating them with the interview results. Using inductive data analysis, the researcher was able to obtain direct information from participants and gain a rich understanding of the phenomenon under study. As new insights emerged from the study results, it was possible to move from specific details to the overall picture of the phenomenon (Elo and Kyngäs, 2008, Hamad et al., 2016).

a) Coding and categorization

Once data were arranged into suitable format (Denscombe, 2003), keywords were used as the basis for coding and creation of thematic categories (Sarantakos, 2012). Since this study employs a combination of inductive and deductive approaches for processing the data, this type of analytical approach for processing, coding and categorizing data is sometimes known as abduction (Peirce, 1903). In this case, where the advantages of inductive and deductive approaches are combined, it was possible to create a more solid theoretical vantage point and deeper connection between data and reasoning (Flick, 2018, Želinský, 2019). Recently, interest has grown in using the abductive approach to qualitative content analysis in social science research due to its ability to provide a structurally creative alternative to the dichotomy between inductive and deductive approaches (Padgett, 2016, Tavory and Timmermans, 2014). Under this type of coding and processing approach, two layers are applied to the coding frame, i.e., the “pre-” process layer and “post-” process layer. The two-layer approach “makes it possible to perceive connections on a deeper level and to penetrate beyond the apparent and reveal a richness of meaning” (Eriksson and Lindström, 1997), and to enhance the possibility of theoretical innovation (Želinský, 2019). In accordance with Alvesson and Kärreman (2011), research is ‘open’ to endogenous meaning in the data, while simultaneously allowing the use of pre-existing (exogenous) theories or theoretical contributions as a source of identification and interpretation

of study patterns. The alternative would be to create and then investigate a defined hypothesis under deductive qualitative content analysis.

Therefore, this analytical coding approach was used in this study through which some main codes were created from the “pre-” process flowing from the interview questions. These were informed by study objectives, to identify core patterns, for example, around the difference among the policy scenarios and their defining policy measures, such as policy-making stakeholders’ views toward implementing each policy scenario, their impacts and likelihood of carrying the actions out. However, from the “post-” stage, other codes were developed from the interviews results. These codes are, for example, other additional policy measures that they identified as likely to come into force, the policy options needed, and their recommendations of future market conditions for Thai industry to remain competitive. After data were coded, categories were analysed and interpreted to disclose the study’s patterns and messages (Holsti, 1968).

The phases of the content analysis process adopted in this study are illustrated in Figure 3.2.

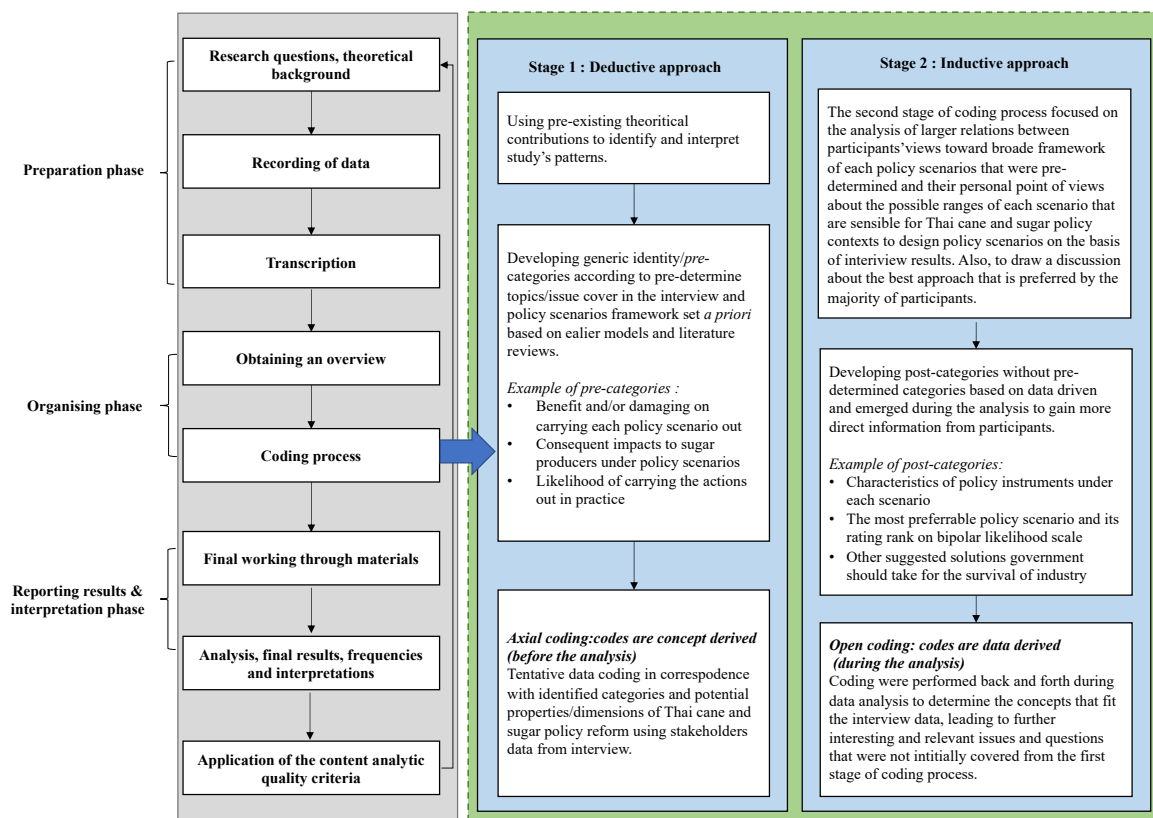


Figure 3.2 Phases of content analysis process in this study

3.2.5.1.2 Quantitative exercise

In terms of the quantitative analysis, some questions related to participants' preference for retaining or abolishing given policy instruments, as well as their suggestions for alternative settings for existing policy instruments were asked, and frequencies of different type of answer were counted. The most common policy settings that the majority of participants were in favour of, for both libertarian-protectionism continuums, were then adopted as definitive for the relevant scenario.

3.2.5.1.3 Computing qualitative content data analysis

To facilitate the analysis of the qualitative data, NVivo software was used, as it related well to content analysis. This software is frequently used in qualitative data analysis, as it allows the researcher to prepare, organize and classify big data sets from interviews through coding, memoing, sorting and data linking facilities and helps in the presentation of data outputs (Bazeley and Jackson, 2013, Leech and Onwuegbuzie, 2011). However, this software package, as well as other computer-aided qualitative data analysis programming software packages (CAQDAS), cannot fully perform data interpretation, i.e. automatic coding is not a substitute for interpretation, but is only the first step towards interpreting the data (Weitzman and Miles, 1995). Therefore, researchers must themselves perform data analysis based on coding, determination of connections between concepts, indicators, and relevant findings between inductive and deductive approach in combination. By using this software to facilitate data analysis, it was possible to obtain and assess information on the subject areas through coding and categorizing, including the number of times a reference was subscribed to the subject areas and what was being discussed. Then data were interpreted to generate meaning. Moreover, performing data interpretation through uncovering connections between coded categories provided explanations and suggestions related to implementing each policy alternative by government in Thailand. Additional detail on NVivo analysis of data in this study is provided in Appendix F.

3.2.5.2 Analysis of quantitative information

Following the defining of the scenarios, based on an analysis of qualitative interview data, in terms of policy instruments and their settings (Section 3.2.5.1), policy makers were also asked to estimate the potential impacts of implementing these scenarios on a number of key parameters, which also form part of the description of the scenario. These derived parameters are: percentage change on supply, market signals and trade and well as cane and sugar price change (producer

price). In addition to quantitative responses in terms of these percentage change estimates, policy makers were also asked rate the level of libertarianism each of scenario represents on an 11-point rating scale from 0 (Fully protectionist) to 10 (Fully libertarian) and also rate the likelihood of each scenario being actually implemented, using a 5-point Likert-scale i.e. ‘Very likely’ to ‘Very unlikely’.

3.3 Results

3.3.1 Results of parametisation of each policy instrument under the three board policy scenarios based on stakeholder consultation

During the interview sessions, stakeholders were given nine policy instruments that were initially designed based the government proposal plan on restructuring sector’s regime and the existing literatures regarding market philosophy and are suitable for managing the Thai sugar sector.

Stakeholders participating in the interviews were asked to indicate how a set of specific policy instruments should be parametised under the three board policy scenarios (Libertarian, Government proposal plan and Protectionism), in the context of Thai sugar policy reforms through their point of view. All participants were asked to make the parametisation of each policy instrument consistent with the market philosophy of each scenario, but also to be pragmatic.

In addition, based on data collected from the interviews, the study was able to capture one additional policy instruments, change the definition of ‘Sugar’ in the Act, which was agreed by majority of participants that a change on this matter is essential and relevant to strengthen the Thai sugar sector. As a result, the total of 10 policy instruments were brought to perform data analysis of this study.

This section shows how the 10 policy instruments, under different settings, are used to form the three scenarios that are incidental and primary focus of Thai cane and sugar legislation. In this study, policy measures are categorised into 2 distinct groups as being “non- discriminatory” or “discriminatory” in terms of the three studied scenarios. Non-discriminatory group refers a collection of policy instruments that were explicitly perceived by majority of respondents as the most significant measures, requiring non-discriminatory reformative actions where only one policy setting would be possible under any scenario based on stakeholders’ views, despite any policy reform direction. The discriminatory policy group refers policy tools that obtain ranges

of policy characteristics and implementing options across three scenarios. In other words, policy elements in this group are distinguishing policy instruments that vary between different scenarios.

3.3.1.1 Policy instruments that do not vary across scenarios (non-scenario dependent policy)

According to the interview results, five policy instruments are identified as most essential components to be put in practice irrespective of scenarios where only one policy setting was deemed to be practicable. Therefore, these policy instruments remained unvarying between scenario to achieve sustainable development of Thai sugar industry and being adjusted in line with the WTO's rules and commitments, i.e., non-discriminatory variables between scenarios.

3.3.1.1.1 Providing cheap loans at low interest rates to producers

To elicit their views on the abolition of low interest loans to cane farmers, the respondents were asked the following question “What would happen if we ended cheap loans at low interest rate to farmers?” The majority of respondents (n=18) expressed their opinion that the provision of low interest loans to producers is indispensable whatever policy scenario is adopted. It is a key policy instrument that aids an increase on cane farmers' self-improvement and capability; consequently, stimulating increases in farm productivity. Policymakers described the majority of Thai cane farmers as being unable to develop self-reliance due to lack of own capital for investment in plant and machinery and inability to secure the loans. This inability to secure loans resulted from lack of financial asset against which loans can be secured and record of poor financial management.

Hence, stakeholders emphasized the need to maintain this mechanism as an essential financial source and key factor led to their capability in continue cane farming as most farmers rely on borrowing to secure the consumable inputs (e.g. fertiliser) needed to produce each year. The stakeholders also underscored the essential nature of this financial instrument, leading to farm productivity improvement and achieving a number of other state provision objectives. One example of state provision objectives is reducing air pollution problem occurs from cane burning which has been around for a long time and got worse and worse due to an increase in cane production volume over the past years. To achieve this provision goal, Thai government has

encouraged cane farmers to invest on new technologies and machineries, particularly the use of cane cutter for harvesting, hence, cheap loans are essential and required for investment on cane cutter so as to make a change on environmental problem. Key general comments regarding the need of this type of financial support are provided below:

" Insufficient and lack of financial capital has already been a major barrier for most farmers to improve their productivity. Since they don't have much money, it is super difficult for them to borrow money from commercial banks. Banks will definitely not authorise loan because of their poor financial status. If they cannot access to special interest rate loans, I don't know how they can continue their farming. Personally, I think, cheap loans must remain and be the last thing that will be taken away at least until farmers are no longer rely on direct payments where they are able to increase a bit of productivity." -10

"There will be many impacts from ending this. For example, recently, state has discouraged cane burning and encouraged policy which encourages farmers to use cane cutter during harvesting period to reduce environmental problem and increase cane quality. If farmers are not able to access to cheap loans, then it is impossible for reaching many other policies' objectives."-9

Based on interviews, the arrangements of stakeholders who are responsible for paying the interest and their details can be seen in the Figure 3.3

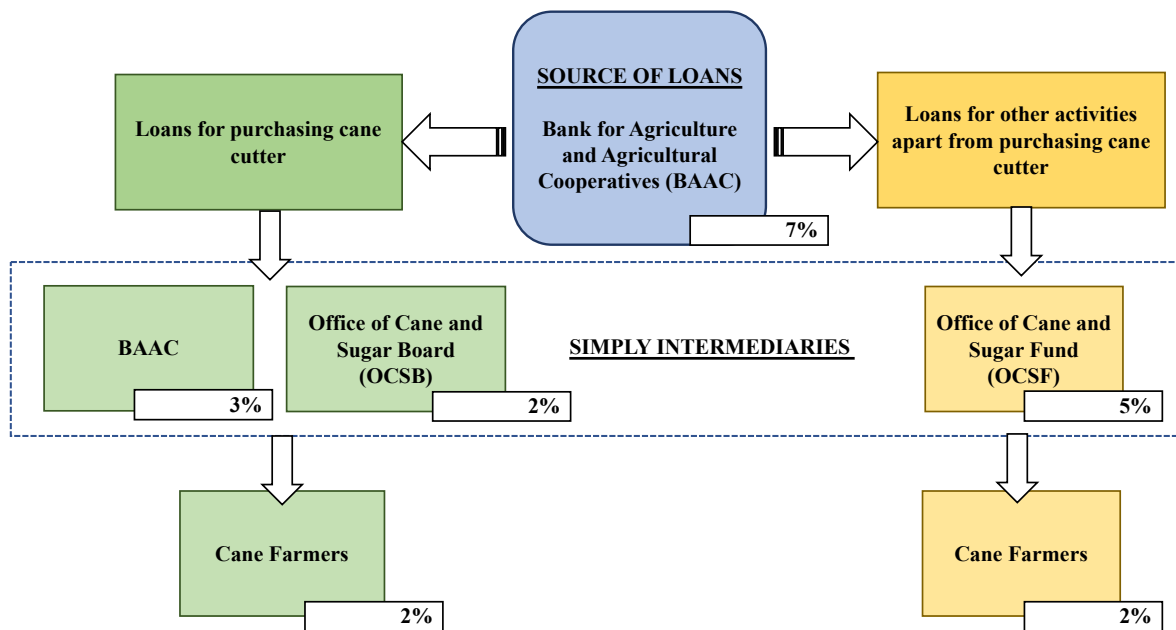


Figure 3.3 Source of loans and a system for sharing interest payments between farmers and third parties as a way of reducing the interest burden on farmers

The Figure 3.3 shows the structure of sources of loans and a system for sharing interest payments between farmers and the third parties as a way of reducing the interest burden on farmers. Credit services to individual cane farmers, classified by 2 types of loans regarding the spending purposes: loans for purchasing cane cutter and loans for other activities apart from purchasing cane cutter.

The Bank of Agriculture and Agricultural Cooperatives (BAAC) is actual source of funds for both types of loans where loans are provided at 7% interest rate. In terms of loans for purchasing cane cutter, the BAAC itself and the Office of Cane and Sugar Board (OCSB) act as a simply intermediary where the BAAC and the OCSB helps sharing three percent and two percent of the interest payments, respectively. In case of loans for other activities apart from purchasing cane cutter, the Office of Cane and Sugar Fund (OCSF) is an intermediary in this case where the organisation helps sharing five percent of the interest payment for this purpose. Therefore, farmers are actually responsible for paying only two percent of the total interest payments regarding any spending purpose.

Fundamentally, by looking at the structure of this type of lending by the OCSF, this mechanism is not considered as ‘state subsidy’. The reason is that the funding used to provide loans, for example for purchasing inputs, is producers’ money from industry’s revenue that is collected and saved into the non-government Office of Cane and Sugar Fund (OCSF) and being authorised

by the organisation. The main purpose of the OCSF's collection is to inject saving into the system to help producers when they face problems. Therefore, it is entirely producers' rights to access to this loan.

It was commented that there is no state funding is used in this mechanism, and so it is not considered 'subsidy' by the WTO. However, OCSF's funding the loans must be first approved by the cabinet and this aspect has been an issue raised by Brazil where government is seen to involve with this support. As a result, 11 respondents suggested that the government approval mechanism should be abolished in order to continue this support without being seen as breaking the WTO's regulation. For example, one respondent suggested:

“One of the revenue sources of the OCSF comes from collecting from farmers and millers. Therefore, the OCSF has strong stability itself to loaning out its money to help farmers and millers even though at the cheap rate. The OCSF has its rights to do which is not considered as subsidy that against the WTO agreement because its farmers' and millers' money anyway. The OCSF is a corporation, not a state's organisation. The only problem is it is addressed in the Cane and Sugar Act. Whatever that is addressed in the act must be approved by the state. Any action that the OCSF need to do especially authorising loans, the state must approve first. That is all, but this act can be seen as a part of government supports. Therefore, the best solution is to reform the act in which issues do not need to go through the approval stage by the state.”-13

However, it was found that stakeholders also engage with the BAAC's loan disbursement for purpose of buying cane cutters. This is done via the Office of Cane and Sugar Board (OCSB), government agency under the Ministry of Industry. Seemingly, it is the involvement of the OCSB that leads other countries, particularly Brazil, to accuse the Thai Government of being actively involved in subsidising its domestic producers under domestic supports category through interest rate credit aid services to farmers. However, under the WTO's regulatory composition, a certain amount of government support is permissible and interest payment support provided by Thai government in this case does not exceed that agree amount. One stakeholder from the OCSB explained that, this interest payment support mechanism was considered as 'permissible subsidies' which fall within the “*De Minimis*” levels allowed for developing countries at 10 % under “Amber” box. He highlighted that the amount of state's budgets has actually been spent on supporting soft loans is accounted for only half of the total spending limit that government have set for which is still under permitted level under this cautionary light condition:

“The budget allowance for cheap interest rate and credit is about 2,000 million Thai baht but less than 1,000 million Thai baht is actually used. I am sure that the maximum limit for this aid is actionable to WTO's regulation which means it definitely does not exceed the allowed level under '10% De Minimis'.”-5

3.3.1.1.2 Change the definition of ‘Sugar’ in the Act

Despite there being no prosecution of Thailand at the WTO, there was a wide agreement between stakeholders participated in the interviews that an existing policy within the Cane and Sugar Act of 1984, which acts to restrict the use of cane and cane syrup should be reformed. 10 policy makers among the stakeholders clearly identified the need to amend this restriction as; (i) it is not up-to-date with the current situation where the use of cane in manufacturing is more diverse and (ii) it blocks opportunities to expand other high-value production industries such as ethanol and bio-chemical products where the industry already has enough potentiality. It was noted that when this legislation, which limits the industry’s potentiality by only allowing sugar to be produced from cane syrup, prevents an increase in cane’s production value. As such, it is difficult for industry to grow if this part of the legislations remains unchanged. More importantly, amending this restriction could perhaps compensate producers for losses experienced due to the drop in sugar price and attractively support farmers to increase cane production volume. In addition, if this approach is successfully implemented, it will improve both farmers and millers’ capability and generating more sources of revenue in the system. As some respondents advised:

“This system is quite not up to date and needed to be reformed because there are many products that can be produced from cane. When sugar is the only product that is produced from cane, it does not increase cane’s production value.”-4

“For me, I think it blocks opportunities.”-12

“This will help the industry by providing another source of revenue that the industry can earn in order to top-up or replace what we might lose”-3

3.3.1.1.3 Maintaining the revenue-sharing system while adjusting the 70:30 ratio

Historically, the revenue-sharing system has been a core strength of the system and a major mechanism driving significant industry growth, through creating collaboration among stakeholders. For example, some respondent stated that:

“I think our 70:30 revenue-sharing system, is the major mechanism driving the significant industry growth we have observed. The obvious strength is there is a development and collaboration among the stakeholders.” -6

Another respondent also further commented that:

“It creates strong collaboration among farmers and millers where both parties are seen as being in partnership. This system is an ideal and effective way to support and encourage farmers and millers to increase their productivity as they know that the higher productivity, the greater profit they will receive from the share they are both entitled to”- 16

It was widely agreed by the interviewees that this system is of particular value in protecting farmers from exploitation by millers and that terminating the system would mean the demise of many farmers and ultimately the collapse of the industry. Building fairness and reducing conflict between farmers and millers to ensure that the industry is running smoothly without chaos are the key purposes of this policy mechanism. For example, two participants addressed:

“This system must be retained because it is the best mechanism to allocate revenue to farmers and millers fairly on agreed terms. Because of this system, the industry has been successful without conflict between the parties for over the past 30 years.”-17

“Farmers can be sure that they will always receive 70% of total system revenue. If the quality of cane delivered is high, meaning that millers will be able to covert more sweetness to produce sugar, resulting in higher sugar production volume and greater revenue where farmers will also benefit from this. Without the system, farmers would only receive the price paid by millers and would not be able to ask for more from the parts that are results of their capability in producing high quality of cane. Therefore, farmers will be disadvantaged and not be motivated to improve their cane quality ” -2

As coincided by 19 respondents, the findings show that the continued existence of this revenue sharing system is both necessary and permissible, regardless of the broad direction of policy reform. The respondents indicate that such a revenue-sharing system is an internal issue while the prosecution at the WTO is raised externally. Respondents asserted that the revenue-sharing system does not violate the WTO's regulations, as it is not a part of state's enforcement and is not referred under the Act. In fact, the revenue-sharing system, particularly the splitting proportion of 70:30, comes from an agreement and acceptance between two parties which both see as fair.

"This is the most important mechanism of our industry and cannot be abolished. The existence of this system does not break any WTO's rules and regulations because it is not implemented through state enforcement, the use of this system comes from an agreement between farmers and millers, where they have agreed that at this proportion, it is fair for both parties"-9

Although policy-maker stakeholders were in general agreement that this system is not enforced and mandated by the government, they acknowledged that government's engagement is needed as intermediary, helping in terms of negotiating between farmers and millers to arrive at agreeable decision. This was clarified by one policymaker:

"There is no government mandate except the state must be acknowledged so that they can manage the amount of revenue farmers are obliged to receive once sugar is sold "-13

Despite the majority conclusion that this system must be maintained, many stakeholders, however, suggest that in the future, the proportions can be readjusted. The change, however, depends on potential willingness to accept the condition by producer sides.

"For the revenue-sharing proportion, this can be reformed if farmers and millers are willing to talk and agree with each other. It does not always to be 70:30, it could be at any proportion as long as it is the win-win situation for both parties."-

4

3.3.1.1.4 Repeal of quota system by replacing Quota A with ‘sugar reserve’ as buffer stock for domestic consumption

The initial perception of policy makers consulted in this study was that, despite the ending of the quota system, the industry needs a mechanism that ensures the stability of supply to its own national domestic market. Without such a mechanism, policy makers were concerned about the possibility of sugar shortage in the domestic market when world sugar price rises. This event should not be allowed to occur and is entirely preventable, particularly when the country has huge oversupply of sugar. As a result, 16 policymakers were receptive to the idea of replacing Quota A with a ‘sugar reserve’ as buffer stock for domestic consumption.

" When it comes to domestic consumption dimension which was called as "Quota A", it connects to the domestic consumption quantity which refers the nation's security and stability that must be retained. Despite the ending in terms of quota A, we still need to reserve some amount of sugar for supplying domestic consumption which is now called "Buffer Stock". This is because we consider our domestic consumers as the first priority rather than liberated ability of sugar mills."-2

"Policymakers concern that, without Quota A, when the world sugar price rises significantly, there will be shortage in domestic sugar because everyone will export sugar to the world market, so we have to import sugar instead. -7

Several government-based respondents conceded that practically, there is no meaningful difference between the principles of pre- and post-reform sugar volume managing mechanism. Both mechanisms would have had almost identical results.

"In the past, we had set the sugar volume quota for all mills for domestic sugar consumption which is known as Quota A. Recently, we just only changed the words from Quota A to sugar reserve for domestic consumption. This is what we are doing right now."-6

Under the new sugar reserve approach, sugar volume allocation for each mill supplying to the domestic market is another dimension that must be discussed. Most respondents were clear that despite the reform, sugar volume allocation must be retained. The research findings show the importance of the remaining measure to protect smaller-scaled millers from competition from

more efficient millers in the domestic market. Several respondents pointed out that smaller-scaled millers will be strongly disadvantaged due to less efficiency from completely ending sugar volume allocation where all millers are flexibly allowed to sell any amount of sugar in the domestic market that they desire. Most respondents were supportive about the survival of all millers therefore all agreed with the idea of assuring a fair market share across all millers as it also ensures the market for the farmers they serve.

"If we abandon this quota volume allocation, meaning that all mills are allowed to sell sugar in domestic market at any quantity and price they want, smaller mills probably cannot survive. Even though we have not completely liberalised right now, small mills have started to complain already. This is about demand and supply as well as market share. This is why we need to allocate the volume to each mill. In consequence, if these small mills cannot survive, it won't be just millers that will have to exit the market but also farmers in the area who are the contract party that supply cane to those certain mills as well."-6

In addition, it was noted by some respondents that allocating sugar volume for every miller is acceptable under the WTO's requirements considering no regulating by state. One non-government agent explained while the new approach from adjustment is similar to requirements imposed under the old system, government's engagement mandating this sugar volume allocation is switched to private corporation institution known as Thai Sugar Miller Corporation Limited (TSMC).

"The contexts between the past and the adjustment are barely different. In the past, the quota allocation was set by the Office of the Cane and Sugar Board. Since the reform, it became TSMC which is responsible for this. It changed just that. Methods, rules, conditions from the beginning were hardly changed. Just a little bit."-18

3.3.1.1.5 Increasing government budgets supporting indirect supports while reducing financial amount for direct support

Over a decade, Thai cane farmers constantly received supplement payments by government. However, as specified by the WTO, direct payments to producers, subsidies directly related to production quantities, are part of the domestic support measures considered to distort production and trade that Thailand has committed to reduce, as obligated under WTO agreements.

The majority of respondents (n=19) embraced in essence the reduction of direct payments to producers and compensatory increases in indirect supports, including research and development projects, the establishment of a research center and infrastructure development. These specific government services fall under 'Green Box' supports and Development Measures categories which are exempted from reduction commitments given that they are considered to be non- or minimally-trade distorting. Compared to support through direct payment services, respondents agree that these indirect supports are a much more suitable long-term solution for developing industry's sustainability where problems are solved by addressing their root causes:

" I think it is much more important to help through forms of indirect supports because it is much more sustainable and let these indirect supports help driving our industry forward. For example, instead of providing direct money to help farmers in part of transportation, it is much better for the state to improve transportation infrastructure such as better road as well as basic structures."-2

Based on the consultations, a number of government service programmes were identified as meeting criteria including domestic support activities that are exempted under the 'Green Box' such as advisory as well as infrastructure services, thus given the 'green light' to continue by the WTO were emphasized. There are many comments regarding the salient of government service programmes required for developing the industry's competitiveness and sustainability, as can be seen from the Table3.3.

Although there was an overwhelmingly positive view that increasing indirect supports is worthwhile over the long term, policy makers also identified a weakness with this approach, i.e it takes a long period of time to arrive at the developmental end result. Some respondents were concerned that many farmers would be unable to keep their business going in the absence of direct supports, thus would not likely survive long enough to benefit from these indirect measures. To avoid the problem, some policymakers emphasize the need of maintaining certain reduced amount of direct payment supports to farmers for a transition period. To arrive at the best result, there was a suggestion that reduction of state budgets on direct payment supports and a state budgetary increase on indirect government service programme must be performed in parallel.

"We all know that the best and most sustainable solution is to increase the level of indirect payment while reducing amount of direct payment. To arrive at the result, it takes very long time, perhaps 10 years, but I do believe that our farmers are willing to wait and are willing to accept a decrease in direct payments if

indirect payments are increased. We must make sure that we are doing both in parallel. Some direct payments that are super essential may be needed in the short run but the rest we can reduce them little by little.”-15

Table 3.3 Comments regarding the salient of government service programmes under green box

Government service programmes	AoA exempted domestic support categories	Comments
Cane breeding & development programme	Green Box-Research	<i>"Most importantly, we must make sure that cane breeding and development programme is included in this long-term plan. Speaking of varieties first, for India now, the reason that there has been a considerable growth in sugar production there is because they have good sugarcane varieties, so I think it is important to study how they researched."-22</i>
Establishing training center and workshops	Green-Agricultural training, extension, and advisory services	<i>"Training and workshops should be provided to farmers so they can obtain more up-to-date knowledge related to cane farming"-10</i>
Irrigation system development	Green Box- Infrastructure services	<i>"I would like the government to do so including improving irrigation system. Irrigation is one of the major issues and government can help improve irrigation infrastructure. It is very important for the state to develop these basic infrastructures. Is it possible? The irrigation issue has been raised for years but has never been solved. It is a must for state to take this into a serious action that need an urgent development. Thailand is an agricultural country in which irrigation and mechanisation are significant issues"-5</i>
Transportation infrastructure development	Green Box- Infrastructure services	<i>"It's better to create a system that is better for transporting sugarcane. Such a transportation system, would be more useful to sugarcane farmers than to pay just a few baht per rai."-19</i>
Farm management research (soil, technologies, machinery)	Green Box-Research	<i>"Today, the most interesting model is the Netherlands system where they use NIR and infrared sensor to scan the soil. Once soil is scanned, information is sent via telephone to Wageningen University, and they are able to receive advice about fertilizer within 10 minutes. It takes a few seconds and it's back. When we send our scanning, our GPS location will also appear so they will know what kind of soil we have and what area it is. So, they will be able to suggest about how we should fertilize. These systems are systems that can be done in Thailand. I've advocated this for 2 years but, no one has ever provided the funding. Also, I will focus more on logistics and cane cutter projects. For today, I think cane cutter machinery is the most crucial project that we need urgent action on, i.e. we must put more money into it. If we don't prioritise disseminating cane cutter to farmers, it will cause health problems for the whole country."-21</i>
Supplement payment for fresh cane delivery	Green Box- Environment protection	<i>"Assuring cane quality is a key for solving air pollution issue which can be performed by the state. With a little help this could have a huge impact on the industry. An example rule that we have used today's is such as deducting 30 bath per ton of burnt cane and paying a premium for delivering fresh and clean cane."-1</i>
Providing production factors (fertilizer and machineries)	Developmental Measures- Agricultural and rural development	<i>"I think farmers should be able to purchase production factors such as fertilizer, compost, pesticide etc. at cheaper prices where state can be the one who provides support in terms of production factors."-11</i>

3.3.1.2 Policy instruments that vary between the three scenarios

The variation between scenarios occurred for the remaining 5 policy instruments, albeit that only two settings were deemed to be practicable in some cases, and so two scenarios would share this setting. In this case, the distinct parameter settings of each policy instrument under each scenario are represented as variable within each scenario.

Findings noticeably reveal that the characteristics of these five policy instruments under the 'government proposal plan' scenario were identical to either 'protectionism' or 'libertarian' scenarios. To demonstrate in detail, under each policy instrument category, if the elements between 'government proposal plan' and 'libertarian' scenarios show they were not in the discriminatory, in other words, these imply that a range of 'government proposal plan' scenario is the furthest possible likelihood of liberalisation for policy instruments fall in this category. Two policy instruments: Domestic price float and Ending price support in terms of 5 baht/kg tax on domestic sugar sale collection show non-discriminatory implication. Conversely, if the policy characteristics between 'government proposal plan' and 'protectionism' scenarios demonstrates no distinguishment within policy instrument, in this sense, it means that a range of 'government proposal plan' scenario is the furthest protection level of policy instruments fall in this category are feasible. Three policy instruments: Ending income support through providing direct payment to cane farmers, Abolition of sugarcane price support programme, Abolition of import restrictions are classified to this group. Details of what policy instruments fall in which categories can be seen in the Table 3.4.

Table 3.4 Details of policy instruments and categories in which they fall

Policy Instruments	Policy characteristics
<u>1. Domestic price control</u>	
Libertarian scenario	Domestic price floats in line with world prices, leading to lower prices overall due to increased competition.
Government proposal plan scenario	
Protectionism scenario	Semi-floating system. The price of domestic sugar will no longer being set by the authorities. However, government seeks to acquire other possible alternatives that are most equivalent to the old system to maintain domestic sugar price at one single price. These options are either allowing collusion between millers to set domestic price or introducing domestic sugar premium mechanism where price could remain the same at one single price to prevent competition and sugar price.
<u>2. Ending price support: 5 baht/kg tax on domestic sugar purchases to fund revenue transfer from domestic consumers to producers</u>	
Libertarian scenario	Abolition of 5 baht/kg (\$6 cent/lb) tax on domestic sugar sale collection into the Office of Cane and Sugar Fund (OCSF).
Government proposal plan scenario	
Protectionism scenario	Ending 5 baht/kg collection mechanism while replacing with new mechanism that work practically the same to pre-policy reformation either allowing miller's domestic sugar price collusion or introducing domestic sugar premium mechanism where price could remain the same at one single price in order to enable money collection into the OCSF.
<u>3. Ending income support through providing direct payment to cane farmers</u>	
Libertarian scenario	Completely ending all income support through providing direct payments to cane farmers paid on a tonnage basis (All income support payments).
Government proposal plan scenario	
Protectionism scenario	
<u>4. Abolition of sugarcane price support programme</u>	
Libertarian scenario	Ending cane price support programme (Abolition of cane price setting).
Government proposal plan scenario	Maintaining cane price support programme where minimum cane price is set by state.
Protectionism scenario	
<u>5. Abolition of Import restriction</u>	
Libertarian scenario	Abolition of all import restrictions, so that sugar can be imported freely
Government proposal plan scenario	<p>Sugar is considered as a 'control' product which is under the control of the Ministry of Commerce, which periodically issues operators with permits. Imports require permits and face tariff protection regarding imports with a specific duty for sugar of \$ 107 per metric ton for beet or cane sugar, except where these are from WTO's member countries, Japan, Korea, Australia, and AEC countries. Exports of sugar to Thailand from mentioning countries do not require requesting permission to import, but the exports must meet the requirements in accordance with the tariff-rate obligation they commit under trade agreement with Thailand.</p> <p>For example:</p> <ul style="list-style-type: none"> Sugar imports from the WTO members face with a tariff rate quota of 13,760 metric tons of sugar with an Ad Valorem duty of 65% within the quota, and 94% above-quota Sugar imports from members of ASEAN EC2015 (AEC), under free trade agreement (FTA), will be duty free within the member countries, except For Philippines (5%), Indonesia (5-10%), and Myanmar (0-5%) Under FTA with Australia, the Ad Valorem duty for sugar imports from Australia is decreasing from 65% (2005) to 0% (2020); the tariff rate quota is increasing from 2,376 metric tons (2005) to 5,225 metric tons (20190 and finally no quantitative limits in 2020.
Protectionism scenario	

3.3.1.2.1 Domestic price float

According to a high-level government official, Thai domestic sugar pricing policy is considered as domestic subsidy, which contradicted the WTO's agreement.

"The domestic sugar price set by state is one of issues considered as domestic subsidies."-1

To settle Brazil's WTO challenge, domestic sugar price will be switch from being set and capped by the authorities to floating. Superficially, there appear to be a dichotomy on views about policy action regarding domestic price float. On one hand, six respondents positively supported the floatation of the domestic sugar price, which allows millers to sell sugar freely in the domestic market at any price they prefer. According to the proponents, this change will bring the industry's system much more into line with liberalised market mechanism where market is less distorted. This group of respondents agree that this action will encourage more competition among millers, making the industry more competitive.

"These changes make industry's system much closer to a liberalised market mechanism as the market is less distorted"- 9

"I totally agree with the price floating and ending quota setting because they encourage more competition in the market"-2

On the other hand, 12 respondents pointed out that they disagreed with this concept of increase in domestic price competition by allowing millers to sell sugar at any desired prices they want, as they highlighted that this will be more damaging than benefiting to the industry as a whole. As a result of higher competition, complete reliance on the market to set the domestic price will cause 'price dumping' which will lower domestic sugar price down close to export price. Consequently, it will negatively reflect the survival of small-scaled millers. At these low prices, they may be operating at a loss, or with such low profit that they cannot save for reinvestment.

"Most millers demand quota A to be retained because they cannot compete with the biggest millers where the price will be dumped, and they cannot survive. There is a possibility that the domestic price will drop to the point where it is equal to the export price."-4

“Small-scaled millers will definitely not survive due to the impact on their cash flow. they will have to compete with rivals through cutting the price because they need to maintain regular cash flow so that revenue is available for using on company management.”-12

Several interviewees made the point that, larger-scaled manufacturers are most likely to obtain greater advantage over the smaller ones because of their greater economies of scale and efficiency, resulting in a ‘Big fish eats little fish’ situation as stated by (17) ; *“Clearly, large-scaled manufacturers are likely to have more advantage over smaller-scale manufacturers because they are able to adapt rapidly to the change because of better economies of scale, higher efficiency and better production facilities where their production costs are lower than the rivals. Since the domestic price has been floated, obviously those who are able to sell sugar at the lower price than others will win”*

A warning was also given by a sugar broker that if only largest-miller, particularly Mith-Pol, can survive in this situation, the processing sector will become a monopoly which is more problematic than beneficial to the industry as a whole:

“The only miller that has built their own immunity system is Mith-pol where they have heavily invested on research and development and technology on its own is likely to be the only one that survive under liberalisation. This won’t bring any advantage to the whole industry because our market will become a monopoly.”-

22

Despite the argument supporting freely floating of domestic sugar price which will in turn lead to higher competition and industry’s competitiveness, many interviewees emphasized the need of delivery of a more appropriate system taking account of the survival of all sugar millers. Seven policymakers suggested a domestic sugar price model that prevents large price falls, i.e. where the selling price of each miller should be very close to one another, so as to prevent unrestricted price competition and therefore increase the industry’s stability. This new model is based on the development of collusion agreements between millers. Within this idea, they described that this pricing mechanism is not considered a subsidy tool because it is the price agreed by producers, where government does not touch the price and can be implemented as long as price is reasonable where consumers’ rights are still protected. Key comments support how this model works are:

" We should make sure there would be no dumping in domestic sugar price to make sure that the industry must survive. To make sure of that, the development of collusion agreement must be presented"-3

"Comparing to the old system, it is pretty similar, except the old system came from state enforcement, while the new one comes from agreement between millers. If we all agree to these terms, we can still sell domestic sugar at the same old price. The only difference is the new term are not regulated by the government but is set by the private sector"-1

Considering the impact on domestic consumers, despite the fact that consumers would benefit more from full price floatation, several policymakers addressed that Thai domestic sugar price is cheaper than other countries even at the old price before the reforms. Some policymakers made the point that allowing price collusion will protect Thai consumers from the risk of consuming more expensive sugar. As a result, this new model will ensure the well-being of all Thai stakeholders as explained by one respondent:

"In addition to the result in domestic price cutting, risk in terms of sugar shortage in domestic market may occur whenever the world sugar prices increase above domestic prices. When the world prices are higher, millers may choose not to sell sugar in domestic market but to export all sugar they produce, causing sugar shortage in domestic market. due to this, we will have to import sugar from somewhere else which this should never be an issue especially when we are net sugar exporter where we produce way much more enough for domestic consumption. Moreover, even under the old pricing system where the prices were set by authorities, our domestic sugar prices were still cheaper than other countries. Therefore, if the new mechanism is put in place, I'm certain that Thai people can be ensured that they do not have to consume sugar at the expensive price like other countries since the risk on domestic sugar shortage is prevented"-

3

To implement such as model, one respondent suggested that authority on domestic sugar price setting should therefore be transferred from government to the Thai Sugar Millers Corporation Limited (TSMC) which is the communication center of all Thai sugar millers.

“Since our domestic price mechanism set by the Office of Cane and Sugar Board has been raised at the WTO as it has been seen as part of domestic subsidies regulated by the government, therefore the authority on domestic sugar price setting should be transfer to the TSMC, non-governmental institution while rules, conditions, methods from the beginning are remain unchanged.”-18

3.3.1.2.2 Ending price support: 5 baht/kg tax (7 cent/lb) on domestic sugar sales

As part of government intervention on domestic sugar price setting, the mechanism of transferring money, from a sugar tax of 5baht/kg (7cent/lb) on domestic sugar sales, into the OCSF for use as income support for farmers must be abolished. This change is a corollary of the flotation of the domestic sugar price. If this is finalised and implemented as planned, the current price controls, which include the special 5baht/kg (7cent/lb) tax on domestic sugar sales, will be terminated.

Despite the approval by the Cabinet that this issue must be amended, there were two distinct perspectives regarding how this issue should be managed going forward.

On one hand, as being considered as domestic subsidy directly mandated by government, a few respondents agreed that this mechanism should be terminated as indicated in the government reform proposals. In this context, respondents described the abolition of this type of monetary support as necessary to bring subject of this policy measure into line with WTO regulation, resulting in arriving at an extreme level of liberalisation. Therefore, in addition to being categorized as a policy feature under ‘Government proposal plan’ scenario, at the same time it is also represented as a feature under the ‘Libertarian’ scenario. One government policymaker expressed his support for this change as follows:

“We abolish the 5-baht tax and support mechanism to bring the industry's regulation into line with the WTO agreement. The termination of this 5 baht/kg tax and transfer mechanism is also addressed in the industry's restructuring plan where it will be ended”-6

On the other hand, 13 respondents anticipated a negative impact from ending this mechanism, particularly on producers. The impact would be a decrease in the revenue collected into the OCSF, meaning less money would be available for supporting producers during bad times.

“What we have done that was quite challenging was floating domestic sugar price and ending 5 baht tax collection policy because it refers the ending of 5 baht per kilogram of sugar collection into the OCSF. So, lower system's revenue collected into the OCSF, meaning less money saved for helping producers during crisis.”-

17

For this reason, most respondents who mentioned this mechanism during the interview session described a pressing need to maintain the essence of this policy instrument while ensuring compliance with the WTO's permitting framework. As being linked with the domestic sugar price float policy, the identical solution was suggested where policymakers were receptive to the idea of retaining the 5-baht collection on every kilogram of sugar sold domestically but where the transfer mechanisms was no longer operated by government but by farmers and millers themselves. As reported by stakeholders, this can be done by voluntary industry collusion agreement if millers collaborate and agree to drive the domestic sugar price mechanism on the same terms that it was used before the policy reforms. According to the interviews, this action is essential because it helps building financial creditability and stability of the OCSF itself and securing funding to make payments to producers:

“As I told you, if farmers and millers collaborate and agree upon the same old term to sell sugar at 23.5 baht without the enforcement by the state, the OCSF would still has this part of its revenue flow i to the system for supporting producer. We do not need state enforcement.”-1

3.3.1.2.3 Removing income support: Direct payments

The stakeholders expressed two distinctive views about removing direct payment supports to cane farmers. On one hand, a few respondents agreed that direct payments should be removed because they distort the incentive to produce cane and inhibit improvements in efficiency and productivity growth. However, it was argued that these support payments should not be removed all at once, but rather over a transition period to allow farmers time to adjust and so increase the change of business survival.

“Ending direct monetary payments to farmers is okay, as farmers should have to try to grow by improving themselves instead of keep asking for and relying on state supports.”-9

“Amount of monetary support should be reduced a bit by bit, so farmers have time to adjust themselves”-11

On the other hand, regarding the government’s objective on driving productivity improvements among cane farmers, to achieve this objective, the majority of policymakers (n=17) endorsed the view that the existence of direct payments to farmers is essential within Thai cane and sugar system, particularly in this situation where regime must be reformed. Since small-scaled farmers are the majority group, with the lowest income farm households and are among the least profitable due to low levels of efficiency which have constrained them from productivity improvements. Hence, they are significantly supported by this system as it provides basic income supplement to farmers who can’t support their farm households. This was clarified by one policymaker:

“Most farmers are quite needy and inefficient where they lacked everything (appropriate resources). They lack sufficient income and resources were scarce. Therefore, topping up payment actually helps them. Moreover, with this income support, farmers’ productivity has also become much better compared to the past.”-12

Most policymakers advocated that this scheme cannot be ended but the amount of payments can be reduced to at least at the point above farm’s break-even price so most farmers can keep their business running.

“I think monetary can be reduced but it must be remained at some certain amount. It should be maintained at least for the point where price is above farmers’ costs.”-17

In the past, direct payments to Thai cane farmers were provided through a ‘flat rate’ payment based on output volume regardless farm size across all farmers where all farmers received the topping up payment at 160 baht per every tonne of cane they produced on top of the cane price. Because of ongoing pressures from the WTO’s negotiations, the Thai government was obligated to reforming its direct payment scheme. To achieve compliance with the WTO’s framework, several respondents proposed that transforming to some form of alternative payment should be taken into consideration. Superficially, there appears to be a dichotomy in views about restructuring direct payment scheme.

The first option being suggested is that which the Thai government is already proposing, i.e., rebranding the fixed 160 bath/tonne top-up cane revenue payment, formally called domestic

price subsidy, as indirect support for inputs to all farmers at a flat rate on tonnage basis without any production output and farm size limitations. The government has been taking this approach to provide a signal to cane farming business that direct payments are now reduced so farmers obtain time to adjust themselves.

“Ending the 160-baht direct payment is a signaling from the state that state is now reducing direct payment. However, we cannot end this completely since some farmers will experience an economic shock and suffer. The State will have to reduce the payment little by little, so farmers do have time to adjust themselves. That is why farmers still receive a 50-baht direct payment (subsidy on inputs) instead of 160 baht this year (subsidy on cane revenues)”-12

However, some policymakers disagreed with the approach that government are now taking. These stakeholders argue that this new input subsidy scheme introduces distortionary incentives to large-scaled farmers instead of small-scaled farmers who are vast majority and are they targeted group that needs this support. They point out that although the amount of support payment is no longer fixed but it is still provided at the flat rate based on amount of cane produced, therefore is not targeted in any way. This implies that the larger amount of cane they produced, the more money they receive therefore this approach does not improve the equity issue, because a significant amount of the direct payments clearly goes to households that have already earn quite large incomes. As a result, this approach does not ensure better allocation of direct payments because smaller-scaled farmers would have the same reductions as the larger farms, however, they might not have the same adjustment scope. These respondents suggested that payment should go to farm households that are actually suffering and not best placed to cope with loss of this support i.e., small and low-income farms.

“I think we pretty much provide this money to the strong ones rather than the weak ones. For example, since we paid 100 baht per ton of cane to all farmers, there are some farmers that obtain over 100,000 MT of cane. Why do we have to help the big ones who have survived already? They are very profitable. I mean, we should set the requirements. For example, we will pay for small farmers only who are still struggling.”-1

One respondent suggested that direct payment ceiling for inputs subsidy should be imposed where maximum cane production volume that are eligible to receive the support should be set. This limitation can be calculated based on the average break-even point of cane farming, as was exemplified here:

“We must reset how the payment system works. For example, I would set the maximum level of payment I state can pay such as maximum at 1,000 metric tons of cane as the break-even point. You, as farmer is still allowed to produce more than that, but state only helps for 1,000 metric tons.”- 15

3.3.1.2.4 Termination of cane price support programme

The legislative basis for the ‘cane price support programme’⁸ is the Cane and Sugar Act of 1984. The mechanism was designed to ensure the survival of cane farmers through a two-staged payment for cane delivered i.e., a ‘preliminary’ and ‘final’ payment. To illustrate how this works, farmers first receive a payment based on a minimum cane price, which is set by the government before the opening of cane crushing season. The top-up to this payment is based on a ‘final’ price, which determined once the OCSB is able to calculate the difference between the total actual sugar revenue from selling both domestically and globally and actual costs incurred during the production season. If the final price is above the preliminary price, millers are obliged to pay the additional amount equal to the difference. In contrast, if the final price appears to be lower than the preliminary price, the OCSF must compensate the millers for the overpayment to farmers, i.e. farmers do not have to return the over-payment.

Based on the consultation, it was revealed particularly by couple government official members that cane price support programme is considered as a price guarantee measure which removes all element of market-price risk from Thai cane farmers:

"(Do you think the two-price system preliminary and final cane prices is a part of a price guarantee mechanism?) Yes, it is. Whenever the preliminary price appears to be lower than the final price, everyone is happy. However, whenever it appears to be higher, this has always been an issue because the OCSF must compensate the differential price while farmers do not have to take the burden. This is because of the structure that protects our farmers from the loss. This is the reason why our farmers and millers have not put any effort into developing themselves because they have no risk of loss and always rely on the supports. -2

⁸ The term of cane price support programme is used in the USDA’s Foreign Agricultural Service reports on Thailand Sugar Annual through the Global Agriculture Information Network (GAIN) database.

This cane price support programme generates mixed opinions. First, a few academic stakeholders felt that this mechanism could be terminated if doing so would bring the industry regulation into line with the WTO's framework. However, they also argued that a new measure, producing a cane price floor, must be introduced to offset this termination. The minimum cane price must be above farmers' costs to ensure survival of farmers:

“Government should set some kind of cane price measure which sets cane price floor at the point where cane farmers can survive or receive some profits. If there is no measure, industry can be in much trouble if cane price appears to be too low.”-10

However, the notion of terminating this cane price support mechanism above was ruled out by most stakeholders. These viewed the pricing system as essential because it prevents a collapse of the industry. A very interesting viewpoint was drawn by one stakeholder which is explained as follows.

“It is necessary to have pricing system because without it, eventually this industry will collapse. This is because sugarcane is different from other crops since it is not possible to stock the cane. If there is no one buy the cane after the production season ends, it must be dumped away, and it will also waste lots of money to cut them and then dump them. Cane is not like other crops that can be stocked after the mills have been closed. As a result, by nature, cane farmers are the ones who are at a disadvantage if there is no buyer. At this point, if we liberalize Thai sugar industry without pricing systems, I believe cane farmers will leave their business and there will be no more cane.”-7

Most importantly, a non-governmental respondent clarified that the action where the OCSF pays the compensation to millers whenever the final price is below the preliminary price is not state subsidy, because money used to offset this loss is collected from producers by the OCSF from other mechanisms that were illustrated from Section 3.3.1.2.2.

“I quite disagree with terminating the OCSF in compensating cane farmers. Continuing this cane price support mechanism is definitely not a problem (in WTO terms) as the money saved under the OCSF is money collected from farmers and millers, therefore it's their money. So, it is their right that they should be compensated where the OCSF plays the role as hedger in cases where the real price is actually lower than the announced price.”-15

Although many policymakers provided evidence in support of an actionable assertion on retaining the cane price support programme, they judged that the recognisable weakness which hinders effective application of this mechanism is the OCSF's financial underperformance with respect to its role addressed in the Act. Policymakers were aware that, in those years where the final price was above the preliminary price, the OCSF has barely been able to collect money from millers into the system, while the OCSF must compensate millers in the years that final price appears below the preliminary price. Insufficient cash flow, due to inadequate revenue streams into the OCSF, results in a lack of financial stability. Commenting on this financial instability some policy makers said:

“Speaking of the OCSF, a “private organization” was established to help cane farmers and sugar millers at times of crisis. However, to be able to pay out to farmers and millers when they face troubles, the OCSF must be able to generate its revenue which is saved for funding to producers. A part of the OCSF revenue comes from Section 57 regarding the higher final price. However, the OCSF has been struggling with collecting money from mills in accordance with the cane and sugar act. So basically, while the law is clear, The OCSF is barely able to collect the money that is determined in the law. This results in lack of stability of the OCSF and triggers other negative consequences as well.”-1

3.3.1.2.5 Removing import restrictions

Regarding the notion of removing sugar import restrictions as a policy feature bringing the industry up to date with the current and future developments in international sugar market, there would appear to be two possible policy approaches.

The libertarian scenario is predicated on promoting liberal trade policies where barriers to free trade including tariffs and quotas are removed. Under this scenario, the alternative approach would be removing all import restrictions for all countries seek to export sugar into Thailand. However, the Thai government still seeks to maintain the highest level of import restrictions. As a result, this conception represents both ‘government proposal’ and ‘protectionism’ scenarios where government seeks to retain the highest level of permissible import restrictions while being in line with international commitments which is presented as the second alternative approach. Regarding the retention of sugar import restrictions in this case, there are two dimensions in terms of import that are distinguished. The first dimension would be to retain certain sugar import restrictions, i.e. those that are permitted under the WTO's commitments and under ACE

free trade agreement. These restrictions would be based on the requirements in accordance with the tariff-rate obligation they commit under trade agreement with Thailand. For example, sugar import from WTO' member countries are allowed following to permissive conditions. In addition to WTO members, sugar import must be freely allowed from countries that Thailand has signed special agreements with, including Australia, Japan, and AEC countries. The details of permissive conditions and exemptions for sugar import from these countries are provided in Table 3.4. In these case import must be permitted according to the exemptions Thailand has committed to. However, sugar imports from other countries depart from AEC and WTO signatory countries where no free trade agreement is signed will still require permits and face the tariff protection regarding imports imposed by Thai government with a specific duty for sugar of \$ 107 per tonne for beet or cane sugar.

The stakeholder consultation revealed that all policy makers across institutional settings at all scales hold a similar perspective to removing import restrictions at any degree where they commonly agreed that any actions will either result in slight or no change to the level of sugar import, despite taking any import policy approaches. One respondent stated that almost no country has in fact exported sugar to Thailand despite the allowance for this under special agreements signed with Thailand, as is exemplified here:

“Despite a free trade within ASEAN since 2010 where there is zero percent tax on sugar imports and exports among all members, nobody has actually imported any sugar from ASEAN countries at all. Our neighboring countries consume Thai sugar. In addition to ASEAN, Thailand has also signed the Thailand-Australia Free Trade Agreement (TAFTA), which is another major sugar producer, but still there have been no sugar imports from Australia.”-14

The main reasons given in support of these propositions were (1) location advantage, (2) massive sugar oversupply in Thailand, (3) domestic sugar price that is considered cheaper than other countries, and (4) long distance conditions and high transportation costs. The comments and findings supporting these reasons are illustrated in Table 3.5.

Table 3.5 Reasons given in support of Thailand's strengths on trade

Empirical reasons	Findings	Comments	No. of respondents
Long distance condition and transportation costs	To export sugar to Thailand, large sugar exporters such as Brazil and Australia face high transportation costs due to their distance from Thailand. This offsets despite their cheaper sugar price and production costs.	<i>"It is very challenging for other sugar exporters such as Brazil to ship their sugar across the continent to Thailand because of high transportation costs even though their sugar is cheaper."-9</i>	9
Location advantages	Thailand is located in the region close to big sugar consumption countries such as China and India and other neighbouring countries where domestic markets are under-supplied by domestic producers.	<i>"Fortunately, we are very lucky regarding the location of the major sugar consumers. World's regions are clearly divided. Therefore, it is almost impossible that sugar from Brazil or any other world sugar producer countries will get into our region. Our consumers and their consumers are clearly classified/separated and divided where Asian market is ours."-12</i>	7
Oversupplying	There is massive sugar oversupply from domestic production, nearly 75% of total sugar volume.	<i>"If you ask for today situation or within 5 years, there is less likely for sugar to be imported because we produce much more than domestic consumption."-7</i>	6
Cheaper sugar price	Thai Domestic sugar price is still cheaper than other countries, regardless of any domestic sugar price policy approaches.	<i>"Our domestic sugar price is still considered cheaper than most countries"-11</i>	6

Based on findings, only some extra-special types of sugar may be imported, as suggested by a couple of non-governmental agents representing the miller sides.

"Despite the sugar import reform, I do not believe that there will be an increase in imports except in case of specialist types of sugar."-5

Although the majority of respondents were very positive that there will be a small or even no impact of any level of removal of import restrictions, some government-based respondents objected to the approach suggested under the "libertarian" scenario on the grounds that domestic producers are unprepared for higher levels of competition. An official policy actor revealed that:

"We are not ready and never start adapting ourselves to be able to support the situation where there is an increase from up-coming competition. If import restrictions were to end immediately, I strongly believe that over a half of the 57 sugar mills would be in trouble, particularly for millers with lesser business diversification."-2

Table 3.6 Summary of policy options

Non-discriminating policies	Policy scenarios	Policy Instrments	Policy Options		Government support	The AoA pillars	Amber box	Blue box	Green box	Developmental box
	Across all scenarios	The 'Sugar' definition in the Act	Amending the Act			✓	Domestic support	X	X	X
Soft loans at low interest rates		Remaining soft loans provided to cane farmers	Loans for purchasing cane cutter		✓	X		X	X	✓
			Loans for other activities		X	✓		X	X	X
Revenue-sharing system 70:30		Remaining revenue-sharing system while proportions may be adjusted			X	X		X	X	X
Quota system		Repeal of quota system by replacing Quota A with 'sugar reserve' as buffer stock for domestic consumption			✓	X		X	✓	X
Indirect supports	Increasing government budgets supporting indirect supports			✓	X	X	✓	✓		

Discriminating policies	Policy instruments	Policy scenarios	Policy options		Government support	The AoA pillars	Amber box	Blue box	Green box	Developmental box
		Domestic price float	Libertarian/Govt Proposal	Completed floating system		X	Domestic support	X	X	X
Protectionism			Semi-floating system		X	X		X	X	X
Income support : Direct payments		Libertarian	Completed removal of direct payments		X	✓		X	X	X
		Protectionism/Govt Proposal	Maintaining direct payments but inplacing amount deduction	payments for production factors		✓		X	X	✓	X
Payments for delivery fresh cane					✓	X		X	X	X
Cane price support program		Libertarian	Ending cane price support program		X	X		X	X	X
		Protectionism/Govt Proposal	Remaining cane price support program		X	X		X	X	X
5 baht/kg tax on domestic sugar sale collection		Libertarian/Govt Proposal	Completely removed		X	X		X	X	X
		Protectionism	Removed while encouraging price collusion		X	X		X	X	X
Import restrictions		Libertarian	Full liberalisation of trade		X	Market Access				
	Protectionism/Govt Proposal	Remaining certain level of sugar import restrictions that is permitted under international commitments		✓						

3.3.2 Stakeholders' judgements on the level of libertarianism evident in sets of policy regimes and on likelihood of a set of possible policy scenarios (From mixed method approach)

The data reported in this section is generated by a combination of qualitative analysis supplemented with some quantitative analysis of data obtained from the consultation exercise. In this study, in addition to the interviews, stakeholders were also asked to identify the level of libertarianism evident in several of policy regimes including one historical and the others hypothetical regimes. On this basis, stakeholders provided a single point on an 11-point rating scale to describe the extent of libertarianism of each policy approach.

Table 3.7 An average stakeholder judgement on a metric of libertarianism of policy approaches by using an 11-point rating scale (0= extreme protectionism and 10 = fully liberalisation)

A metric of libertarianism of policy approaches using an 11-point rating scale					
Statistics	Level of libertarianism current appropriate for Thai sugar sector	Historical regime	Hypothetical regimes		
		The Act of 1984	Protectionism	Government Proposal	Libertarian
Average	5.70	3.61	5.56	6.24	7.20
Median	5.00	3.50	5.00	6.50	7.25
Mode	5	5	5	8	8
Min	3.50	0.00	3.50	4.00	5.50
Max	8.00	6.50	7.50	8.00	9.00
SD	1.271	1.845	1.316	1.346	1.100

Table 3.8 Stakeholders' judgement on likelihood of scenarios being implemented in practice using 5-point Likert scale)

Likelihood of scenario being adopted			
Statistics	Libertarian	Government Proposal	Protectionism
Average	1.65	4.20	4.45
Median	1.50	4.00	5.00
Mode	1	4	5
Min	1.00	1.00	1.00
Max	4.00	5.00	5.00
SD	0.813	0.894	0.945

At an early stage in the interview process, respondents were asked to identify the level of libertarianism of the historical Thai sugar regime, i.e. under the Thai Cane and Sugar Act of 1984 prior to the onset of the reform process in 2016 on a 11-point rating scale (0= extreme protectionism and 10 = fully liberalisation). As expected, the average rating scores (3.61) were below the three reform alternatives, i.e. the three alternatives were more libertarian than the unreformed regime. This finding helps to explain the fact that in the depth-interviews all respondents emphasized the need to reform the policy regime. The reasons frequently mentioned by interviewees are “bringing the industry in compliance with the international law” (interviewee 6, interviewee 8) and “reducing complexity from strong government intervention and increasing flexibility” (interviewee13, interviewee14).

The most striking result to emerge from the interviews is that virtually no government-based policy actors and academics endorsed, or favour, the liberalisation scenario, except one non-governmental agent. This stakeholder declared that the liberalisation scenario will contribute an increase in sugar mill business agility:

“Speaking as miller representative, I would love to have greater agility in my business. I don’t like the government’s intervention. I don’t like being controlled. I want the system to be more flexible and the management can be done quickly. These are what we want to see. From the industrial side, it should be more flexible for millers to operate their activities” 5

In contrast, the 21 out of 22 policymakers across institutional settings agreed that the extreme liberalisation of the Thai cane and sugar policy regime is inadequate and not suitable for the foreseeable future as one policymaker at national scale noted:

“In the future, it is possible that our industry could be fully liberalised, but it will not be any time soon. There is a chance, but it is going to take significant time to move the industry towards liberalisation.”-14

For the Thai industry, the findings clearly confirmed that the benefits of full liberalisation are far outweighed by the benefits of types of policies that retain certain levels of domestic producer supports and market intervention. This conclusion of the consultation is supported by stakeholder estimates of the likelihood of the scenarios being adopted. The Table 3.8. Shows that the average score of the ‘Libertarian scenario’ lay between ‘Very unlikely (1)’ and ‘Unlikely (2)’, with most stakeholders describing it as being ‘Very unlikely (1)’ to be adopted in practice. Therefore, the hypothesis H3 was supported.

When asked about the effect of the ‘libertarian’ scenario, even though most stakeholders acknowledged the theoretical proposition about agricultural policy liberalisation such as increasing household welfare and improving both inequity and income distribution, they criticized this liberalisation theory building and agreed that the resulting of liberalisation will put the industry under pressure and expose inability to survive of most producers. As such, most policymakers are generally supportive of findings ways to alleviate majority of producers in which the mechanism chosen to not threaten the dominant social position rather than to a desire to liberalize agricultural trade for the efficiency-based reasons that many economists emphasized:

“From economics perspective, the truth is we should liberalise our industry so those who obtain high productivity can improve even more. It is a theory where anyone who is not able to improve should go out of the system. But in Thai society, we will try to keep everyone alive. The idea may be a bit contradictory, but it is the reality.”-18

“From my point of view, liberaltarian policy is absolutely not suitable for our producers since only a few people will benefit from this type of policy.”-14

Some policy actors suggested that not only was full liberalisation infeasible in the Thai policy context, but it would also not be possible in most sugar producer countries. One respondent made a clear point that countries that have taken a full liberalisation approach, such as Australia, experienced greater downsides than benefits.

“Speaking of liberalisation, Brazil itself does not liberalise its sugar industry. Australia in fact is the only country that has fully liberalised its cane and sugar industry. Looking at Australia’s industry, you can see that Australia has been treading water since the liberalisation. In the past, Australia and Thailand competed strongly against each other on the world sugar market, but now Australia is quite far behind us.”-22

The findings of the stakeholder consultation are that the primary goal of the great majority of Thai policy actors is to maintain both millers and cane farmers, at all scales, in business as much as it is possible. Regarding this primary goal, the security and well-being of Thai cane and sugar producers are two relevant aspects that policy actors greatly emphasize. The impacts of policy

reform on the domestic economy are considered of far greater priority than any impacts on the international market.

“Before relying on international economy, the first priority is supporting domestic economy and well-being of our own people”-1

According to the interviews, protection of the survival of cane and sugar producers of all scales is seen as the self-evident role and responsibility of Thai government. Considering the structure of Thai bureaucracy and the cabinet, the party is elected by citizens on the basis of an electoral campaign and manifesto promises of greater benefits for all people. Amongst all cane farming households, protection of producer supports has always been a vote winner. Therefore, many see the government’s core responsibility as taking care of cane farmers, particularly when their livelihoods vary, and the majority group are small-scaled. This group is least likely to continue cane farming business on their own without government supports due to low production efficiency and competitiveness. Moreover, without producer supports, cane farmers are most likely to be disadvantaged by millers. The existence of the act helps secure benefits for farmers’ and contributes fairness between farmers and millers. Policy actors were aware of the likely negative consequence if the concept of liberalisation is implemented in policy, i.e. it would result in wide-spread chaos.

In the respect to the survival of cane producers at all scales, most policy actors highlighted that certain level of government interventions must be retained in order to prevent a ‘Big fish eats small fish’ situation developing among both farmers and millers. This exact term was used by 5 respondents. The following quote explain unfavourable incidents, which diverge from government goals, that will likely occur through pursuing a libertarian policy approach.

“In Thai industry, libertarian policies will result in ‘Big fish eats small fish’, where the small-scaled and less efficient producers will not survive and will disappear from the industry while only large-scaled or highly efficient ones will exist.”-11

Most importantly, the findings also indicate the survival inter-relationship between sugar millers and farmers. If the industry is liberalised, smaller scaled millers are more likely to struggle in competing with larger-scaled ones, particularly in domestic market due to lower efficiency and negotiating power in terms of price which will result in a significant decrease in their market share. As consequence, the crash of some millers also reflects the prospects for survival of farmers in the geographic areas serviced by these millers, as one policy actor explained.

“When we start to liberalise, the ones with the advantage would be the strong ones and the ones that will be struggling will be the ones that still suffer many setbacks. The problem is that when millers cannot survive, farmers in the same base area will not be able to survive either. They will definitely not be able to deliver cane to other mills at greater distances, i.e. more than 100 kilometers away. The survival of one group affects another. This is an unfavorable thing for the government because it will create much more conflicts and chaos consequently.”-1

Both Civil Servants and Academic in the interviews, concluded that (1) pursuing a libertarian policy scenario approach is not sensible for the Thai cane and sugar industry and unlikely to be put in practice; and (2) retaining certain levels of government intervention mechanisms would be a much more beneficial approach and more widely accepted. In search of sensible policy approaches, which retain certain levels of government intervention and producer supports, stakeholders identified two distinct levels of support, represented by (1) government proposal plan scenario, as a middle-of-the-road policy approach, in which certain domestic production subsidies are removed but where as much support as is permissible under the current WTO’s rule is retained; and (2) a protectionist scenario which represents the highest range of extreme protectionism policy approach, including maintaining all of the current internal market producer supports, that are permissible under WTO commitments.

The qualitative and quantitative data analysis confirms the policy recommendation of most stakeholders that a ‘protectionist’ approach is the most well-suited approach and the most favourable of the three policy scenarios for the Thai cane and sugar industry in the current circumstances. This was the view of nearly three-quarters of respondents (14) across all institution types, who also felt that the protectionism policy scenario and was most likely to be introduced in the Thai context. The word “land of compromises” was mentioned as representing Thai social and cultural contexts.

“This (Protectionism) is a suitable option in the Thai context. Our social and cultural conditions are seen as a land of compromises. There is a higher possibility of this approach compared to the other options. It is the better option for government to practice this way rather than being too cruel to farmers”- 4

While the government policy reform proposals have already begun to be implemented, most respondents provided little support to this plan when taking producers’ responses into account. Policymakers in this group were aware that the current proposal plan will not be effective as it

has already been opposed by most cane farmers who believed that the changes will cause them negative impacts.

“Most cane farmers have already opposed the government proposal plan. They are starting to ask for more help and supports. Therefore, the government are only going to make policy changes in terms of the policy instruments that are currently in breach of WTO rules, while covering one’s eyes and ears on those that are not too obvious.”-14

Most stakeholders agreed that some support and subsidy tools, such soft loans and direct payments, are essential to guarantee the survival of producers at all scales, as highlighted by one official respondent (9), especially in the society where there are massive numbers of cane farmers, half of whom operate at a very small scale and who still lack of knowledges, self-reliance and competitiveness. By taking protectionism approach, government is more likely to achieve its national target regarding the survival of most producers particularly small-scaled farmers, as exemplified below:

“The number of small-scaled farmers is greater than half of total cane farmer population which is the main problem. This is why we still need some strings in order to help protect small-scaled farmers against risks.”-3

“I think this(Protectionism) is the most suitable type of policy to our industry. At this moment, it is still very hard for our farmers to compete with others because of low competitiveness. Therefore, the state must take action to help our own people’-14

Despite the announcement of proposed policy reform package as the current policy reform strategy in response to the complaint at the WTO, many policy-actors hand expressed confidence that government will ultimately mend this plan and end up landing a policy approach that follows the same track as the old regime prior to the reform, i.e. being more protectionist than its initial plan. As Table 3.7 shows the scenario most subscribed to by respondents, as being most suitable for current conditions in the Thai sugar sector, was the protectionism scenario, this being the closest in fundamentals to the old regime. These respondents agreed and perceived that the current government proposal plan is itself an unrealistic policy which will need to be made more protectionist. Despite the recognition by all respondents that the sugar regime required

amendment, adjustments should be carried out only where needed to achieve compliance with WTO rules:

“Despite the policy reforms that have been introduced, I think the actual idea and methodological way that government is in fact approaching are still exactly the same (as old regime).”-13

“It is truth that support and subsidy are needed to be amended, but it must be maintained at the maximum level allowable by the WTO. From my view, I think for the benefits of our local producers, state must subsidise.”-15

Furthermore, policy actors who supported the protectionism scenario held contrasting understandings about which policy instruments had to be prohibited to achieve compliance with WTO rules. These policy actors argued that some support measures, such as revenue-sharing system and quota allocation, all of which are included under the proposal plan, are fully compliant with the WTO’s rules.

“We should make sure that the things we reform are actually against, or not compliant. In fact, the provisions of WTO are set because the WTO is concerned about the subsidy issue which is not allowed under the framework. Therefore, we must ask ourselves, have we supported anything beyond the rules and regulations. Personally, I think some issues in the proposal plan do not actually break the WTO rules.”-13

“From my point of view, I feel like the government has attempted to change too many policies based on the government proposal plan. Some of them are not that essential. I think we should amend only the obvious issues that are really not in compliance with WTO.”-14

The above statements clearly illustrate a belief amongst some stakeholders that some of the changes under the government reform proposal went further than necessary to obligations under the WTO. Some respondents expressed the view that the draft government proposal plan was produced too quickly without evidence-based analysis. These respondents believed that some of the policy instruments that were being complained about at the WTO were in fact allowable subsidies. From their perspective, some supports are totally practicable while others, despite

falling into the amber box category, still fall under the allowance limit. The problem they argue, is not the policies themselves, but the lack of government attempts to explain their legality.

“Personally, I think what we did was too sudden. We ended up adjusting out terms too fast without preparation plans. In consequence, some issues seem to have caused problems.”-5

“From my personal view, I think we still have allowance given under Amber box and volume allowed under de minimis. When Brazil first challenged us, I was so surprised because I think the amount of money we spend for this aid does not exceed the allowed level under "10% De Minimis'.”-12

Conceptualizing the idea of subsidy reallocation was suggested by five respondents, especially by academics, as a relevant approach to direct fiscal policy decision related to subsidies in line with WTO’s rules. This would require government to seek other alternative compatible support options if government are seeking to retain its extreme protectionist measures, while achieving compliance with WTO commitments. In consequence, respondents, particularly academics, stated that:

“I think there are other ways to provide support, for example, in the case of the 5 baht/kg collection, we still need to subsidise, but it doesn't have to be continued through retaining the exact same policy that is seen as a prohibited action at international level. However, despite the change, the core mechanism can remain unchanged. This is a question of subsidy allocation. We can still collect this levy but arrange for this money to be used for other purpose while finding other source of money to replace this.”- 21

More importantly, policy-actors’ perception of the likelihood of implementation of the protectionism scenario, and their reasons for holding these opinions, coincided and was supported by the quantitative findings illustrated in Table 3.8. Respondents were asked to indicate the likelihood of the protectionism scenario being implemented in practice on the scale 1 (very unlikely) to 5 (very likely). Twenty out of 22 interviewees responded to this question. The results confirmed an average likelihood score of 4.45 out of 5 where 12 respondents indicated that it is “very likely”, and 7 respondents said it is “likely” to be implemented. Hence, the hypothesis H4 was supported.

In addition to rating each of the scenarios in terms of their degree of libertarianism on an 11-point rating scale, all respondents were also asked to rate a level of libertarianism appropriate for Thai Sugar Sector at the present time using the same 11-point rating scale. Twenty interviewees responded to this question. As shown in Table 3.7, there was no noticeable difference between respondents' perspectives on the protectionism scenario and their personal view on the level of libertarianism appropriate for Thai Sugar Sector at the current time. The average score for the protectionism scenario was 5.56 compared to a score of 5.70 for the level of libertarianism currently appropriate for Thai Sugar sector (median - 5, mode - 5 and minimum - 3.5). The libertarianism ranking score for the 'government proposal' is 6.24 and for the 'libertarian' scenario is 7.20.

From the results, the notion that the 'government proposal' scenario is suitable and should be introduced as a policy approach appeared to be lesser desirable compared to protectionism scenario as this notion was accepted by only six respondents out of 22 stakeholders where five of them are high-level officers involved in the development of Thai cane and sugar policy. The interview findings revealed the government proposal scenario was to be preferred by those the officers who have been involved with the formulation and establishment of the current government proposal plan:

"I agree with the plan because I am a part of the team that was involved with this reformation."-6

There was a consensus among these stakeholders in this group that delivering the right support level is extremely important as it reflects both producers' capability for development and their survival. These respondents emphasized that too much support from the extreme protection regime, especially in forms of money, will discourage producers from improving their capability, resulting in no development. In contrast, full removal of supports is impracticable. Producer supports are always essential and irrevocable as retaining these supports are key components of the election manifesto of the party of government. However, this does not prevent financial support being transferred in other non-monetary forms, as one government official explained:

"The fact is the disadvantage of protectionist policy is there will be no development. However, yes, it is true that it is government's role to support our own farmers. That is what government has been elected to do. Farmers vote for the government party regarding to agricultural policy campaign that they find it would be beneficial for them and it is undeniable that all these campaigns are about supports and benefits that will be given to farmers. So, yes, government

cannot just take away all supports. But these supports don't always have to be in forms of money otherwise farmers will always be expected for monetary supports only. -6

Despite a common the perception that the government proposal scenario was the most suitable policy approach in the present circumstances viewed by the government officers, there was a difference of opinion about whether this represented a middle-of-the-road policy approach, or a more extreme libertarian scenario, i.e. being the furthest extreme of libertarianism that was possible at present. Government officials put the question this way:

"I think the highest level of liberalisation would be the same as the current government proposal plan"-17

The notion that, in minds of many stakeholders, there is close proximity between government proposal and libertarian scenarios, is supported by the data in Table 3.7. The data presented resulted from asking respondents to place the government proposal scenario on an 11-point rating scale representing degree of libertarianism. Based on obtained responses on this scale, the results showed that under 'government proposal' scenario, many respondents placed the rating score at very near the extreme of fully libertarian regime of this scale. They suggested at the point 8 on this scale is the most sensible and maximum degree of libertarianism and feasibility for 'government proposal' scenario as at this scale point (8) was the most frequent identified point along a continuum of value given among all responses to this scenario. Based on placement identified by respondents, the degree of libertarianism for 'government proposal' scenario would be positioned in close proximity along the 'libertarian' scenario as at this same scale point (8) was also most frequently placed under libertarian scenario.

3.3.3 Results in relation to anticipated impacts of the policy reform scenarios on market signals, supply and trade

Respondents were asked how each policy scenario would impact the Thai sugar sector within five years of implementation, compared to the current situation (2019). To ensure complete responses and consistency in the issues covered by each stakeholder, stakeholders were asked to focus on a set of key market indicators, these being: (i) trade; (ii) domestic supply; (iii) cane farm incomes; (iv) cane producer prices; and (v) the domestic sugar price.

Tables 3.9- 3.11 show the distributions of these estimates across the sample of 22 interviewees, while in a summary of the results is presented in Table 3.12

Table 3.9 Stakeholder estimates of the impacts of the scenarios on market metrics, import and export volumes –Protectionism scenario

Respondent number	Change in import volume (%)	Change in export volume (%)	Change in cane production volume (%)	Change in sugar production volume (%)	Change in farmer income (%)	Change in miller income (%)	Estimate producer cane price (Baht/tonne)	Change in domestic sugar price (%)	Change in domestic sugar supply (%)
1	0	5	3	5	5	5	850	-10	0
3	2.5	10	-12.5	-12.5	27.5	20	975	0	2.5
4	0	0	0	0	-10	-10	675	-10	0
5	0	0	5	0	7.5	10	900	-5	0
6	0	3	4	4	5	5	800	-5	1.5
7	-10	0	0	0	0	0	930	0	0
8	10	5	10	-10	5	7.5	850	0	0
9	0	10	20	20	10	10	850	0	0
10	0	5	7.5	5	7.5	7.5	1000	0	0
11	0	0	0	0	5	5	850	-10	-3
12	0	0	5	0	10	0	875	-10	0
13	0	0	0	0	0	0	900	0	0
14	0	0	5	-5	2.5	5	875	0	0
15	0	5	2.5	3.5	5	5	750	-10	-2.5
16	10	10	20	10	15	15	850	0	5
17	0	7.5	10	10	7.5	5	900	7.5	4
18	0	-15	-10	0	-7.5	-7.5	700	-10	-2.5
19	0	-5	-5	-10	-5	-5	700	0	-2.5
20	5	2.5	10	5	12.5	15	900	0	5
21	0	0	-10	0	-5	-5	825	0	0
22	0	0	0	0	7.5	15	900	0	0
23	0	10	7.5	10	10	15	875	-10	0
Mean	0.795	2.409	3.273	1.591	5.227	5.341	851.364	-3.295	0.341
Median	0	5	4	0	5	5	850	0	0
Mode	0	0	0	0	5	5	850	0	0
SD	3.887	5.748	8.351	7.332	8.162	7.992	83.839	5.198	2.179

Table 3.10 Stakeholder estimates of the impacts of the scenarios on market metrics, import and export volumes –Government proposal scenario

Respondent number	Change in import volume (%)	Change in export volume (%)	Change in cane production volume (%)	Change in sugar production volume (%)	Change in farmer income (%)	Change in miller income (%)	Estimate producer cane price (Baht/tonne)	Change in domestic sugar price (%)	Change in domestic sugar supply (%)
1	5	-20	-20	-20	-10	-10	650	-15.8	0
3	5	-20	-25	-25	25	15	900	0	-2.5
4	0	0	0	0	-15	-15	700	-10	0
5	0	-15	-7.5	-7.5	-15	-15	700	-15	0
6	0	-5	-5	-5	-15	-15	800	-10	1.5
7	0	0	-20	-20	-7	-7	650	-15	0
8	10	5	5	5	3	3	750	0	0
9	0	-10	-3	-3	-15	-15	650	0	0
10	0	-5	-5	-5	-12.5	-12.5	680	0	0
11	0	-10	-10	-10	-12.5	-12.5	675	-15	0
12	0	0	0	0	-10	-10	675	-12.5	0
13	0	-10	-5	-5	-10	-10	650	-15	0
14	0	-7.5	-20	-20	-12.5	-10	650	0	0
15	0	-10	-10	-7.5	-7.5	-2.5	675	-15	-2.5
16	0	20	30	20	10	10	900	0	5
17	10	5	-5	-5	5	2.5	825	-7.5	4
18	0	-15	-15	-15	-15	0	750	0	-5
19	0	10	-10	-10	-7.5	-7.5	700	-12.5	-5
20	0	-20	-20	-17.5	-15	0	725	-10	5
21	0	0	10	0	7.5	10	850	0	0
22	0	0	0	0	-10	-7.5	730	-12.5	0
23	0	0	-10	-10	-10	-10	680	-15	0
Mean	1.364	-4.886	-6.614	-7.295	-6.773	-5.409	725.682	-8.218	0.023
Median	0	-5	-6.25	-6.25	-10	-8.75	700	-10	0
Mode	0	-10	-20	0	-15	-10	650	0	0
SD	3.155	10.191	12.107	10.075	10.434	8.936	80.272	6.686	2.495

Table 3.11 Stakeholder estimates of the impacts of the scenarios on market metrics, import and export volumes –Libertarian scenario

Respondent number	Change in import volume (%)	Change in export volume (%)	Change in cane production volume (%)	Change in sugar production volume (%)	Change in farmer income (%)	Change in miller income (%)	Estimate producer cane price (Baht/tonne)	Change in domestic sugar price (%)	Change in domestic sugar supply (%)
1	7.5	-22.5	-25	-25	-10	-10	530	-20	0
3	10	-20	-25	-25	20	10	900	-10	-2.5
4	0	0	0	0	-10	-10	490	-30	0
5	0	-20	-10	-10	-5	-5	650	-25	0
6	0	0	-7.5	-7.5	-10	-7.5	600	-25	1.5
7	0	-10	-15	-15	-10	-8	675	-50	0
8	5	-10	-10	-10	2.5	2.5	650	-35	0
9	10	-20	-20	-20	-10	-10	600	-20	0
10	0	-15	-15	-15	-17.5	-17.5	580	-35	0
11	0	0	-17.5	-17.5	-12.5	-12.5	600	-40	-3
12	0	-10	-12.5	-12.5	-12.5	-12.5	625	-30	-2.5
13	7.5	-15	-15	-15	-10	-12.5	575	-27.5	0
14	0	-15	-22.5	-22.5	-10	-7.5	550	-20	0
15	0	-12.5	-12.5	-10	-10	-3	600	-25	-2.5
16	0	10	20	15	20	20	800	0	5
17	5	5	-5	7.5	5	5	787.5	-7.5	4
18	10	-20	-25	-20	-10	0	700	-20	-5
19	0	5	-15	-15	-10	10	850	-25	-5
20	7.5	-25	-25	-22.5	-25	15	650	-25	5
21	5	0	15	10	-10	-7.5	680	-15	0
22	0	0	0	0	-17.5	-10	650	-25	0
23	7.5	5	-20	-17.5	-15	-10	625	-25	-5
Mean	3.409	-8.636	-11.932	-11.250	-7.614	-3.682	653.068	-24.318	-0.455
Median	0	-10	-15	-15	-10	-7.5	637.5	-25	0
Mode	0	0	-25	-15	-10	-10	650	-25	0
SD	4.049	10.683	12.148	11.306	10.814	9.999	102.237	10.806	2.815

The results (see Table 3.12) clearly indicate significant differences in the perceived impacts of three scenarios. Therefore, the hypothesis H1 was accepted.

a) Cane price:

There are large cane price effects across the three policy reform scenarios. Averaging across all of the stakeholder estimates, the cane price is highest under the protectionism scenario followed by government proposal and libertarian scenarios, respectively. However, cane prices under all three scenarios were expected to be lower than a 10-years term average price (MY2009/10-MY2018/19) (see Appendix D), decreasing by 9.85% (protectionism), 23.16% (government proposal), and 30.84% (libertarian), respectively.

b) Cane and sugar production:

Based on the consultation estimates, the volume of cane would grow by 3.27% compared to the base year under protectionism scenario. Government proposal and libertarian scenarios, on the other hand, would negatively impact on cane production, as production volumes were projected to decline approximately by 6.61% under government proposal scenario and 11.93% under libertarian scenario from the record production of 130.97 million tonnes in MY2018/19 due to lower price effects.

Sugar production was projected to follow largely the same directional trends as forecast for cane. Therefore, sugar production was expected to decrease approximately 11% and 7% under libertarian and government proposal scenarios, respectively, from the MY2018/19 due mainly to reduced cane production. Based on the interview results, sugar production was expected to increase negligibly under protectionism scenario due to expected slight increase in cane production.

c) Domestic sugar price:

The interviews and quantitative estimation results are consistent that there will be a negative effect of these policy changes on domestic sugar price. The current temporary deregulation of domestic sugar price controls and elimination of special 5 baht/kg tax on domestic sugar sales would reduce domestic sugar prices. However, by taking the changes on other policy measures

into consideration simultaneously, implementing each policy scenario would generate wide-ranging negative price effects.

The removal of all market interventions in trade and production, as well as consumption distortions, as assumed under the libertarian scenario, would have large domestic price effects. Based on the quantitative estimates of stakeholders, domestic sugar price was projected to fall close to the world sugar price. Compared to a 10-years term average price (MY2009/10-MY2018/19) (see Appendix D), domestic sugar price under libertarian scenario would decrease to approximately 17 baht/kg with an estimated 24.32% reduction on average. Implementing the government proposal and protectionism scenarios, by following the suggested actions (see Section 3.3.1.2.2) given by respondents during the interviews, would prevent domestic price falls due to expected minimal decrease in prices from both scenarios compared to a 10-years term average price (MY2009/10-MY2018/19), the domestic sugar price under the government proposal and protectionism scenarios were forecasted at 21.11 baht/kg (-8.22%) and 22.22 baht/kg (-3.30%), respectively.

d) Trade:

A high number of respondents indicated that any kind of policy reform was likely to have no impact on sugar imported to Thailand compared to base year where imports were expected to remain marginal, with zero percent changes projected by half of respondents for libertarian scenario and over 17 out of 22 respondents for government proposal plan and protectionism scenarios (reasons are explained previously in Section 3.3.1.2.5)

Based on estimation by respondents, the removal of all production support and market interventions, trade and domestic consumption distortions under the libertarian scenario was likely to result in a small increase in sugar imports, at an average of 3 percent. In contrast, by applying the 1.5x IQR rule to all market signals, supply and trade indicators in order to determine outliers from the quantitative dataset, the results clearly demonstrated that any numerical values apart from 0 which indicated “no change/ zero percent change” on imports were detected as outliers and so were removed from government proposal and protectionism scenarios’ datasets. Hence, the findings revealed that there will be no sugar imported into Thailand, as imports were expected to remain marginal from pursuing either these two scenarios due to the huge surplus of domestic sugar supplies over domestic demand and other comparative advantages highlighted previously by policy-actors in section.

On average, sugar exports will likely decrease by 8.6% and 4.9% under libertarian and government proposal scenarios respectively, due to a significant expected decline in cane and sugar production. On the other hand, the protectionist scenario could result in a minimal 2-percent increase by average from based year if cane price could recover to roughly 850 bath/ton in accordance with the estimation. Nonetheless, despite the protectionism scenario presenting the least policy changes, i.e. the scenario attempts to retain many of the policy instruments of the old regime, pursuing this approach would still not stimulate export growth, as 9 respondents highlighted that exports would remain at the same level.

e) Domestic sugar supply:

The results from a quantitative analysis of stakeholder estimates, after identifying outliers with the 1.5x IRQ rule, indicated no change in terms on domestic sugar supply under the government proposal and protectionism scenario. These findings were consistent with both qualitative and quantitative sugar imports results as sugar imports were expected to remain marginal where there will be no sugar imported into Thailand due to significant excess domestic sugar supplies and other comparative advantages. Conversely, domestic sugar supply was expected to decline by 1.26% on average due to small effect from an expected slight increase in sugar imports under the libertarian scenario, assuming trade was fully liberalised.

Table 3.12 Results on market signals and trade based on difference in the perceived impacts of three scenarios

Market information- Based year 2018/19 (*MT=Million metric tons) (Source: OCSB,2019)

Import volume (Metric ton)	Export volume (MT)	Cane production volume (MT)	Sugar production volume (MT)	Cane farmer income - system income (Baht)	Sugar miler income - system revenue (Baht)	Cane price (Baht/Metric ton)	Domestic sugar price (Bath/Kg)	Domestic sugar supply (MT)
240.68	11.04	130.97	14.57	91,679,000,000.00	115,407,647,814.44	700	22.98	2.6

Market signals: Libertarian scenario

Statistics	Import volume (%)	Export volume (%)	Cane production volume (%)	Sugar production volume (%)	Cane farmer income (%)	Sugar miler income (%)	Cane price (Baht/metric ton)	Domestic sugar price (%)	Domestic sugar supply (%)
Average	3.41	-8.64	-11.93	-11.25	-7.61	-3.68	653.07	-24.32	-1.26
Median	0	-10	-15	-15	-10	-7.50	637.50	-25	0
Mode	0	0	-25	-15	-10	-10	650	-25	0
SD	4.05	10.68	12.15	11.31	10.81	10	102.24	10.81	2.04

Market signals: Government Proposal scenario

Statistics	Import volume (%)	Export volume (%)	Cane production volume (%)	Sugar production volume (%)	Cane farmer income (%)	Sugar miler income (%)	Cane price (Baht/metric ton)	Domestic sugar price (%)	Domestic sugar supply (%)
Average	0	-4.89	-6.61	-7.30	-6.77	-5.41	725.68	-8.22	0
Median	0	-5	-6.25	-6.25	-10	-8.75	700	-10	0
Mode	0	-10	-20	0	-15	-10	650	0	0
SD	0	10.19	12.11	10.08	10.43	8.94	80.27	6.69	0

Market signals: Protectionism scenario

Statistics	Import volume (%)	Export volume (%)	Cane production volume (%)	Sugar production volume (%)	Cane farmer income (%)	Sugar miler income (%)	Cane price (Baht/metric ton)	Domestic sugar price (%)	Domestic sugar supply (%)
Average	0	2.41	3.27	1.50	5.23	5.34	851.36	-3.30	0
Median	0	5	4	0	5	5	850	0	0
Mode	0	0	0	0	5	5	850	0	0
SD	0	5.75	8.35	7.30	8.16	7.99	83.84	5.20	0

3.4 Discussion

3.4.1 Policy elements of the three scenarios

Overall, the findings revealed that the vast majority of stakeholders were well-disposed to the reform at the present time. However, in the evaluation at the policy instrument level, the current study found that the policy instruments in view were classified into two groups. First, while most stakeholders agreed that reform was needed, there was a group of policies that stakeholders were not prepared to see removed because they were deemed essential to the well-being of the sector, therefore, needing to be in place regardless of the scenarios. These policy instruments are considered as the non- distinguishing policy elements of the three scenarios. These policy elements were deemed as the most essential, therefore, needing to be in place regardless of the scenarios. The results of the analysis of this set of policy elements are discussed in Section 3.4.1.1

The second set of instruments are not so essential and so they appear only under certain circumstances, for example when a scenario calls for more protectionism. Some of these instruments occur under pairs of scenarios for example the ‘protectionism’ scenario sharing a policy instrument with ‘government proposal plan’ scenario.

The most obvious finding to emerge from the analysis was that those policy elements appearing under the libertarian scenario alone, or which are shared with the ‘libertarian’ and ‘government proposal’ scenarios, were very unlikely to be implemented in the context of Thai cane and sugar sector. This finding implies that, the protectionist scenario is the most favourable policy option of all distinguishing policy instruments where the rationale behind this assumption is discussed in Section 3.4.1.2

3.4.1.1 Policy instruments deployed under all scenarios

3.4.1.1.1 Credit Policy: cheap loans at low interest rates to producers

The results for policy consultation found that social-economic status is low for most Thai cane farmers. Financial resource insufficiency has been a significant barrier to obtaining loans from commercial banks for majority small-scaled farmers because of their poor financial credit history, insufficient reliability and uncertainties that this causes about their ability to make loan repayments. As noted by Meyer (2011), lenders such as commercial banks may attempt to mitigate the risks by charging higher interest rates, or lending only to farmers with proven track record of repayment etc. However, these strategies limit the scope of the sector to develop and

often shut out the poorest farmers who are the frequent concern of policy makers. With little ability to access financial support, it is extremely difficult for these businesses to stimulate increases in farm productivity, especially under the present conditions where farmers are hard-hit by higher input prices and a significant drop in cane price. The stakeholders believe, in accordance with Isvilanonda and Bunyasiri (2009), that the soft loan scheme is the instrument of choice to tackle the finance access issue. The stakeholders agreed that this farm support instrument must be retained under any of the policy reform approaches, and should be the last to be removed under any drive to libertarianism. The finding is consistent with that of Zamroni (2006) who emphasizes that the Thai government has to provide an open and easy access soft loan scheme to ensure that cash is available to facilitate the cultivation process and to acquire key operating inputs such as fertilisers and machinery. Zamroni (2006) also points out that the Thai government must provide this soft loan support to help prepare and empower Thai farmers to make necessary changes prior to any future liberalisation of the farming sector.

Policy stakeholders justified the maintenance of the soft loan policy instrument, which is provided by the Thai agricultural development bank, known as the Thai Bank of Agriculture and Agricultural Cooperatives (BAAC), on the grounds that it is permissible without infringing on the ‘subsidiarity principle related to financial services’⁹ allowable under WTO law or normative standards. This may be explained by the fact that, unlike many agricultural development banks, the BAAC is not state owned or funded by international donor agencies, is operated on the commercial basis and funded entirely from deposits by Thai public commercial banks and agricultural cooperatives. According to Seibel (2000) and Meyer (2011), the BAAC in Thailand, together with the Bank Rakyat Indonesia (BRI), are the only two agricultural development banks in existence that have successfully achieved operational autonomy, i.e. are free from political interference. Seibel (2000) makes the point that since the reforms of the BAAC in 1975, the bank has been able to increase its savings mobilisation to the point where rural deposits have become

⁹ The Annex on financial services under the WTO agreement states that a financial service offered by a financial service supplier, such as monetary authority or public entity, including banking and other financial services (excluding insurance), can be applied in pursuit of micro- and macro-prudential monetary policies. These financial services include activities such as acceptance of deposits and other repayable funds from the public and lending credit. Other market-friendly subsidies through specialised agricultural development banks, where governments make fundamental changes in ownership, governance, products, and perhaps even the clientele served should be allowed in case of Thailand because Thailand has not changed its GATS commitments since its previous review.

the key source of its funds. Although Meyer (2011) also cautions that in spite of the BAAC reforms in 1975, although a licensed financial institution it is still not a full-service commercial bank. This is because it has been subjected to controlled interest rates by the government. However, Meyer demonstrates that despite some government controls, the BAAC has operated with relatively modest subsidies and been able to maintain a somewhat successful firewall against the most distortionary governmental initiatives. Most importantly, today, the BAAC is able to serve the very poor Thai farmers who form the majority of the population.

In addition to the structure of the BAAC, a source of this cheap loans which is clarified above, another important finding was that that soft loans from the BAAC are made through a financial intermediaries, either through the Office of Cane and Sugar Funds (OCSF) or the Office of Cane and Sugar Board (OCSB). The policy consultation revealed that which financial intermediary is mediating depends on the purpose of loans. First is cheap loans for other activities apart from purchasing cane cutter which are made through the OCSF, the non-state owned organisation, therefore, should be allowed. The second type of the loans is granted for purchasing cane cutter, which is made through the OCSB (i.e., the government department under the Ministry of Industry), therefore it is questionable whether this complies with the WTO. Since this cheap loans made by the OCSB is for purchasing cane cutter which is part of government provision aiming to cut the percentage of sugar fields being burned in response to air quality dipping below healthy standards, therefore it could be argued that this subsidy should be exempted under the “Green Box- Environment protection”. For the above reasons, policy stakeholders have argued that loans of this kind should not be counted as product-specific amber box subsidies, to be included in Thailand’s AMS calculation. It is reasonable to assume, therefore, that the resolution of the complaint by Brazil will not require the removal of this policy support instrument.

3.4.1.1.2 70:30 Revenue-sharing system and cane price setting

Emphasized by stakeholders as the ‘core strength’ of the sector, the idea of terminating the revenue-sharing system between farmers and miller, to achieve WTO compliance was resisted. The most obvious finding to emerge from analysis is that this revenue-sharing system is seen as personal relationship between farmers and millers and not considered as a matter of public law because these proportionate shares were established under an agreed revenue-sharing formula (70:30) which was arrived at these proportions through a fair decision-process involved both parties. The finding suggested that there is no state mandate or intervention involved in arriving at the terms of the agreement. Therefore, this mechanism itself does not violate the

WTO's regulations, therefore its allowable status permits its practice in a Thai context. In this regard, the policy consultation emphasise that based on the assessment of the necessity of revenue-sharing system, this policy instrument can be continued under all scenarios. These importance and value of the revenue-sharing agreement is recognised by a number of scholars, who see it as providing effective incentives to all parties and motivation to improve efficiency and increase work productivity where all parties must work as a unified system (Arani et al., 2016, Tsay, 1999).

A number of previous studies confirm the stakeholder assumption that the revenue-sharing mechanism not only improves performance and productivity but also improves both parties' profit, ensures profit distribution and stabilizes gross margins among members, creating a win-win situation for sector participants (Cui et al., 2020, Song and Gao, 2018, Van der Veen and Venugopal, 2005). The stakeholder concept of cane farmer-miller relationship is conformed by Ramsay (1987) who highlighted that the use of this mechanism has been very successful in solving prolonged conflict between Thai cane producers and sugar millers over the prices of cane and fair income distribution. Under this mechanism, instead of trying to negotiate cane price at the beginning of the crushing season when neither party knows with any certainty how sugar prices will respond to supply volumes, both parties agree to share the revenue, whatever the price. As a result of reducing the risk of fluctuations in cane price paid by millers, sugar millers themselves benefiting from stable gross profit as they are able to manage cost better and obtain security of supply of cane (Chuasawan, 2018, Ramsay, 1987). In consistent with Doner and Ramsay (2004) , stakeholders point out that Cane itself differ from other crops because storage life of cane is very short by its nature. Therefore, it must be brought to manufacturing process as soon as is cut due to rapid spoilage rate. The most evident challenge appears particularly in the situation when the world sugar prices drop. As a result, without this system, some millers may decide to cut their production if their production costs lie above the world sugar price which could leave surplus of cane, as it would not be brought to refining process. In consequence, vast majority of cane farmers would be directly affected especially when they are numerous, with over 430,000 cane farming households while there are only a few numbers of sugar millers. Thence, to keep their sugar business running, eventually millers will begin to cut the cane price to lower their production costs while cane farmers would have just been "price taker" of price set by millers.

Moreover, the results also revealed that, without stable revenue sharing mechanism, cane purchases by each miller will be at different prices. This will disturb cane distributing system which is now well-managed and create a loss to cane and sugar value. This can partly be

explained by the fact that farmers would desire to deliver their cane to millers who offer higher price regardless of distances between farm to mill, resulting in loss in sugar content. The sweetness loss reflects lower revenue for millers and lower cane price consequently. Hence, this study found that the idea of terminating this mechanism is hardly accepted particularly since the system has been used for long period of time, both parties involved are also well acquainted with the system. Giving the consideration to solve the conflict between farmers and sugar millers, the revenue-sharing system has also been practiced in many other sugar sectors such as the USA, Australia, Mexico, India, South Africa, and Philippines (Larson and Borrell, 2001).

3.4.1.1.3 Change to the legislative definition of ‘Sugar’ in the Act

Another interesting observation made by stakeholders is the necessity of amending the Cane and Sugar Act of 1984, to remove the restriction which prohibits the use of cane and cane syrup for any uses other than sugar production, because it blocks opportunities for millers to expand through diversification into other high-value production lines such as ethanol and bio-chemical products. Kanjanavisut (2019) suggests that in this fast-growing technology era, the introduction of a range of alternative value-added products from cane and the downstream industries (i.e. sugar-bioproducts, biomass-fueled electricity, and chemicals and substrate material for consumer products) would help alleviate the current downward pressure on the cane price, while adding stability through increased domestic demand for cane. This therefore represents it a prime opportunity for the Thai cane and sugar industry to diversify, for sustainable increases in profitability and competitiveness. Chitaroon (2019) reflects that cane has far greater diversification potential than other crops grown in Thailand due to both the versatility of its by-physical components and its very high gross yield. To illustrate, from 12 million hectares planted rice delivers approximately 70 million tons of rice into manufacturing process, while just 1.6 million hectares of cane delivers over 100 million tons of cane into the manufacturing process each year (Chitaroon, 2019). In addition, its by-products are much easier to be transformed to produce a wide range of new end-products than other plants.

3.4.1.1.4 Increasing government budgets supporting indirect supports while reducing financial amount for direct support

Stakeholders asserted that government budgets for services supporting the cane sector fall under ‘Green Box’ supports and Development and Food Security Measures categories and so would be compliant with WTO requirements. Stakeholders believed that increasing this type of indirect

support would be essential under any policy scenario that aimed to reduce the amount of government spending on direct supports, a type of support that would be Amber Box at best.

Stakeholders involved in policy formulation embraced, in essence, the reduction of market-based policy instruments providing direct support, while shifting toward more indirect supports and market-oriented programmes. As Thailand has come under pressure to reduce trade-distorting supports that are more directly linked to cane and sugar production, the Thai government has considered various alternative ways to support producers that would offer at least the same degree of protection, but with less distortion of trade. A number of previous studies (Blandford, 2001, Meléndez-Ortiz et al., 2009, Rude, 2001) have advocated switching domestic support measures judged to be most production and international trade distorting and subjected to restriction classified as ‘amber box’ support to allowable forms of support that are considered to have no, or at most, minimal distorting effects and are classified as ‘green-box’ (Annex 2 of the AoA) and the ‘blue-box’ categories (Article 6.5) and policies were made in Article 6.2 which are sometimes called the ‘development box’. Such programmes are exempt from reduction and trade disciplines. The key elements of domestic supports in the WTO terminology which are identified by “Boxes” can be found in Appendix J.

Since the agricultural policy of Thailand has long had a protectionist character, stakeholders embraced the need to expand the number and scope of policies that are not subjected to WTO restrictions and, in parallel, decrease direct payments to producers so that a greater share of subsidy is spent on green box and development measures. Based on consultations regarding government service programmes required for developing the industry’s competitiveness and sustainability, this study found that out of 11 categories of allowable green box measures, currently only three have been pursued in Thailand. These significant categories of Green Box expenditure of Thai cane and sugar sector are general services (Annex 2 Para. 2), payment under environment programme (Annex 2 Para.12), and public stockholding for food security (Annex 2 Para.3). According to the consultations, in terms of provision of general services, investment in scientific research programmes, especially cane breeding programmes, irrigation systems and farm management are sector top priorities, followed by providing agricultural training, extension and advisory services, and upgrading of infrastructure services connected to public utilities including infrastructure works associated with water supply and road and other means of transportation. The result ties well with previous studies wherein most developing countries spend the greater proportion of their Green Box subsidies on general services, whereas a large number of measure types under the heading of Green Box support have not been applied such as income safety-net programmes, structural adjustment assistance provided through resource

retirement programmes and regional assistance programmes in particular (Jha, 2007, Peng, 2007).

3.4.1.1.5 Quota system

In response to a WTO challenge by Brazil directed at Thailand's quota system, the Thai government decided to revoke the sugar quota system. Despite this, stakeholders argued for the need to replace Quota A with a 'sugar reserve' to act as a buffer stock to ensure the availability of sugar supply in the domestic market. Without such a mechanism, many stakeholders pointed out, there was a possibility of sugar shortage in the domestic market, especially when the world sugar price jumped steeply above the domestic price. This would prompt sugar traders to export sugar for greater returns. This event should not be allowed to occur when the country has a huge sugar surplus and is entirely preventable. Sutopo et al. (2008) and Susila and Sinaga (2005) confirm that the world sugar price fluctuates wildly while this cannot be substituted by other products, but it is consumed continuously in a year.

Stakeholders were of the view that securing availability, accessibility and stability of staple foods, such as sugar, for its citizens, should be a top priority for the Thai government, rather than liberating the activities of sugar millers. Such a national reserve scheme, stakeholders argue, should have no, or at most minimal, distorting effects on production and trade, since it does not have the effect of providing price support to producers, therefore it is essential and sensible to put such a policy mechanism in place, irrespective of policy scenarios.

This stakeholder belief accords with those of scholars, who assessed the value of adopting the concept of 'buffer stock' and 'food reserve' to deal with food security and volatility (Abbott, 2012, FAO, 2011, IMF and UNCTAD, 2011). According to Díaz-Bonilla (2017) and FAO (2021), the primary objective of a buffer stock is related to price stabilization within the domestic market to avoid excessive volatility not only in times of emergencies linked to climatic or political events, but also over the regular agricultural production cycle. Under this mechanism, government generally establishes a price band i.e. a range of domestic prices government wants to remain within, with the ceiling price aiming to protect domestic consumers from price hikes and the floor price aiming to support producers. However, in practice, the use of this buffer stock mechanism can be quite ambiguous and often tends to drift into a form of subsidised price support to producers. Based on findings from policy consultation, to avert such ambiguity, policy stakeholders argue that government full authority for domestic price setting and stock distribution should be transferred from government to a private authority, for example

development of collusion agreements between millers to set the domestic price to achieve price stabilisation and public support for commercial storage.

The stakeholders argue that in practical terms there is no meaningful difference between the sugar-volume management system proposed by the Thai government and that defined by the pre-reform policy. Neither, it is argued, will have much impact on sugar trade. Stakeholders were also of the view that the reformed sugar buffer acts in accordance with WTO rules as its purpose is ensuring internal food security. This is consistent with what has been found in WTO document (Agreement on Agriculture, 1867 U.N.T.S. 410) and previous study by Timmer (2010), simplifying that holding of buffer stocks for internal food security purposes qualifies as a WTO Green Box measure in the case of developing countries' special treatment. From the WTO's frame, this stockholding programme in relation to the provision of domestic food aid to sections of population in need is exempt from reduction commitments, thus given the "green light" going forward (Agreement on Agriculture, 1867 U.N.T.S. 410)

In addition to securing domestic consumers' benefits, stakeholders also noted that ensuring the survival of all millers has always been a key goal of the Thai government, since it also impacts the viability of the farmers they serve and the future of Thai cane and sugar section more broadly. With respect to this focal point, sugar volume allocation for each mill supplying to the domestic market is another dimension that must be discussed in relation to the new sugar reserve approach. Stakeholders argued that the sugar volume allocation to each miller must be retained as its purpose is creating internal balance and assuring a fair market share across all millers. The importance of retaining this measure is to protect smaller-scaled millers from being disadvantaged due to their lower efficiency compared to dominant millers. To ensure that this mechanism allocating sugar volume to millers is acceptable under WTO requirements, it is considered essential that it is not operated by government, but rather by private sugar miller's corporation institution known as Thai Sugar Miller Corporation Limited (TSMC).

3.4.1.2 Policy elements that vary between scenarios

3.4.1.2.1 Domestic sugar price measures (Domestic pricing and 5 baht/kg tax on domestic sugar sale collection into the OCSF to fund revenue transfer from domestic consumers to producers)

While it is made explicitly clear by stakeholders that some form of domestic sugar volume management mechanism must be retained, the domestic price control system, known as a 'home price scheme' must be terminated, to allow the domestic sugar price to float, even though this

might be an unpopular move, with certain disadvantages. This is essential to settle Brazil's WTO challenge.

Stakeholders indicated that full domestic sugar price floatation, i.e. solely determined by the market, would generate fierce price competition between sugar millers. Joskow and Klevorick (1979) show that this would likely result in creating an unfair market advantage, i.e. monopolistic behaviour in the domestic market, due to significant productivity difference between firms. Only the largest and most competitive millers, particularly the Mith-Pol group, will benefit and survive, while the smaller and less -competitive firms, who constitute the majority, are likely to struggle under this condition. With much lower production costs, there is possibility that a dominant firm will develop a 'predatory' pricing strategy in the internal sugar market by drastically reduce their sugar price below their competitors in order to increase domestic market share (Funk and Jaag, 2018, OECD, 1989).

To prevent abuse of market power and unnecessarily destructive competition, the stakeholders suggested adoption of a non-governmental, enforced-domestic sugar pricing model, with publicly available terms, where the selling price of all millers should lie within a given range, rather than being allowed to float freely. Here, policy-based stakeholders appear to be seeking an outcome that is as close to pre-reform pricing conditions as possible, while still being in line with the WTO requirements. Such an option is effectively a transfer of the former role of government to a coalition of sugar millers where millers must agree to set domestic sugar price in the same way that government did pre-reform. As a result, the industry would still be able to secure the same amount of funding collected into the OCSF and to continue its scheme providing financial support to cane and sugar producers. These collusive pricing agreements would involve explicit cooperation between all millers, through agreement and private communication. According to Bolotova et al. (2008) and Porter (2005), this action can be undertaken where firms produced homogeneous products, as in the case of sugar. A study of the Sugar Institute in the USA by Genesove and Mullin (2001) is insightful in this regard. They found that the establishment of explicit collusive business practices employed by the Sugar Institute was achieved through this coordination mechanism among the US sugar-refining cartel where communication among all firms played a major role in this achievement.

As in the case of the Sugar Institute in the USA, the aim of adopting this practice in Thai sugar context, as advocated by the stakeholders, would be to prevent discriminatory pricing and price war as exercise of market power. According to Porter (1983), price war is often likely to occur during the economic downturns and in the presence of economic volatility which is much like the Thai current circumstance, especially if no pricing mechanism exists. In this regard, a number

of studies (Harrington, 2005, Porter, 1983, Porter, 2005, Stigler, 1964) suggest that forming collusive agreements where all firms within the industry act in collaboration to determine pricing policies, would help cartels to regain their stability and retain both their market share and profitability.

However, empirical findings in this area to date suggest that price collusion was sometimes problematic, owing to the issues of the illegal nature of collusion and the impact on consumers due to potentially undesirable rises in price (Connor and Lande, 2012, Zhang and Round, 2011). Therefore, if price collusion cannot be shown to be both legal in law and lead to significant net societal benefit, it might not be an appropriate solution. Under the Trade Competition Act B.E. 2560 (2017), price agreements in Thailand are not totally illegal, depending on the original guiding principle and ultimate goal of this type of price arrangement and how it affects market outcomes. Therefore, such an arrangement might indeed be possible under Thai law. In the judgment of the author, the collusion scheme would act in a complementary way to the pre-reform price fixing mechanism which aimed to make the sugar price more transparent and eliminate discriminatory pricing raised by dominant millers, while domestic consumers' interests would still be protected. Such an approach would be in line with the key provision of the Trade Competition Act B.E. 2560 (2017) which aims to prevent abuse of market power by a dominant player which may result in monopoly and practices which do not reflect free and fair competition (Office of the Council of State, 2017). Negative impact on domestic consumers is a concern often raised about explicit price fixing. However, stakeholders believed that Thai sugar market is an exceptional case. The Thai domestic sugar price has historically been cheaper than other countries even under the former policy regime where domestic prices were artificially fixed. If the domestic price is fully floated without establishing a price collusion mechanism, the most obvious problem to result would be the possibility of internal sugar shortages when the world sugar prices rise and millers export large volumes of sugar otherwise destined for the domestic market to generate higher revenue.

Ideally, this thesis demonstrates the efficacy of such an activity under the Thai condition, so this approach seem to be most sensible and desirable to the current context. Implement price collusive agreement is apparent not drastic as is often alleged particularly in the Thailand case as it ensures the social benefits and well-being of all Thai stakeholders while the risk of price volatility is also prevented.

3.4.1.2.2 Cane (producer) price support programme

The Office of Cane and Sugar Fund (OCSF) was responsible for compensating millers for any overpayments. Stakeholders did accept that not all of the outcomes of this mechanism were beneficial. This 'unique' arrangement reduces the level of market risk to producers considerably and is seen as a major driver to cane farmers to expand their production and could attract other crop farmers to switch to cane farming regardless of their level of productivity. Meriot (2015) argued that recent increases in production volume seen in Thailand are basically the result of an increase of cane cultivating area, and not a consequence of productivity gains.

Notwithstanding mixed opinions generated regarding this cane price support programme, Stakeholders were of the view that it would be a mistake to terminate the support mechanism even with the possibility of replacing it with a new measure, such as guaranteeing a minimum price above producer costs. This mechanism was suggested as the most influential in preventing a collapse of the industry. There were no alternatives, it was felt that would have the same effect of reducing price risk.

Concerns about this mechanism raised by Brazil, i.e., that overpayments made to millers amount to state aid does not stand up to scrutiny. The OCSB data (see Appendix D) shows the development of cane prices and the difference between preliminary price and final price. It can be seen that overpayments have been irregular and are not the norm. For this exceptional event, the compensation used to offset this loss is entirely provided by the Office of Cane and Sugar Fund (OCSF), and so is not a state subsidy. Despite resembling a price guarantee measure, the mechanism has never been operated by the state (not a state aid), so it is not subject to WTO constraints and so can, and must, be retained.

3.4.1.2.3 Cane farmer income support through direct payments

In 2013 the Thai government introduced an income support mechanism for cane farmers by authorizing additional direct payments known as top-up cane payments, i.e. a supplement totaling 160 baht (US\$5.3) per tonne of cane. This was prompted by weak domestic cane prices, resulting from a low global sugar price at that time. However, this direct payment programme has been continued since then, regardless the world price trend. However, due to the WTO complaint filed by Brazil, the Thai government decided to discontinue the top-up cane payments where the last payments were provided in MY2017/18 due to deregulation of Thai sugar market.

Stakeholders felt that the original intention of the mechanism was fine, but the mechanism became problematic when it was continued when prices improved. This changed the nature of the policy instrument from one of protection from market downturns to constant support at stable and fixed amounts regardless of on-farm decisions and the state of social-economic parameters. As has been found with similar schemes in the EU (Defra, 2018a, Defra, 2018b), this scheme was likely to inhibit efficiency and productivity growth in the sector and could detain farmers beginning to adapt to market conditions, particularly when their income is also protected by other support measures such as the revenue-sharing system and cane price support programme discussed earlier. Several studies have shown that direct income support protected farms that are not viable by themselves and stopped them from exiting farming, thereby slowing down structural reform, and creating economic distortions (Adams et al., 2001, Chau and de Gorter, 2000, GAO, 2012). While beneficial in strictly economic terms, this restructuring would be problematic in the Thai context. Where the majority of cane farmers are rural poor, with the lowest household incomes. For this reason alone, many argue for retaining the direct payment programme. This support provides basic income supplement to those who are struggling to support their farm households particularly in the current situation where industry faces huge negative impacts from policy reforms. Some researchers, for example Chang (2009) and Volkov et al. (2019) argue that direct payments are necessary in such circumstances particularly when imbalance still exists in order to protect employment, keep small rural farmers in business, and improve social-economic sustainability of small farms.

Stakeholders concluded the reform of direct payment supports undertaken so far will not change the fundamental structure of the direct payment system. The results show that the furthest degree of libertarianism of this policy instrument that the Thai government is likely to go on, and in fact have implemented is to rebrand the previous top-up payment to cane revenue for indirect support for inputs. Despite the lower levels of support compared to the cane price top-up scheme, this new direct payment programme would still be provided at a flat rate based on output volume, without any limitations. The stakeholders found no evidence of any preferential direction of this support to the poorest and least profitable producers. It is very likely to introduce distortionary incentive to large-scaled farmers who are best placed to cope with loss of this support. These findings are also consistent with Kang and Kim (2008) and Thurston (2008), as direct payment support is directly proportional to the size of cane production volume, such that that farmers who have small size of farm and output could not receive sufficient money while larger farmers who are more efficient than others receive bigger volume of financial injections, suggesting that this type of direct payment is unbalanced, favouring larger farmers who are already closest to the efficiency frontier and likely to make the rich become richer. This is contrary to the basic need

for the principle of income support (Jongeneel and Silvis, 2018). As long as the direct payments are paid without constraints, it is evident that that new approach is still flawed and unlikely to reduce income disparities among different farm group and unlikely to create better allocation of direct payment. The case of the U.S. Farm Bill is a relevant example of facing the targeting issue and lack of effectiveness of the direct payment programme to farmers. According to GAO (2012) Direct payments under the U.S. Farm Bill do not appropriately distribute benefits consistent with contemporary assessments of need i.e. the benefits are concentrated among the largest farmers based on farm areas where over 70% of total direct payments were provided to the top 25% of receivers.

3.4.1.2.4 Sugar import regulations

Consistent with the findings of Chuasuwan (2018), the stakeholders view was that removing import restrictions to any extent would either result in slight or no change to the level of sugar imported and will likely to have no significant impacts on domestic players. This due to several local advantage attributes including: (1) location advantage (2) massive sugar oversupply in Thailand, (3) domestic sugar price that is considered cheaper than other countries, and (4) long travel distance for imports, leading to high transportation costs. Chuasuwan (2018) recognises that Thailand is centrally located close to the major sugar markets with high levels of regional demand for Thai sugar exports, particularly from China, Indonesia, and Japan, so transportation costs are lower compared to some other net-exporter countries, such as Brazil. Moreover, the cost of Thai sugar production is relatively low, second only to Brazil which does not compete with Thailand in the same region.

To determine the degree of trade liberalisation Thailand should adopt, it is essential to take the grounds for choosing liberalisation into consideration. In perfect world, complete global trade liberalisation would result in economic growth, efficient allocation of resources, and poverty alleviation at the global level. In the real world, complete trade openness still remains moribund, with very few precedents. To date, no country has completed a transformation to a free market where imports of certain products are freely allowed because at least some measure of protectionism always exists. Moreover, there is a universal acceptance that gains from trade liberalisation will not be distributed equally among countries because of differences in size and level of economic development. This due to the fact that a string of microeconomic factors, specialization patterns and comparative advantage of countries are not uniform (Schneider and Kernohan, 2006, Valdes, 1991). Due to these reasons (i.e. unequal distribution of gains from full

liberalisation owing to the differences in size, level of economic development, microeconomic factors), stakeholders believed that Thailand's own liberalisation (unilateral trade liberalisation) is clearly not an option due to the unequal position of sugar sectors among the countries. The opposition to import liberalisation in Thailand is strong in several agricultural industries, particularly in the case of sugar (Warr and Kohpaiboon, 2007). According to Talukder (2013), the abolition of sugar price control would decrease sugar production by 30%, which would bring the industry to the self-sufficiency level. Nevertheless, there would be much greater negative effect on domestic production if import restrictions are terminated alongside the abolition of sugar price controls. Warr (2009) found that unilateral trade liberalisation within Thailand would worsen the course of economic development and raise inequality and poverty incidences among farm households in the post-liberalisation era. Therefore, some measures and instruments for import regulation must be retained. This view is reflected in both the 'government proposal' and 'protectionism' scenarios, where Thailand would keep the existing sugar trade policy instruments. However, certain conditions must be met in order for policies to remain consistent with the international obligations. Consistent with NaRanong (2000), these stakeholder views are found that the Thai government should rely on existing multilateral (with WTO members and AEC members) and bilateral (with Australia) trade negotiations to deal with trade and border protection for sugar. In Fergusson (2011), these types of trade negotiations are described as a sectoral tariff approach. Through these trading arrangements, this strategy of limiting imports is seen as part of defensive protectionism, where some rules and protectionist mechanisms are imposed. For imports from the WTO members, a two-tiered tariff rate quotas (TRQ) system is used. According to Burfisher (2001), even though the TRQ is a simple tariff measure that contains a quota, it is not considered as a quantitative restriction since it is always possible for country to import over the quota. However, in reality, if the above-quota tariff rate is set high enough, it could discourage further imports, effectively acting as a binding quota. However, in practice, currently, there is no simple best way and no alternative to reforming the TRQ's (Skully, 2001). For Sugar imports from AEC members, sugar imports can enter Thailand duty free under the multilateral free trade agreement (FTA) except in the cases of Indonesia, Philippines and Myanmar (USDA Foreign Agricultural Service, 2019). Simultaneously, sugar imports from Australia will be duty free with no quantitative limits in 2021 under the bilateral trade agreement (Meriot, 2015). Since Thailand has achieved a "zero-for-zero" agreement on sugar with several countries, this reflects a positive sign of at least partially successful bilateral and multilateral approaches. However, sugar imports from other countries outside the trade agreements are still require permits and face tariff protection regarding imports with a specific duty for sugar of \$ 107 per tonne for beet or cane sugar.

In harmony with Warr (2009), within Thailand, it is likely that the prospects for furthering trade liberalisation are not encouraging unless it takes place through bilateral or multilateral trading arrangement such as the schemes the currently in use whereas the chance of full removal of all import protection measures is clearly improbable.

3.4.2 The anticipated impact of policy reform scenarios on prices, supply, market signals, and trade

This study also set out with the aim of assessing how policy makers think each policy scenario would impact on supply, market signals, and trade. Stakeholders believed, compared to market information in base year (2018/2019), as anticipated, that the ‘libertarian’ scenario is likely to be the most extreme, i.e. resulting in the most significant negative impacts in all areas, followed by the government proposal scenario. These results are broadly consistent with projections made by OECD (2007) and Talukder (2013) concerning direction of impacts on production, although the degree of impacts estimated by Thai policy makers in this study are considerable smaller. To illustrate, the overall level of net change in cane and sugar production under the libertarian scenario were estimated by stakeholders as approximately - 11% and -7% under the government proposal scenario. These values are considerably smaller levels than those projected by Talukder (2013) who estimated that Thai cane and sugar production would drop by 30% if domestic price control were to be removed, but the net change would be even larger if trade barriers were also eliminated. Similarly, OECD (2007) suggested that, with the removal of the pricing pooling arrangement through quota restrictions on domestic market supplies and import restrictions, internal cane and sugar prices in Thailand would drop, reducing the size of cane production and, in turn sugar production by an estimated 21% and that sugar exports would also decrease by 30%. due to lower production.

Surprisingly, the consultation revealed that policy makers believed that the protectionism scenario, if implemented, would be the only approach that could possibly result positive outcomes, i.e. a slight increase in sugar exports, cane and sugar production, and both farm and miller incomes, while causing minimal impacts on cane and domestic sugar prices compared to the other scenarios. However, these forecast positive outcomes were not supported by the results of the survey of cane growers, undertaken later in this study. The farm survey results suggest that despite being the least extreme scenario, the protectionism scenario would still be likely to result in net negative impacts on cane production, i.e. reduced cane production volumes and sugar exports. This rather contradictory result may be due to the higher cane price

projected (by stakeholders) to occur under the protectionism scenario (850 Baht/ tonne) compared to the base year price (700 Baht/ tonne). It is apparent that policy makers might view that a higher cane price should lead to an increase in cane and sugar production and exports.

These stakeholder consultation results, with respect of projected market signals, supply and exports etc., have important policy implications in themselves, i.e. Thai policy-making stakeholders appear to be underestimating the likely true magnitude of effects of policy reforms. A possible explanation for this might partly be related to the fact that, in the Thai case, policy reform, regardless of approach taken, is unprecedented event. Decisions are therefore being taken in a highly uncertain and complex, environment that the industry has never confronted before, hence policymaking in this type of situation can be extremely challenging and so result in slight misinterpreting the size of consequences. Despite this limitation, this study certainly adds to our understanding of the possible impacts of reform under different types of policy approaches. These issues will be further addressed in later chapters in a form of triangulation that increases the robustness of these conclusions.

3.4.3 The future policy direction for Thai sugar industry based on the account for policy consultations

In accordance with the conclusions of the stakeholders, Phakdeewanich (2004) demonstrates that, regarding its inceptions, cane and sugar policies of Thailand have always been protectionist in character and a set of these policies will be maintained for the foreseeable future, albeit in a slightly modified form. Stakeholders involved in policy formulation were highly supportive and well-disposed to finding opportunities to implement policy options that provide the greatest level of protection and who therefore tended to follow much as the same track as the old regime prior to the reforms. To this group the protectionism scenario is seen as the optimum for the Thai sugar sector at present circumstances. Conversely, ending all government supports represented by the libertarian scenario or imposing any of policy instrument that distinguish the libertarian scenario would be quite damaging and therefore is inadvisable to apply to the present Thai context. Hence, the hypothesis H2 was accepted.

In general, the agricultural liberalisation policy has always been a contentious issue. Despite a number of historic arguments in favour of agricultural policy/trade liberalisation, dating back at least to Adam Smith's era, for example benefits for economic development as the engine of growth (Krugman and Obstfeld, 2009, Staff I.M.F, 2001, Winters, 2004), libertarianism was not viewed as likely to yield these benefits for the Thai sugar sector. Many scholars argue that, in

the context of many developing countries, especially the least developed, agricultural liberalisation has its costs and sometimes could deter the economic development (Bureau et al., 2006, Chang et al., 2009, Fabiosa et al., 2005, Kirkpatrick and Scricciu, 2006, Sally, 2007). The Thai sugar sector is no exception. In line with several literatures on agricultural protections and distortions in Thailand (e.g. Warr, 2008), it is possible that the distinction of historical, cultural and social-economic contexts along with technical difficulties are the significant reasons of Thai government and the stakeholders in this study, preferring agricultural protectionism (Warr, 2008). The cane farming sector in Thailand comprises small-scaled subsistence farmers who are impoverished, resource-poor and poorly educated and have conventional problems such as financing. These constitute over 80 percent of the total farm population while only about 5 percent of farms are considered large-scaled commercial (Sriroth et al., 2016). In this regard, the majority of farmers face difficulties in raising their productivity, which still lags behind the development of industry. Moreover, there are some other factors leading to the need for protectionism such: as unequal position of agriculture compared to other economic activities, initial starting point for any reform process (i.e. very protectionist in the case of Thailand) and level of development attained by the sector (Marković and Marković, 2014, McCorrison et al., 2013, Schneider and Kernohan, 2006).

Despite the push for greater openness, the real task for most developing countries will still be fostering economic development (Lankes, 2005). Consistent with Warr and Kohpaiboon (2007), stakeholders in this study were of the opinion that the impacts of policy reform on the domestic economy are of far greater importance than any impacts on the international market. According to the consultation, it is unsurprising that both the government and study stakeholders define the purpose of the Thai cane and sugar regime as to serve the sector's economic interests and protect the economic interests of small-scaled producers, as well as consumers' welfare, rather than a desire to liberalise agricultural trade to achieve supposed efficiency gains. This would be a typical position for most countries considered low-income with agriculture-based economies. In choosing a set of policy options, it is essential to have a fundamental understanding of the sector situation, where account must be taken of an industry's political power structures (groups and individuals) and of its cultural values and other key factors which constrain policy implementation in developing countries (Powell, 1999).

Given the need for the realization of these goals, like many other countries such as those in the EU, strong economic and social objectives have always been state's prime goal and remain so to this day (Marković and Marković, 2014). According to the data collected, it could be conceived that multiple economic objectives must be set for Thai sugar industry, i.e. the

development of cane and sugar production through increased efficiency, ensuring a fair share of benefits among stakeholders, securing rural farm income from price volatility, and ensuring fair competition among sugar millers. In addition to economic objectives, social objectives include: ensuring local employment, protecting living standards of cane and sugar producers, as well as providing food security and price stabilization to domestic consumers both in terms of sufficient availability and attaining acceptable prices.

The consultation revealed a policymaker view that the majority of producers are likely to oppose the libertarian policy approach and even to some extent the government proposal scenario, as they are likely to contribute greater negative impacts. These findings reflect those of Warr (2008) who makes a clear point that, within Thailand, the opposition to agricultural liberalisation policy is strong in the case of sugar. This observation is likely to be related to the negative effect of liberalisation policy on the producer survival and the established link between sugar millers and cane farmers. According to stakeholders, if domestic support measures were to be abolished, along with import restrictions, only the very strongest and most competitive sugar millers and large-scaled commercial farmers (this being only a small sub-set of the population) would survive and gain benefits from the process due to their much higher economies of scales and higher production efficiency. In contrast, the less-competitive ones are likely to collapse. The crash of some millers reflects the prospects for survival of famers, especially small-scaled farmers in the geographic areas serviced by these millers. These findings are consistent with those of Zamroni (2006), who found that like most small farmers around the world, small-scaled cane farmers will be worse off with this approach. In accordance with Panitchpakdi (2001) and Garmann (2014), it is possible, therefore, that agricultural liberalisation policy could potentially entail unemployment and farm income losses.

Moreover, there is empirical evidence that liberalisation it would cause a transmission of international price volatility into the domestic market, which would lead to greater volatility for both producer' price and consumer' prices (Sekhar, 2004, Yang et al., 2001). Liberalisation of policy would also have adverse impacts on domestic cane production, producer price and income elasticities of cane and sugar products, as well as for food security and social benefits of all stakeholders. For these reasons, this study concurs with earlier observation by Warr (2008), that it is political necessity that the Thai government continue with policy interventions as a means to assure the livelihoods of large sections of the population where removal of these policy protections would threaten the sector's current social and economic position. Political pressure is another key factor the Thai government must, at least in the short term, adopt protectionist policies to the extent that WTO commitments will also. This is because retaining most producer

supports are key components of the election manifesto of the party of government and are significant component of the ‘populist’ economic policy agenda of most governments.

3.4.4 The determination of the scenario descriptions presented to cane farmers and sugar refiners

As described in section 3.2.5, two types of data were obtained from the policy maker consultation: (i) qualitative information related policy settings for each scenario and (ii) quantitative data on anticipated impacts of each scenario on market signals, supply and trade. These results were used to construct the scenario descriptions/settings for later surveys of cane farmers and sugar millers (Chapters 4 and 5).

Table 3.13 presents a summary of the 10 policy instruments used to define each scenario, together with the policy settings determined by policy stakeholders. These policy instrument settings were then used in a second round of policy stakeholder consultation to inform the estimation of anticipated impacts of each scenario on market signals, supply and trade (see Section 3.3.3), with these data also used in the scenario descriptions in Chapter 5. However, estimated cane price were only data obtained from the second round of policy stakeholder consultation used in the scenario descriptions in Chapter 4 due to cognitive burden of interview questions and timeliness of this whole research which there was an overlap between policy consultation and farm survey data collections. In due course, something simple i.e. prices are selected to draw the policy scenario descriptions.

Table 3.13 The summary of the parametisation of policy instruments used to inform and determine the scenario descriptions/settings in farm and miller survey chapters (Chapters 4 and 5)

Policy instruments/Scenarios	Protectionism	Government Proposal	Libertarian
Abolition of quota system	X	✓	✓
Full domestic sugar price float	X	✓	✓
Abolition of revenue-sharing system	X	X	X
Abolition of direct payments	X	X	✓
Abolition of 5 bath/kg (\$6 cent/lb) tax on domestic sugar sale	X	✓	✓
Abolition of cane price support program	X	X	✓
Full abolition of import restrictions	X	X	✓
Abolition of cheap loans and special interest rate	X	X	X
Increase state's budget on in direct supports	✓	✓	✓

3.4.5 Limitations, alternative approaches and quality control

A possible limitation of this approach is the use of market signals production, and trade data elicited from policy makers judgements rather than secondary data such as observational data. This limitation may raise concerns about bias among the stakeholders. For example, some respondents may be those who prepare and implement policy on behalf of elected politicians, or large organisations. Therefore, this approach could lead to artificially favourable judgements for scenarios that were closest to official policy. However, this research allowed participants to answer interviews completely anonymously which many researchers (e.g. Banuri et al. (2019), Lelkes et al. (2012), Ong and Weiss (2000)) have proven to reduce, or even prevent, the effect of response bias in research. Notwithstanding this limitation, this approach of obtaining data from the real-world agents involved in policy formulation, offers valuable insights into the range of different policy scenarios, including an understanding of the possible impacts of such scenarios through the lens of policy experts and policy makers who are actually making such decisions and calculations on behalf of government. By mean of this approach, researcher was able to obtain more accurate critical information and design the scenarios to be technically high-policy relevant in terms of outputs that fit in Thai current context because these policy professionals are, in general, well-equipped to conduct and use policy evidence-based assessment. However, using other possible alternative approaches (e.g. performing some modellings based on secondary data, using influence from past studies and referring to economic theories) in future research may help overcome this limitation but none of these alternatives on its own would deliver as much precision and details as is supported by the selected approach in

this study. In other words, deriving information from multiple sources would be required to achieve similar precise outputs to this study where only single source of data was used.

The trustworthiness of this study was checked by various means to ensure that a high degree of confidence can be placed in: data, interpretation and methods adopted. This process of research quality-test protocols is very significant as the final internal check, allowing researchers to determine whether the findings from the study are accurate, reasonable and logical, and so worthy of consideration by readers (Amankwaa, 2016, Burnard, 1991, Morse and Richards, 2002). Lincoln and Guba (1985) outlined the following as valid trustworthiness criteria in qualitative research methods: credibility, dependability, and confirmability.

a) Credibility

To enhance the credibility of this study, four strategies were employed throughout the research process to ensure that no relevant data have been excluded. The first strategy is checking abstractions against raw data (Lincoln and Guba, 1985), where each transcript was checked against the audio records to ensure that nothing was missed out or mistaken during the transcription.

Second, member checking was used at various stages of data collection and data analysis in order to eliminate researcher bias during process of the study: (1) at the interview pilot stage, the researcher discussed the interview structure and topics/questions with participants at the end of interview session to allow participants to suggest changes of some topics that might have been misreported and unclear; (2) in an informal post-interview session with some participants, interpreted data was sent back to participants for review. In this case, the researcher had a chance to discuss findings with participants to determine whether the interpretation matched with what they actually intended to say and allow them to provide feedback on their own interview transcripts. Lastly, a peer debriefing with the researcher's supervisors was used to confirm the interpretation of results and coding decisions, where qualified supervisors reviewed whether the researcher had missed key points and or overemphasized minor ones.

b) Dependability

According to Bitsch (2005), dependability refers to the stability of qualitative findings over time. In order to confirm the dependability of the research outputs, peer examination was established.

Despite the similarity with respondent checks on the interpretation of their inputs employed to increase study's credibility, using peer examination allowed the researcher to discuss the research process, interpretation, and findings, with her research supervisors who have profound experience of qualitative research, giving deeper reflexive analysis of the study. Moreover, according to Neuendorf (2017), attending a relevant training course by researcher is necessary for reliable coding. In this study, the researcher is a graduate student who has attended professional training sessions on the use of: NVivo, managing data and writing up data analysis at the University of Reading in during 2018 and early of 2019.

c) Confirmability

Confirmability captures the extent to which research processes deployed in a study can be confirmed, followed and replicated by others who review the research results (Baxter and Eyles, 1997, Bradley, 1993). Therefore, evaluating confirmability is a very significant part of ensuring the quality of this study, as it refers to the objectivity of data. Here the researcher must ensure that the findings and an inquiry are consistent. Peer-debriefing sessions and respondent checks used to confirm the study's credibility were also used to achieve confirmability in this study. In addition to these strategies, the researcher had opportunities to present some of the study findings at international research conferences, in order to receive some feedback to confirm that the research data methods, data analysis and findings emerged are accepted by other researchers.

Most importantly, this study as well as the other two studies presented in this thesis (Chapters 4, and 5) were conducted in compliance with University of Reading research ethics policy including: informed consent, anonymity, confidentiality and safeguarding. Prior the commencement of the interviews, this research was approved by an authorised member of the Ethics Committee, University of Reading where the ethical checklist was completed to ensure that this study complied with the committee's standard (see Appendixes K, L and M).

3.5 Conclusion

Based on data collected from the stakeholder consultation, it might be assumed that the forthcoming direction taken by government for reform of Thai cane and sugar policy, is very likely to be maintained near the status quo, since the Thai government would not allow a significant change or reduction of trade and current internal market producer support measures. It is clear that the Thai cane and sugar sector will receive special treatment, permitting a high degree of discretion on the part of government. The overall conclusion is that the protectionism

scenario was optimum and seen as the most desirable approach for Thai sugar sector under present circumstances. The changes required by the WTO challenge, which at first seemed to require massive changes across the entire breadth of the Thai sugar regime, will not be responded to in this way. Rather, based on the findings of the consultation, policy reformation will tend towards incrementalism, focusing on minor modifications to certain policy instruments, to achieve WTO compliance, rather than involving more radical instrument changes and redesign. Some existing policy instruments will, because they can, be retained *in statu quo*. The result may be explained by the fact that policy actors strongly agree that most of the support measures being proposed in the government reforms are fully compliant with the WTO's rules. These supports are:

1. Import regulations
2. Revenue-sharing system
3. Sugarcane price support programme
4. Providing soft loans at low interest rate to cane farmers

However, there are some policy instruments which require slight modification where government interventionism must either come to an end, or be maintained at minimum level in order to be practicable and bringing the industry into compliance with the international law but must still obtain their characteristics as protectionist devices. These supports are:

1. Domestic sugar price measures (repeal of quota system and abolition of 5 baht/kg tax on domestic sugar sale collection)
2. Income supports to cane farmers in form of direct payments

Finally, despite not being the subject of questioning by Brazil at the WTO, this study found that a modification to the definition of 'sugar' in the Act of 1984 and increasing government's budget for indirect supports, are essential survival tools for maintaining competitiveness and establishing long-term sustainability of the Thai sugar sector.

Clearly, the stakeholders believe that protectionism is the most suitable policy approach for the current conditions and therefore, of the three scenarios developed by them, the Protectionist scenario is most likely to be implemented. However, although a protectionist approach is likely to be undertaken by the Thai government, there are signs in their proposed reforms of some moves towards a greater degree of liberalism, even though this is modest and going at a slow pace. This must be, in part, thanks to external pressures, i.e., Brazil's complaint and the need to move closer to common solution within the Agreement on Agriculture of the WTO. Stakeholders

widely agree that the sector policy is in need of reform because of inherent weaknesses. For instance, under the old policy regime, both cane farmers and sugar millers were strongly protected in every dimension. Therefore, neither wishes to lose their absolute benefits. This issue has become a huge barrier to Thai producers improving their efficiency and productivity. Since farmers and millers are major parts of the OCSF board, attempts at policy reform have never been met with approval. With the enforced change by the WTO, this process has finally gained some traction.

Chapter 4

Thai cane farmers' responses to future sugar policy reform

4.1 Introduction

From the previous chapter, parametrisation of each policy instruments under the three board policy scenarios and anticipated impacts of the policy reform scenarios on cane prices based on stakeholder consultation were investigated. To serve the goal of this thesis, this chapter presents the quantitative research that aims to investigate the significant drivers of farmers intention to continue cane farming under policy regimes and to understand their farming responses to the three hypothetical policy regimes.

After the introduction, this chapter begin by the methodology used in this study presented in section 4.2. In this section, data collection including sampling procedure and survey administration is presented in section 4.2.1. The details of questionnaire survey, its instrumentation and measurements including the Theory of Planned Behaviour (TPB) dimensions and background factors can be found in section 4.2.3. Section 4.3 and 4.4 are concerned with the quantitative data analysis used for this study. The section 4.5 presents the findings of this study focusing on: 1) the influence of scenarios on farmers intention to continue cane farming, 2) significant drivers of intent to stay in cane production under each scenario, and 3) impacts of scenarios on their farming likely responses (i.e. quit cane farming or changing size of cane production etc.) and Thai cane sector. The interpretations of findings and their significance in light of existing literature are discussion in section 4.5. Lastly, conclusion and some policy recommendation to this chapter is presented in section 4.6.

4.2 Methodology

To test cane producer responses to the policy regimes, a quantitative research method was used, and farm survey was carried out, collecting data by means of face-to-face interview using a structured questionnaire. The questionnaire was built upon the knowledge gained from the literature review and from the in-depth interview presented in the previous chapters.

4.2.1 Data collection

4.2.1.1 Sampling procedure

A database of 430,817 registered cane farmers in Thailand held by the Office of Cane and Sugar Board (OCSB) in 2019, was used as the sampling frame from which to draw the sample for use in this survey. This official census is the most complete register of cane producers available. The sampling strategy focused on two stratification dimensions that were considered key to ensure the representativeness of the sample extracted: (1) farm size and (2) geographical region. These two stratification dimensions emphasized because of the possibility that farmer responses to different policy scenarios will vary along these dimensions.

Cane farms are distributed over 20 provinces in four regions, i.e., the northern, the northeast, the east and the central region. A non-probability sampling method using quota filling within the two stratification dimensions. Farm size was captured by three size groups (small, medium, and large), while quota filling for region was based on the number of cane farms. Total sample size of this research was determined using the calculation developed by Yamane (1967). Based on $\pm 5\%$ precision level where a confidence level is 95% and $P = 0.5$, the minimum sample size was determined to be 400. Therefore, large-scale survey of cane producers was undertaken. The actual data was collected from a total of 462 farms, representing 0.11% of total number of cane farmer households. Figure 4.1 shows all provinces where cane is cultivated and where data were collected across four regions in Thailand. Table 4.1 and Table 4.2 show how quotas were filled in the sampling process by farm size and geographical region groups. However, as shown in Table 4.2, the region balance of the sample of study deviates slightly from the census data. The proportion of respondents in the North and Central regions were slightly higher than the census while the proportion was much lower in the Northeast region. An explanation for region imbalance in data collection was mainly due to the need to complete the survey within a given time frame and size of budget, higher expense costs to collect farm-level information in the Northeastern region in particular.

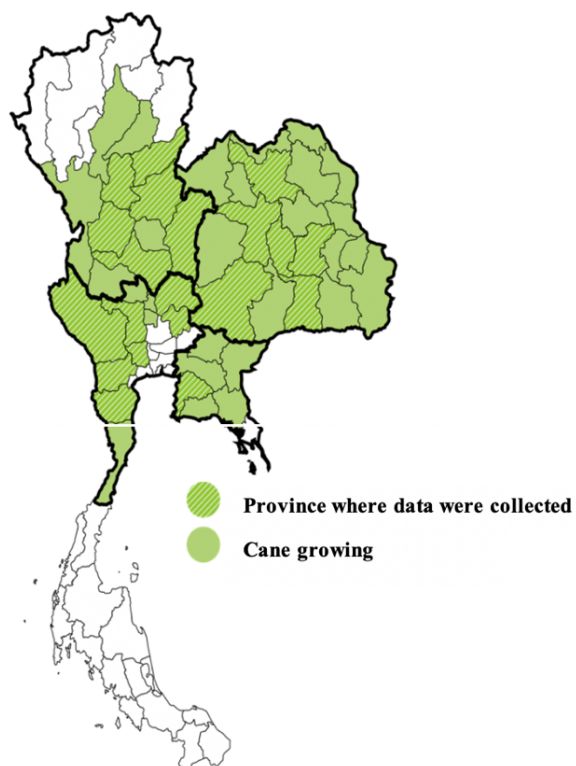


Figure 4.1 Cane growing area and where data were collected across four main regions

Table 4.1 Official statistics of Thai cane farmers and sampling quota by farm size

Typology	No. of farmers (population)	Proportion of farmers in each size class (%)	No. of farmers (sample)	Sample (%)
Small (< 10 ha)	170,982	40%	200	43.29%
Medium (10-80 ha)	212,401	49%	200	43.29%
Large (> 80 ha)	47,434	11%	62	13.42%
Total	430,817		462	

Source: OCSB (2019) and main farm survey 2019

Table 4.2 Official statistics of Thai cane farmers and sampling quota by region

Typology	Proportion of farmers in each region	
	Population (%)	Sample (%)
North	22%	38.3%
Central	33%	35.7%
Northeast	39%	19.3%
East	6%	6.7%

Source: OCSB (2019) and main farm survey 2019

Farm size classification used in this study is based on categories according to the OCSB record. Official statistics show that the average farm size for small, medium and large-scaled farmers are 2.88, 24.66 and 166.02 ha, respectively. Based on our sampling, the average farm size for small, medium and large-scaled farmers are 3.75, 33.55 and 147.07 ha, respectively (See Table 4.3), suggesting that the sample contains slightly larger farms, on average, than exists in the target population.

Table 4.3 Average farm size comparison between official statistics by the Office of Cane and Sugar Board (2019) and sampling

Typology	Average farm size – Population	Average farm size – Sample
	(ha)	(ha)
Small (< 10 ha)	2.88	3.75
Medium (10-80 ha)	24.66	33.55
Large (> 80 ha)	166.02	147.07

This sample was divided into three balanced sub-groups of approximate 150 farms and different scenarios presented to each sub-group (See Table 4.4). The justification for using this approach is because of time required for data collection and high cognitive burden of survey questions and response times. The number of farms sampled in each size group reflected the actual numbers of farmers in the target population in each sub-group, as shown in Table 4.1.

Table 4.4 Sample selection based on farm size under three scenarios

Farm typology	Libertarian scenario	Government proposal scenario	Protectionism scenario
	Counts (%)	Count (%)	Counts (%)
All size scales	154 (33.3%)	158 (34.2%)	150 (32.5%)
Small	62 (40.3%)	77 (48.7%)	64 (42.7%)
Medium	68 (44.2%)	63 (39.9%)	66 (44.0%)
Large	24 (15.6%)	18 (11.4%)	20 (13.3%)

4.2.1.2 Survey administration

A questionnaire-based survey using face-to-face interviews was selected as the preferred method for the following reasons. According to Thamthanakoon (2019), who had performed farm survey work in Thailand, a lack of an internet access particularly in rural areas makes reason online surveys impossible. Second, a postal survey would be unlikely to generate many responses since Thai farmers have no previous experience of this type of survey. Finally, and perhaps most importantly, the complexity of some of the questionnaire questions, as well as the low educational level of some famers, means that farmers would need some explanations when answering the questions. Despite very high costs associated with face-to-face interviews, this was felt to be the only approach that would be effective in this case.

To reduce the workload on the researcher, a data collection team was recruited during March-April 2019. A team of eight was drawn from employees at the Thailand Sugarcane Breeding Center (TSBC). The members of the team consisted of seven interviewers and one survey manager. Data collection team were trained by researcher, over six sessions each dealing with a different issue (See Figure 4.2). The pilot testing of the questionnaire was conducted with 25 cane farmers at the time of their visits to the TSBC in Kanchanaburi province (Central region) by researcher and the team members in April 2019 to confirm the questionnaire's wordings. Adjustments were made to some questions in light of feedback from the Pilot. This mainly consisted of clarifying the intentions/meaning of some questions and the reordering of some.

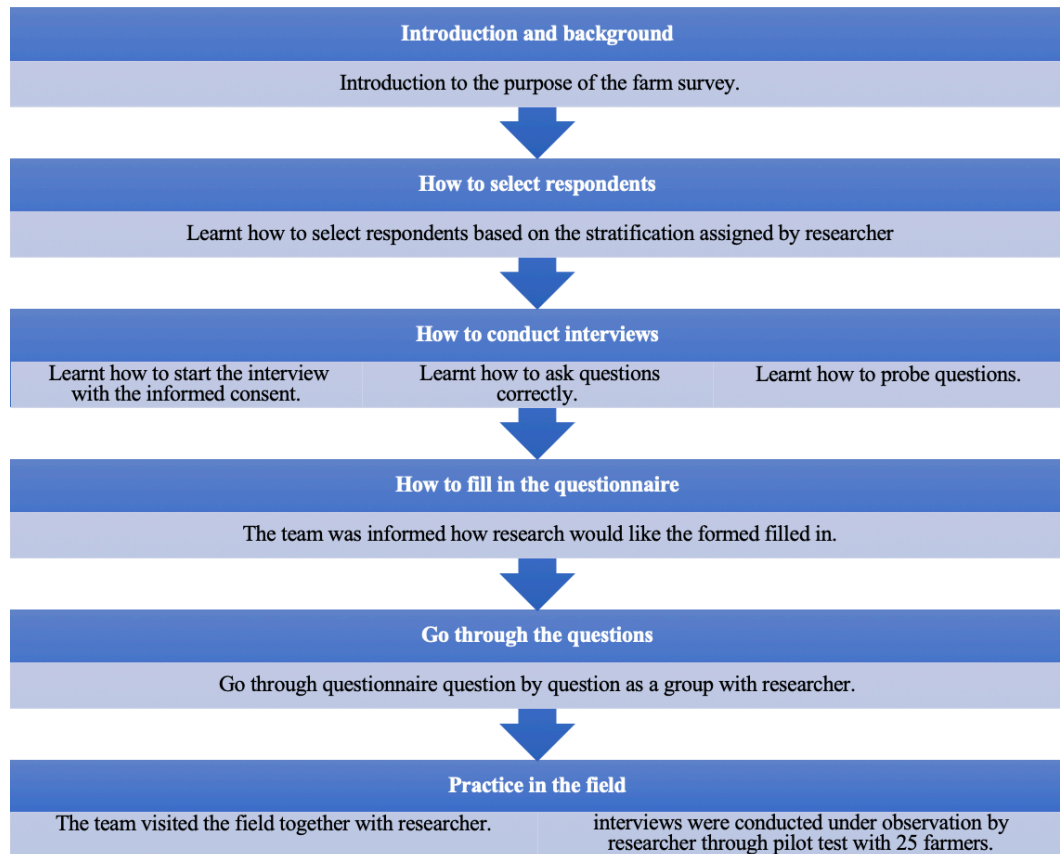


Figure 4.2 Process of recruiting and preparing data collection team

The farm survey was conducted during May to August 2019. Research team contacted the supervisors of the Cane Farmer Association Center in several provinces for cooperation in research project prior the travelling for data collection. The supervisors provided data collection team specific dates that the training courses would be hold at the center. Most interviews, therefore, were undertaken at the Cane Farmer Association Center where farmers were member of during the day farmers attended the training course at the center. However, because of difficulty to recruit samples in accordance to sampling size and stratification requirement as initially planned from the training center particularly insufficiency of small-scaled farmers, thus some of the interviews took place on the respondents' farms at time to suit the respondent where their contact information was provided by the Cane Farmer Association Center in each regional location. Farmers' participation was completely voluntary, and no monetary incentive was provided. However, the data collectors were paid, collectively, a sum of £1,500 to cover incentive, travelling and accommodation costs. These funds came from the researcher's research expenses.

4.2.2 Questionnaire survey, instrumentation, and measurements

4.2.2.1 Translation

The questionnaire was initially developed in English before being translated to Thai. The translation process involved, forward and back translation to ensure the equivalence of meaning between the original and target language instruments (Maneesriwongul and Dixon, 2004).

First, forward translation was done separately by two independent translators. The first translation was by the researcher, a native Thai speaker, who is knowledgeable about content area of study. The second translation was undertaken by a professional freelance bilingual (Thai-English) translator who has experienced working in English literatures and agricultural business and marketing, but who did not have knowledge about the original instrument. The two versions of Thai questionnaire were then evaluated and compared. Next, a group of specialists, i.e. two academics and three people who have experience in the field of cane-related research and farm survey evaluated the accuracy and the simplicity of language, to ensure that Thai cane farmers would be able to understand the translated version. The main task for these specialists was to find everyday language, i.e. not too formal or academic, with the identical meaning for respondents in order to preserve all characteristics of original version.

Finally, the simplified questionnaire was back- translated into English to test for consistency in the meaning and equivalence between the two versions (Chang et al., 1999). Once all checks were complete the Thai-language version of the questionnaire was pilot-tested and respondents' feedback used to revise and clarify the meanings of questions (Chen et al., 2002).

4.2.2.2 Instrumentation -The reform scenarios for the expression of farmers' intention

As explained in Chapter 3, a set of three possible future policy scenarios were designed, representing spectrum of policy approaches on the libertarian- protectionism spectrum. Based on policy consultation, the three scenarios are identified as followed:

Government proposal scenario captures the current 'government proposal' for policy reform, which includes: the removal of certain domestic production subsidies but seeks to maintain as much producer support as permissible under current WTO rules.

Protectionism scenario assumes to maintain the current internal market producer supports, but otherwise complies with international (WTO) commitments.

Libertarian scenario assumes to eliminate all production support and market interventions, trade, and domestic consumption distortions.

From policy consultations, policymakers and academics were asked to estimate cane price under each scenario. The cane price is obviously highest under the Protectionism scenario, and lowest under the Libertarian scenario. In Table 4.5, the policy parameters hypothesized are summarised for each reform scenario.

Table 4.5 The summary of the parametisation of policy instruments and hypothetical cane prices under three scenarios

Policy parameter/ scenario	Protectionism	Government proposal	Libertarian
Cane price per metric ton	850 Baht (\$27)	725 Baht (\$23)	650 Baht(\$21)

Policy parameter/ scenario	Protectionism	Government proposal	Libertarian
Abolition of quota system for sugar sales	×	✓	✓
Full domestic sugar price float	×	✓	✓
Abolition of revenue-sharing system	×	×	×
Abolition of direct payments to farmers	×	×	✓
Abolition of cane price support program	×	×	✓
Full abolition of import restriction	×	×	✓
Abolition of cheap loans provided to farmer	×	×	×
Increase state budgets for indirect supports	✓	✓	✓
Abolition of 5 baht/kg (\$6 cent/lb) tax on domestic sugar sales	×	✓	✓

In seeking to explore farmers' intentions about future cane farming, the use of a scenario-based survey was purposed as a methodology to accurately determine the likely responses of farmers to specific policy contexts. For all three scenarios, the aim was to collect farmer views and likely responses but also data that would enhance understanding of the rationales for and drivers of their decisions. In this study, one policy scenario was presented to each farmer in the questionnaire. Descriptions (see Table 4.5 for a list of the policy instruments that characterized each scenario) of these alternative future scenarios were provided in text form, and the sugar regime as it existed at the time of survey acted as the comparator. Because the survey was done face-to-face, farmers were allowed to ask for clarifications if needed.

4.2.2.3 The behavioural model

To successfully make an assessment of why farmers respond in particular ways to different policy options it is necessary to understand the factors underlying and influencing farmers' behaviour (Hansson et al., 2012). This is a difficult task. To deal with this difficulty, it is crucial to construct a proper predictive model that can describe well the way in which farmers act and subsequently adopt this model to predict how they would change their behavioural intention toward farming practices if a certain policy was implemented (Coelho et al., 2012).

Traditional neo-classical and other standard economic models, assume that human behaviour is economically rational and based on perfect information (Mingolla et al., 2019, Pike, 2008). In this respect, economic factors (i.e., costs and returns and government measures) have obviously been key determinants in weighting up farming choices (Garforth, 2015, Pike, 2008).

However, the critique of economic rational choice model is now well received wisdom and it is accepted that using standard economic model alone in surveys of farmer behaviour is not adequate to measure the real-world behavioural responses (Jones et al., 2016). Understanding farmers' behaviour and factors that influence them is a complex issue (Blackstock et al., 2010, Farani et al., 2019). In practice, farmers, are often not wholly rational, as defined above, in their decision-making. In this sense, it is meant that farmer's motivations for continuing or changing what they are doing are not made in full of knowledge and based solely on profit maximization, and other aspects are involved such as held values and a range of other social-economic and psychological factors (Gillmor, 1986, Huijps et al., 2010, Posner, 1998, Prendergast et al., 2008).

While external drivers such as financial incentives and policy measures are necessary, they are often not sufficient in themselves to effect behaviour change in farmers (Gasson, 1973). According to Hu et al. (2006), without reference to both external and internal factors (e.g. socio-demographic and psychological) in the study, an incomplete understanding will likely result. Therefore, recently many scholars have accepted the necessity of looking beyond the traditional economic drivers by adding a complementary perspective in the field of behavioural economics in order to improve prediction of farmer decision-making leading to better farming outcomes. Behavioural economics seeks to enrich the traditional economic model by applying insights from non-economic predictors (internal factors), such as social-psychological factors to wider understanding of economic behaviour and increase relevance of economic models (Camerer and Loewenstein, 2011, Hansson et al., 2012).

As a result, to investigate farmers' expressed intention to undertake actions, it is reasonable to employ behavioural economics model to this study. To date, in the context of agricultural and rural research, a large number of economic behavioural models are available which might be used to predict farmers' responses to policy initiatives and link socio-psychological constructs and their antecedents with behaviour. According to a review of work using theories of behaviour change across social and behavioural sciences written by Davis et al. (2015), the top 5 most frequently used are The Theory of Planned Behaviour/Reasoned Action (Ajzen, 1985), Trans-theoretical Model (Prochaska and DiClemente, 1982) Information-Motivation-Behavioural Skills Model (Fisher and Fisher, 1992), Social Cognitive Theory (Bandura, 1989), and Self-determination Theory (Ryan and Deci, 2000).

In this study, through the lens of behavioural economics, the Theory of Planned Behaviour (TPB), among the most popular conceptual models, was selected as it can take into account of both internal (psychological) and external factors (e.g. policy and economic considerations) that have been demonstrated to influence individual intentions to perform particular action in different context. Moreover, the TPB is also flexible framework, according to Ajzen (2020) himself, allowing for the inclusion of other predictor variables that are not part of the theory in order to improve predictive power. However, for proposing new factor into the TPB model, some criteria should be met. First, the proposed factor should have a causal relationship with the determining intention or action. Second, factor should be measurable, definite, and behaviour-specific. It should be conceptually standalone from the theory's existing predictors but, simultaneously, compatible with other elements in the model. From among additional predictors often proposed by researchers, past behaviour was added into the TPB model in this study as an indicator of habit strength (Ajzen, 2020).

The TPB is a highly regarded application and has long been successfully applied to studies to explain and predict a multitude of farmers' behaviour in agricultural policy context. For example, TPB was used by Garforth and Rehman (2006) to explore the possibility of incorporating data on farmers' motivations and influences on their responses to specific policy changes in England; by Jones et al. (2015) to understand dairy farmer's intention to reduce antibiotic usage; by Gorton et al. (2008) to assess farmers' attitude to agricultural policy and farming features in the context of the 2003 CAP reform; and by Stojcheska et al. (2016) to study farmers' responses to rural development policy challenges in Western Balkan countries.

4.2.2.3.1 The Theory of Planned Behaviour

Like other social-psychological models, the TPB is developed followed an ‘Expectancy-Value’ theory which put forward that human behaviour is determined by probability or expectancy that an outcome will results from an action, and subjective value and utility places upon that (Ajzen and Fishbein, 1980, Feather, 1982, Vroom, 1964).

The TPB is an extension of the Theory of Reasoned Action (TORA) originally proposed by Ajzen and Fishbein (1980). As shown in Figure 4.3, the TORA endorsed the view that a person’s behaviour is influenced by their perception of the attitude of others and subjective norms. However, despite being a good explainer of behaviour, the TORA provides a less comprehensive explanation of farmers’ intention as behaviour examine under this model are assumed to be under total voluntary control without taking the account the fact that behaviour is not completely voluntary and not necessarily always be controlled (Ajzen, 2020). In response to this gap, (Ajzen, 1991) TPB was developed by adding perceived behavioural control to the TORA which capture individuals’ perception of other present factors outside their control that may facilitate or impede performance of an action.

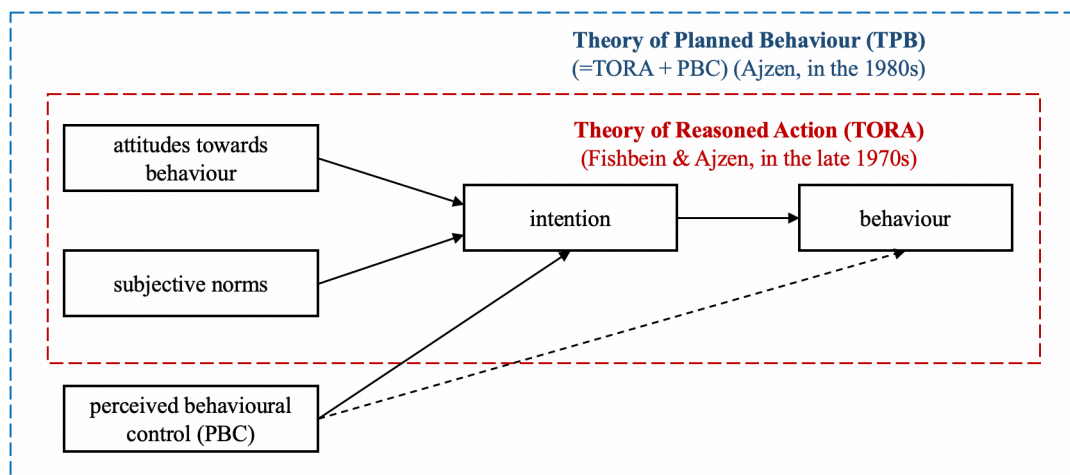


Figure 4.3 Theory of Reasoned Action (TORA) and Theory of Planned Behaviour (TPB)

The fundamental concept of TPB assumes that an individual’s intention to behave the way they do is the best predictor of behaviour. Intention illustrates a persons’ motivation or readiness to carry out specific behaviours (Conner and Armitage, 1998). Therefore, behavioural intention is assumed to be the direct antecedent of behaviour. In general, the stronger the intention to engage in certain behaviour, the greater probability that ultimate performance will occur (Ajzen, 1991). As a result, it is suggested that behavioural intention may be used as a proxy and can predict

considerable proportion of the variance in actual behaviour. A meta-analysis of 422 TPB studies by Sheeran (2002) found that, based on a weighted average correlation of intention-behaviour relationship, there are strong associations between intentions and behaviour, and that intentions explain, on average, 28% of the variance in the future behaviour.

Intention, in turn, is determined by three independent psychological components: attitudes towards the outcome of the behaviour, subjective norms and perceived behavioural control. In general, the more positive the attitudes to an outcome, the more favourable the opinions of important referents in the society around the individual, and the stronger an individual's perception regarding the possibility of access to required resources and opportunities, the stronger the intention to engage in certain action, and therefore the greater the likelihood of performance of undertaking the action.

Even though the efficacy of the TPB in predicting the intentions through the three psychological constructs has been proven in many studies (Armitage and Conner, 2001) which is known as the sufficiency assumption where no other predictors should have a direct impact on intentions (Sok et al., 2021), in reality, the relative importance of the predictors of intention varies across behaviour and circumstances (Ajzen, 1991). TPB does suggest that various socio-demographic characteristics and other background variables such as policy measures may play a role and could complement the understanding of behaviour determinants (Ajzen, 2011, Senger et al., 2017). According to López-Mosquera et al. (2014), a substantial percentage of variance in intention and behaviour, is left unexplained, therefore, recently, many authors have addressed this limitation by including additional variables in their extended TPB model if they are considered to be relevant, for intuitive reasons, to increase the model's predictive powers/validity in explaining farmer intentions (Borges and Lansink, 2015, Daxini et al., 2018, Donati et al., 2015, Rezaei et al., 2019, Stojcheska et al., 2016). Hence, in this study, background factors were added into regression models alongside the TPB dimensions to test their effects on intention. Depending on the subject of analysis and based on literature reviews, in our analysis, a number of possible influential background factors that were included in our conceptual model to explain farmers intention to continue cane farming in the next five years. Such variables are, were of three types: factors of a personal nature (age, gender, education, and family members), farm structure (farm size, regional location, number of workers, production yield, and proportion of farm devoted to cane production) and farming characteristics (past behaviour in cane farming, access to loans, contact with agricultural advisory and participation in formal cane-related training or activities. In addition, situational context and policy and regulation agenda (e.g. market prices and laws and regulations) can influence decision-making by either facilitating or

inhibiting the action (Celio et al., 2014, Ritter et al., 2017), therefore policy variables were also included in the analysis to capture the potential effect of policy measures on farmers' intentions to continue in cane farming.

4.2.2.3.2 Model specification

According to TPB, three determinants (attitude, subjective norms and perceived behavioural control) are identified as having influence on the intention to perform a particular behaviour. However, since outcome attitudes also derive from individual's beliefs (indirect measures), when applying TPB, two measures of each belief are taken based on an expectancy-value formulation. One is called 'outcome evaluation' which relates to how good or bad the effect of behaviour is perceived to be. The second measure is known as 'belief strength' which capture perception of the likelihood of the behaviour leading to such an outcome. In TPB, behavioural belief strength (bs) i.e. the expected likelihood of an outcome ' i ' occurring, is multiplied by outcome evaluation (oe) i.e. the valued place on outcome ' i ' (utility) ($bs_i \times oe_i$) and the sum yields the belief based measure of attitude (ATT) as shown in the following equation:

$$ATT = \sum_{i=1}^n bs_i oe_i \quad \text{Eq.1}$$

Where i = beliefs about possible outcome i

Subjective norm (SN) captures an individual's perception of social pressures from given referents upon him or her to carrying out, or not carry out, a behaviour. Drawing an analogy to the indirect attitude model, indirect subjective norm is determined by the total sum of accessible normative beliefs based on expectations of important referents. Normative beliefs ($nb_j \times mc_j$) are derived from the multiplication of the strength of normative belief (nb), with respect to a given social referent (j) and motivation to comply with the opinion (mc) of the j th important referent. By applying the expectancy value formula to these measures, subjective norms are computed as shown in following equation:

$$SN = \sum_{j=1}^n nb_j mc_j \quad \text{Eq.2}$$

Where j = possible important referents

Perceived behavioural control (PBC) captures factors perceived as facilitating or impeding the performance of a behaviour. This is determined by the sum of two dimensions, i.e. control belief

(cb_k) , which is an individual's subjective probability, that given facilitating or impeding factor (k) will be present in the circumstance of interest multiplied by control factor (pc_k), which is the perceived power of the factor to control the behaviour. A representation of this model is shown in Equation 3.

$$PBC = \sum_{k=1}^n cb_k pc_k \quad \text{Eq.3}$$

Where k = possible control factors that facilitate or prevent the behaviour

As stated earlier in section.4.2.2.3.1, despite a focus on these subjective psychological determinants, the TPB does not ignore background factors such as personal characteristics, structural and socio-economic conditions, and agricultural policy agenda. It is assumed that, if relevant to behaviour, any personal characteristics and socio-economic difference between farmers should be reflected in difference on their intention. Hence, factors of this kind were not overlooked in this study. Therefore, the possibility of background factors having a direct effect on intention was tested. A schematic representation of fully specified TPB model used in this study is shown in Figure 4.4 and full lists of background factors used in this study is shown in Figure 4.5.

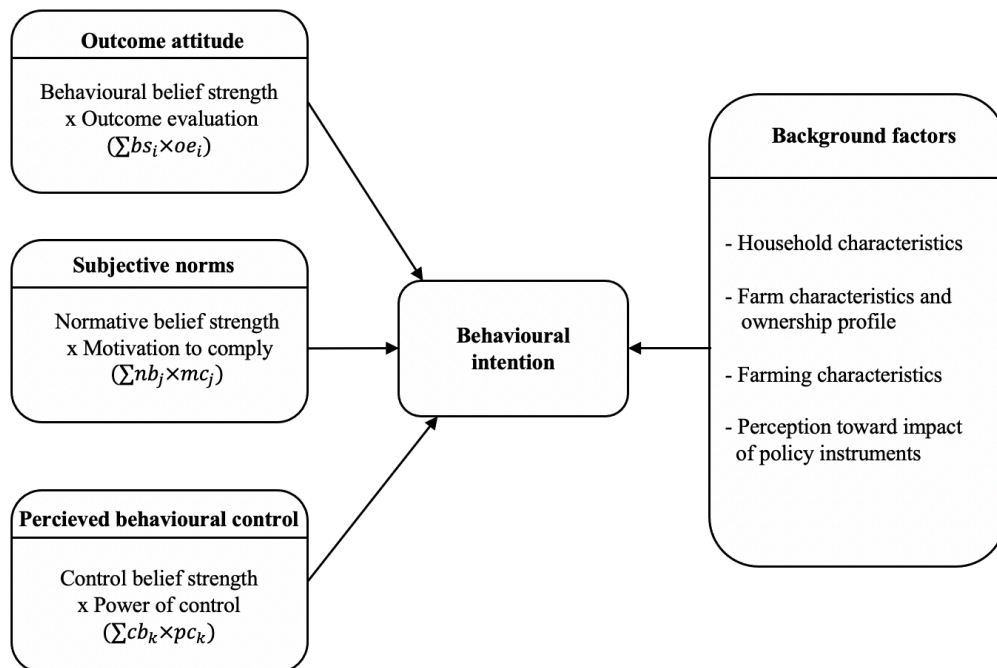


Figure 4.4 The theory of planned behaviour used.

Household characteristics	Farm characteristics and ownership profile	Farming characteristics	Perception toward impact of policy instruments
<ul style="list-style-type: none"> • Gender • Age • Educational level • Cane farming experience • Avg. income from agriculture • Off- farm income • Employment status • No. family members • No. family members ages <16 • No. family members work on farm 	<ul style="list-style-type: none"> • Regional location • Distance from farm to sugar mill • Machinery ownership • PROP of land devoted to cane production • Arable land size for agriculture • Total land size for cane farming • Cane yield • Tenure arrangement • No. labours work on farm 	<ul style="list-style-type: none"> • Past behaviour • Loans borrowing • Identifying successor • Having farm visits • Participating in cane-related workshops • Participating in cane-related meeting • Cane burning • Having farm advisor 	<ul style="list-style-type: none"> • Ending cheap loans • Domestic sugar price float • Abolition of price supports to cane farmers

Figure 4.5 Background factors used.

According to Francis et al. (2004), each psychological variable in the TPB model may be measured directly or indirectly where both forms of measurement approaches purportedly measure exactly the same underlying phenomenon. Therefore, data on the state of these determinants can either be elicited directly, or indirectly, through questioning. However, deciding whether to use direct or indirect forms of measurements of the TPB dimensions depends on research goal. Using direct measurements to predict intention alone is possible and would be sufficient if the research goal is simply to gauge the effect of a particular TPB dimensions in determining behavioural intentions. However, if the purpose of the study goes beyond this goal including gaining deeper understanding of influences and identifying specific beliefs that contribute most, it is necessary to employ indirect measures as they capture the multiple dimensions that contribute to a factor. Based on this rationale, the TPB questionnaire used in this study was first developed to contain both direct and indirect forms of measurement. In order to evaluate which form of measurement is the best determinant of behavioural intention separate regression models were run for both constructs to check their predictive power. As a result, the aggregate indirect measure was selected to for regression modelling. However, the components of the indirect measure were used to determine why individuals held certain attitudes, subjective norms and perceived behavioural control beliefs and the nature of these beliefs (Ajzen, 2005, L  pple and Kelley, 2013).

Prior to the main analysis, a valid measure of beliefs about continuing cane farming in the next five years is necessary to deepen our understanding. In order to validate the belief-based structure, it is important to first establish the reliability of each variable within direct and indirect measures (Flowers et al., 2017). For direct measures, reliability test may be established using an index of internal consistency, such as Cronbach’s Alpha coefficient to determine whether the items in the scale are measuring the same construct (Francis et al., 2004). However, it is

inappropriate to evaluate the reliability of indirect measures through the use of an internal consistency criterion because they are formulative rather than reflective indicators of underlying constructs (Ajzen, 2002, Conner et al., 2001). Alternative, establishing a series of bivariate correlation analysis between the indirect and corresponding direct measures of the same constructs can be used to confirm the convergent validity of the indirect measures (Russo et al., 2015). Adhering to the guideline, we tested the composite direct indicator using internal consistency tests. Next, the association of each of the individual elements of the composite indirect and direct measures were also tested to see whether they are correlated. According to the theory, we should expect significant correlation between direct and belief-based measures of attitude, subjective norms and perceived behavioural control to confirm that indirect measures are well constructed and adequately cover the diameter of the measured constructs (Ajzen and Fishbein, 1980, Francis et al., 2008). If the acceptable correlation is found, specific behavioural, normative and control beliefs can be used to performing in the main analysis.

4.2.2.4 The structure of the questionnaire in the study

To investigate Thai cane farmers' likely response to a set of possible future policy regimes, three different versions of the questionnaire were used reflecting the three different policy scenarios developed in the policy consultation study. The core of the questionnaire was designed to elicit information required to address the research questions. The questionnaire was divided into two main sections.

4.2.2.4.1 Farm and farmer characteristics (Section A)

The section A includes profiles of respondents including farm household characteristics, farm, and cane farming characteristics.

4.2.2.4.2 Scenario-based questions about future cane farming (Section B)

Section B comprised of two parts covering direct questions about responses to policy scenario and the specific theory of planned behaviour questions, with these parts were varied according to each of the 3 scenarios. The participants were separated into 3 groups to answer the different questionnaire versions. Under each version, brief details of each particular policy scenario were given which the participants were required to read before giving their answers.

a) TPB questions

Questions related to the TPB constructs were adapted from Ajzen (2006). Other questions were developed from literature. The classic TPB model is a two-stage approach capturing first intention to undertake a behaviour and then the actual behaviour itself. However, the two main constraints to the two-stage approach in this study are: (i) that none of the actual policy scenarios considered in this study were implemented, hence the actual behaviour cannot be measured and (ii) time-scale over which implementation of policy and farmer response to this is too long to be captured in this study. Therefore, this study followed the approach of measuring only ‘intention’ as the dependent variable, with this assumed to be the antecedent of farmers’ choice behaviour.

The purpose of questions in this section were to identify to what extent cane farmer intention to continue in cane farming in the next five years is determined by the TPB dimensions and to identify the drivers and barriers to farmers to continue in cane production under each scenario.

There are four main categories of independent variables which were considered as potential influences on cane farmer intention to continue cane farming. These are the three components of TPB constructs: 1) direct attitudes toward continuing cane production in the next five years under a given scenario; 2) direct and indirect subjective norms, and 3) direct and indirect perceived behavioural control, along with additional variable: 4) past behaviour. Past behaviour is included here because several past studies have proposed that past behaviour may be an important predictor of future intention on farming (Bergevoet et al., 2004, Menozzi et al., 2015, Read et al., 2013, Swinscoe, 2017).

All TPB questions were measured using five-point, unipolar, anchored Likert scales. Attached labels were dependent on the factor under consideration. The behavioural intention of farmers was measured by a single question regarding intention to continue in cane farming in the next five years with the possible responses ranging from very unlikely (1) to very likely (5). Direct attitudes towards the outcome of the behaviour (OA) were measured by seven questions, a single question was used to measure direct subjective norm (SN) and there were four measures of direct perceived behaviour control (PBC).

This section of the questionnaire also included 24 pairs of questions that were used to build indirect TPB measures. For the indirect measure of attitude, 11 behavioural belief strength questions followed by their outcome evaluation were included. Four salient referents were elicited to assess belief-based measure of subjective norms. With respect to each referent, farmers indicated the strength of their normative beliefs followed by the degree of motivation to

comply. For belief-based measures of perceived behavioural control, control belief and power of control were measured by nine pairs of questions. A composite measure for each TPB was generated by aggregating the products of all of the expectancy-value-type paired questions within each TPB construct.

In this study, it has been recognized that the 5-point scale use for each question and the respondents' selection of a point on that scale may not measure the 'absolute truth' and each participant's interpretation of a number within the scale is subjective and may prone to bias. Nonetheless, this limitation is offset by the benefits of using ordinal scales, i.e. the possibility of undertaking statistical analysis of cause-and-effect links and relative comparisons. The description of each variable, their scale of measurement, and sources are shown in Table 4.6. A full list of questions presented in questionnaire can be found in Appendix B.

Table 4.6 The description of TPB variables, their scale of measurement, and sources.

Variables	Statements	Scale (1-5)	Sources
Dependent variable			
Intention	1) I intent to continue cane farming in the next five years	Definitely no- Definitely yes	Adapted from Ajzen (2006); Senger et al. (2017)
Independent variables			
Direct form of attitude toward cane farming	1) My continuing with cane production in the next five years would be;	1.1) Bad-Good 1.2) Unpleasant-Pleasant 1.3) Useless-Useful 1.4) Invaluable-Valuable 1.5) Unenjoyable-Enjoyable 1.6) Harmful-Beneficial	Adapted from Ajzen (2006); Senger et al. (2017); Phetvaroon (2006);
	2) Of all farming alternatives available to me, cane farming is the most;	2.1) Unprofitable enterprise- Profitable enterprise (a five-level semantic differential scale)	Menozzi et al. (2015)
Direct form of subjective norms	1) Other farmers like me will continue cane production in the next five years	Strongly disagree- Strongly agree	Adapted from Ajzen (2006); Senger et al. (2017); Savari and Gharechace (2020)
Direct form of perceived behavioural control	1) I am confident that I can continue cane farming in the next five years 2) Continue cane farming in the next five years is completely up to me 3) For me, to continue cane farming in the next five years is under my control 4) I choose how I would continue cane farming in the next five years	Strongly disagree- Strongly agree	Adapted from Ajzen (2006); Senger et al. (2017)
Attitude (behavioural belief and outcome evaluation). Indirect form	1) Policy scenario will damage cane farmers 2) A decrease in domestic sugar and cane prices will negatively affect my income from cane production 3) My business will be strongly negatively affected by the cane price drop 4) A drop in domestic sugar price will negatively impact my sugarcane production 5) Ending government support will affect my farm business 6) Not receiving any price supports will be bad for my cane business 7) Not receiving any producer supports related to cane production will be bad for my cane business 8) I can get my business to be better than it is now under this scenario 9) I should do more work off-farm to support my cane farming activities 10) This scenario will impose too much interfere with my future farming plan 11) No matter what the policy is, I will keep my farm running	Outcome evaluation component; Belief strength component	Adapted from Willock et al. (1999); The author (2019)

Variables	Statements	Scale (1-5)	Sources
Subjective norms (normative belief and motivation to comply). Indirect form	1) Family and friends 2) Neighbouring cane farmers 3) Sugar millers 4) Government	Motivation to comply component; Belief strength component	Adapted from Senger et al. (2017); Thamthanakoon (2018)
Perceived behavioural control (control belief and power of control). Indirect form	1. Have got enough skills to continue in cane farming 2. Have sufficient resources to continue in cane farming 3. Need lots of government support 4. Have capacity to continue in cane farming 5. Have the necessary authority to continue in cane farming 6. Have sufficient knowledge to continue in cane farming 7. Lack the money for necessary investment 8. Believe that my farm is too small to be financially stable 9. Would not be able to borrow money to have sufficient funds	Power of control component; Belief strength component	Adapted from Senger et al. (2017); The author (2019)

b) Farmer intentions

Direct questions about responses to policy scenario, such as the impacts of reform scenario on the number of active producer and the volume of cane produced, additional categories of questions were included. First, farmers were asked to indicate any changes they would make to their farm in response to the given scenario, for example, whether they intend to continue cane production just as they do today, or expand the size of farm, or switch some land out of cane to produce other crops. Second, farmers were also asked to indicate what they would do with their farm, if they decided that they would not continue cane farming in the next five years, for example switching production to alternative crop, starting off-farm work, passing land to a successor, and renting or selling their farm.

4.2.2.5 Non-responses bias

High non-response rates can have a negative impact on the representativeness and validity of the survey results (Armstrong and Overton, 1977, Burns and Burns, 2008). However, the validity issue as well as reliability issue were not overlooked in this study. The benefit of fact-to-face interviews with trained interviewers is that any ambiguities and misconceptions that the respondents may have been eliminated (Saloniki et al., 2019). Because of effective recruitment strategy, the researcher managed to successfully recruit all respondents identified in sampling

strategy. Therefore, accurate data were collected with a non-response rate of zero, and no missing value was found.

4.3 Data inputting procedures and data quality checks

There were three main steps involved in data inputting and recording in this study

Step 1: Completed questionnaires were electronically scanned by the data collect assistants and sent to the researcher through the shared Google drive. The original questionnaires are kept safely in locked storage at the survey manager's office at Kasetsart University, so that raw data could be re-checked if necessary.

Step 2: Electronic data transcription was done by researcher by using Microsoft Excel and data backup was done during this process.

Step 3: Once data entry process was completed, the final data file was imported into the Statistic Package for the Social Sciences (SPSS) software version 25 and Stata/SE version 16 for data analysis. The scanned files were stored as password-protected files on the researchers' personal laptop and the University's share drive.

Before the actual analysis, the quality of data was checked by removing the unused data and variables were modified for further analysis.

4.4 Data analysis

Methods of data analysis varied according to the research question being addressed and the nature of the data available. There are three main parts of data analysis in this study. First, the socio-economic and demographic characteristics of respondents were reported using descriptive statistics. All cane farmer attributes (i.e. farmer household characteristics, farm and farming characteristics and farmers' perception toward impact of given policy instrument) were compared by farm size category using Chi-square and One-Way ANOVA tests. To identify drivers of and barriers to remaining in cane production (under the three scenarios) a two-stage ordered probit regression modelling were exercised. In the first stage, a pooled regression was performed to determine whether the reformed scenarios themselves significantly impact farmers' intention to continue cane farming in the next five years. In the second stage, three sets of regression models were constructed, one for each scenario, to undertake the TPB analysis to

identify the mechanism of impacts and the factors influencing farmers' intention to remain in cane production.

In addition to ordered probit regression, the expected value approach, using estimates of both the magnitude of change and the likelihood of changes, was used to estimate the impacts of these reform scenarios on the number of active producers and the volumes of cane produced.

4.4.1 Data analysis technique

4.4.1.1 Descriptive statistics

Data for 30 attributes and characteristics of cane farmers were collected in this study. These include data about farmer household characteristics, farm and farming characteristics and farmers' perception toward impact of given policy instrument. These were used to describe the sample, create sub-groups within the main dataset and test for differences between subgroups, using inferential statistics (Kaliyadan and Kulkarni, 2019). Therefore, two main specific statistical tests were employed.

To test for subgroup differences in categorical variables, chi-square test was used. This has been widely used in many studies when making a comparison between sub-groups of agricultural producers (Kelsey and Mariger, 2004, Riesenber and Gor, 1989, Tudor et al., 2014). This method was selected because this study does not assume the data are normally distributed (McHugh, 2013). However, when conducting statistical tests using Chi Square for multiple categorical variables, there is an increased risk of obtaining significant results by chance and so the Bonferroni correction, the single most popular, is applied to decrease that risk. This technique is able to avoid quoting adjusted p values incorrectly or providing erroneous rationale (Armstrong, 2014).

When comparing group differences for continuous variables, significant differences between the means of three farm size groups were determined by One-way ANOVA. This test was determined to be appropriate to this study as there is only one categorical independent variable with at least three different groups and one continuous dependent variable (an ANOVA, Kim, 2017b). Despite informing whether the groups being studied differ, ANOVA does not tell any deeper insights into patterns between specific groups. Hence, further method of multiple comparison testing as post-hoc analysis is required (Parab and Bhalerao, 2010). The Tukey's honestly significant difference test was chosen to investigate all pairwise comparisons between

farm size groups in this study as it is considered to be the best and most popular method for post-hoc analysis in a wide variety of studies.

4.4.1.2 Validation of the TPB dimensions

Principal component analysis (PCA) was used to check if there is any TPB items from the questionnaire do not fit to the data for performing further regression analysis. PCA is widely used in many studies related to the theory of planned behaviour, to confirm and validate the three TPB dimensions (attitude, subjective norms and perceived behavioural control). PCA reduces the dimensionality of datasets, by summarising variables into meaningful constructs, called principal components (PC). It is argued that if PCA, which applied to the TPB variables, creates factors that align to the three TPB dimensions then this validates those dimensions. According to Jolliffe (2002), the reduced number of components can be used as variables in the regression modelling without losing meaningful variation in the original data. The varimax rotation method, most common orthogonal rotation procedure, was selected. The components were extracted and retained where eigen values are greater than one based on the 1.0 eigenvalue cut-off rule (Hair, 2009, Zeller, 2005). In order to extract the components from statements, the Kaiser-Meyer-Okin measure (KMO) (Kaiser, 1958) and Bartlett's test (Bartlett, 1947) were used. The KMO measure was used to check the sampling adequacy where this statistic represents a ratio, ranging from 0 to 1. According to Kaiser's criterion, the value should be at least greater than 0.5 for PCA to be acceptable. In addition, the Bartlett test was also used to assess whether the correlation matrix among the variables significantly differs from the identity matrix. The retained components were used as composite explanatory variables in further regression analysis which was used to examine if these variables influence cane farmers' intention to continuing in cane production.

Cronbach's alpha (α) was performed to evaluate the internal reliability of the composite TPB variables representing attitude, subjective norms and perceived behavioural control in order to ensure that the composites form coherent constructs. Tests used on the independent variable set used in the three regression analyses were performed using SPSS Statistic Version 25.

4.4.1.3 Identifying the drivers and barriers to continuing in cane production

Based on farmers survey, the dependent variable, farmers' intention to continue in cane farming, was based on an ordered five-point Likert ranking scale from very unlikely (1) to very likely (5). Because the distance between categories is unspecified, the farmer's intention cannot be treated

as interval, and so is therefore ordinal. In consequence, using the ordinary least squares regression technique is inappropriate as it can generate spurious probabilities and negative variance estimates. Hence, for this type of data where there are more than two categories of response, it is typical to employ an ordered regression modelling for data analysis (Greene, 2003). As a result of this, this study employed a two-stage ordered probit regression modelling for estimating the determinants of Thai cane farmers' intentions to remain in cane production in the next five years.

According to Greene (2003), the ordered probit regression modelling can be presented as:

$$y_i^* = x_i' \beta + \varepsilon_i \quad \text{Eq. 4}$$

Where: y_i^* is latent variable representing level of intention to continue cane farming in the next five years associated for farmer i ; x_i' represents a vector of independent variables; β is a vector of regression coefficient to be estimated; and ε is a random error term, assumed to be normally distributed across observations with a mean of zero and variance of one. Because y_i^* is latent, the observed discrete responses of the variable, y_i can be expressed as follows:

$$\begin{aligned} y_i &= 1 \text{ if } y_i^* \leq \theta_1, \\ y_i &= 2 \text{ if } \theta_1 < y_i^* \leq \theta_2, \\ y_i &= 3 \text{ if } \theta_2 < y_i^* \leq \theta_3, \\ y_i &= 4 \text{ if } \theta_3 < y_i^* \leq \theta_4, \\ y_i &= 5 \text{ if } \theta_4 \leq y_i^* \end{aligned} \quad \text{Eq. 5}$$

The θ_j are the unknown threshold parameters to be estimated simultaneously with β . The probability that the ordered dependent variable y takes possible different values is:

$$\begin{aligned} \text{Prob}(y_i = 1|x) &= 1 - \omega [\beta'x_i - \theta_1] \\ \text{Prob}(y_i = 2|x) &= \omega [\beta'x_i - \theta_1] - \omega [\beta'x_i - \theta_2] \\ \text{Prob}(y_i = 3|x) &= \omega [\beta'x_i - \theta_2] - \omega [\beta'x_i - \theta_3] \\ \text{Prob}(y_i = 4|x) &= \omega [\beta'x_i - \theta_3] - \omega [\beta'x_i - \theta_4] \end{aligned} \quad \text{Eq. 6}$$

$$\text{Prob}(y_i = 5|x) = \omega [\beta'x_i - \theta_4]$$

Where ω denotes a standard normal cumulative distribution function and the cut-points (θ_j) which divide the categories of the dependent variable. The estimation of the parameters of ordered probit modelling is estimated by the maximum likelihood method using the log-likelihood function as follows:

$$L[P_i(y_i)] = \sum_{j=1}^n \sum_{y_i=j} \ln [\omega(\theta_j - x_i' \beta) - \omega(\theta_{j-1} - x_i' \beta)] \quad \text{Eq. 7}$$

Since the coefficients of the ordered probit model are difficult to interpret and, in this study, we are not only concerned about the direction of impact of independent variables but also a sense of the magnitude of their effects, the marginal effects of change in the regressors are also estimated as follows:

If the covariates are continuous variables, the marginal effects of those covariates for j -th response are given by

$$\frac{\partial \text{Prob}[y_i=j|x_n]}{\partial x_n} = [\omega(\theta_{j-1} - \sum_{\theta-1}^{\theta} \beta_n x_n) - \omega(\theta_j - \sum_{\theta-1}^{\theta} \beta_n x_n)] \beta_n \quad \text{Eq. 8}$$

However, according to Mallick (2008), if x_1 is binary dummy variable such as gender, then the marginal effects are computed as

$$\Delta \text{Prob}[y = j|x_n] = \text{Prob}[y = j|x_n + \Delta x_1] - \text{Prob}[y = j|x_n] \quad \text{Eq. 9}$$

However, reporting and interpreting the results of nonlinear models are inherently complicated. To investigate the marginal contribution of x to the outcome, it is essential to select the most appropriate quantity of interest derived from marginal effects in order to best predicting the correct results of the study. To date, there are at least three approaches to generating marginal effects such as marginal effects at representative value (MERs), marginal effects at means (MEMs), and average marginal effects (AMEs). Selecting an approach to generate marginal effects depends on theoretical issues and how the independent variable values are set. Many empirical studies suggested calculating marginal effects at mean of x is not equivalent to calculate the marginal effect for each observation, particularly when most are binary and triple dummy independent variables. According to many critics, with binary variables, the interpretation of MEMs can become problematic as it does not make much sense to take averages

of binary choice variables when partial cross-over between states cannot exist in reality, therefore many researchers prefer to switch from MEMs to AMEs because of difficulties in providing an intuitive interpretation of MEMs (Cameron and Trivedi, 2010, Williams, 2012). In an analogous way as presented by Cornelißen and Sonderhof (2008) and Norton and Dowd (2018), the AMEs can be computed for the case of a mixture of continuous and dummy variable as it averages across the variability in the fitted outcomes. For these reasons, in line with Greene (2003) and Leeper (2017), AMEs was used in this study.

In the first stage, a pooled regression was used where an ordered probit model was applied to the whole sample (n =462) to examine whether the reformed scenarios are associated with intention for cane farming. In this stage, all 30 socio-economic and demographic variables act as controls related to the three scenarios. The empirical model for the first-stage regression is expressed as:

$$I = \beta_0 + \beta_1 \text{scenario} + \beta_2 D_1 + \dots + \beta_{31} D_{30} + E \quad \text{Eq. 10}$$

Where

I = farmers' intention to continue in cane farming in the next five years.

D_1, \dots, D_{30} = socio-economic and demographic variables

E = residual or error term.

In the second stage, the sample was split into three sub-groups on the basis of which scenario was presented to them. Separate regression models were applied to each sub-sample. In each of the three regression models the TPB variables were included alongside the 30 socio-demographic variables. In these models, the 30 socio-economic variables act as controls related to the TPB constructs (attitude, subjective norms, and perceived behavioural control). The equation for these three sets of regression model used is given as:

$$I_n = \beta_0 + \beta_1 \text{attitude} + \beta_2 \text{subjective norms} + \beta_3 \text{perceived behavioural control} + \beta_4 D_1 + \dots + \beta_{34} D_{30} + E_n \quad \text{Eq. 11}$$

Where

I_n = farmers' intention to continue in cane farming in the next five years i.e., I_1 , I_2 , and I_3 represent 'libertarian', 'government proposal', and 'protectionism' scenarios, respectively.

D_1, \dots, D_{30} = socio-economic and demographic variables

E_n = residual or error term i.e., E_1 , E_2 , and E_3 represent 'libertarian', 'government proposal', and 'protectionism' scenarios, respectively

4.4.1.4 Estimating changes in cane production area

Based on available data in from the questionnaire, there are two types of information collected on change in both area and volume of cane farmed in the next five years i.e., value estimate and likelihood of actualization. Both types of information together can be used to generate a probability-weighted estimate of change in cane production in light of different reform scenarios. Therefore, the expected value approach was chosen to estimate these outcomes.

According to Atkinson (1957), the expected value approach can be used to predict possible influence choice which can be determined by one's expectation of the likelihood that outcome will yield from a behaviour and the value that individual place upon that. In statistics, this method is very useful when researcher seeks to estimate unknown parameters based on available data. This procedure can generate a desirable criterion for a good estimator in an unbiased manner. In this setting, the expected value of estimate is equal to the true value of underlying the parameter (Grinstead and Laurie Snell, 2020). The expected value can be calculated by multiplying each of the possible outcomes by the likelihood each outcome will occur. Then, summing all of those values.

Following to Papoulis (1984) the expected valued method applied to this study is presented as:

$$E(x) = \sum_{i=1}^k w_i x_i = w_1 x_1 + w_2 x_2 + \dots + w_k x_k \quad \text{Eq.12}$$

$$= Lp_1 x_1 + Lp_2 x_2 + \dots + Lp_k x_k$$

Where:

$E(x)$ = the expected value of change in cane production area

x = the cane production area farmer currently produced of k -th response

w = a probability weight reflecting change in cane production area of k -th response

L = likelihood probability weights reflecting likelihood of actualization in uniform form

p = parameter value of intention of k -th response based on the five-point Likert scale i.e., ‘definitely no’ (1), ‘no’ (0.75), ‘neither’ (5), ‘yes’ (0.25), and ‘definitely yes’ (0)

To estimate change in cane production area, three subsequent steps was perform following the Eq. 13-14 based on assumptions of farmers’ intention whether they are likely to quit cane production entirely or remain in cane farming to more or less extent.

First assumption is to estimate loss of cane production output resulting from farmers who intend to quit cane farming in the next five years. From the intention question (Q.104.1), farmers who indicated ‘definitely no’ or ‘no’, are assumed to quit cane production altogether. Therefore, the production area loss from these groups was calculated as shown in Eq.13 where likelihood probability weights (L) is equal to 1, assuming 100% loss in cane production area while parameter value of intention (P) of those who indicated ‘definitely no’ and ‘no’ are equal to 1 and 0.75 respectively.

$$\begin{aligned}
 E_{quit}(x) &= \sum_{i=1}^k w_{(quit)i} x_i = w_{(quit)1}x_1 + w_{(quit)2}x_2 + \dots + w_{(quit)k}x_k \\
 &= L_{quit}p_{(quit)1}x_1 + L_{quit}p_{(quit)2}x_2 + \dots + L_{quit}p_{(quit)k}x_k \quad \text{Eq.13} \\
 &= 1p_{(quit)1}x_1 + 1p_{(quit)2}x_2 + \dots + 1p_{(quit)k}x_k
 \end{aligned}$$

Where:

$E_{quit}(x)$ = the expected value of loss in cane production area from those farmers quitting cane production

x = the cane production area farmer currently produced of k -th response

w_{quit} = a probability weight reflecting change in cane production area of k -th response

L_{quit} = likelihood probability weights for quitting cane production to the value of 100%

p_{quit} = parameter value of likelihood to quitting cane production of k -th response based on the five-point Likert scale question (104.1) i.e., ‘Very unlikely’ (1.00) and ‘Unlikely’ (0.75)

Those who intended to remain in cane production can be divided into three subgroups: (i) remaining cane production volume just like they do today; (ii) remaining in cane production but reducing cane production area; and (iii) expanding cane production. However, for farmers remaining in cane production but deviating from what they currently do today, no estimates of the magnitude of the proportionate (ii) decrease, or (iii) increase in cane area were elicited.

To classify farmers into these three subgroups, Q.104 was used, along with, two follow-up questions, as shown below:

Q104.1 I intention to continue cane farming in the next five years.	Definitely no	No	Neither	Yes	Definitely yes
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Q105.5 I would continue growing cane just as I do today.	Very unlikely	Unlikely	Neither	Likely	Very likely
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Q105.6 I would expand the size of my cane area.	Very unlikely	Unlikely	Neither	Likely	Very likely
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Farmers would be considered to remain in cane production just like they do today if they answered:

'Definitely yes' or 'Yes' or 'Neither' to Q.104.1	And	'Very likely' or 'Likely' to Q.105.5
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Farmers would be considered to remain in cane production, but reduce cane production area if they answered:

'Definitely yes' or 'Yes' or 'Neither' to Q.104.1	And	'Very unlikely' or 'Unlikely' and 'Neither' to Q.105.5	And	'Very unlikely' or 'Unlikely' and 'Neither' to Q.105.6
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Finally, farmers would be considered to expand their cane production area if they answered:

'Definitely yes' or 'Yes' or 'Neither' to Q.104.1	And	'Very unlikely' or 'Unlikely' and 'Neither' to Q.105.5	And	'Very likely' or 'Likely' to Q.105.6
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According to above tables, there is no estimate of cane production area loss by farmers who intend to remain in cane production just as they do today as it is assumed to remain unchanged.

To estimate expected value in terms of change in production area in the case of the group who intend to remain in cane production, but varying their production, the value regarding area change was not elicited from the survey. However, if we assume that these values would be normally distributed about the mean within the range 1-99 (percent change) then the group should have a mean of 50%. Hence, we can apply the likelihood probability weights (L) from Q105.3 to this value of 50% to derive a weighted percent change in cane production area where a weighted percent change in cane production area (w) is obtained by multiplication of the likelihood probability weights (L) with the value of 0.5 (50%) and parameter value of intention (P) of Q.105.6.

However, it could be argued that such an estimation would be just as accurate, if not more so, than applying the likelihood probability weights to actual area values estimated by farmers, because there would be several sources of uncertainty over such estimates. First, farmers may not have fully worked out the implications of the scenarios and so not be in a position to give an accurate estimate of how much cane area they would need to adjust; second, this production volume would likely vary from year to year depending on rotational requirements. To achieve greater accuracy in estimating change in cane production area of this group who intended to remain in cane production, but varying cane production outputs, two expected values were generated from Q.105.6 as presented:

First, Eq.14 represents expected value of change to cane production area due to cutting the size of production.

$$\begin{aligned}
 E_{cut}(x) &= \sum_{i=1}^k w_{(cut)i} x_i = w_{(cut)1}x_1 + w_{(cut)2}x_2 + \dots + w_{(cut)k}x_k \\
 &= L_{cut}p_{(cut)1}x_1 + L_{cut}p_{(cut)2}x_2 + \dots + L_{cut}p_{(cut)k}x_k \qquad \text{Eq. 14} \\
 &= 0.5p_{(cut)1}x_1 + 0.5p_{(cut)2}x_2 + \dots + 0.5p_{(cut)k}x_k
 \end{aligned}$$

Where:

- $E_{cut}(x)$ = the expected value of change in cane production area from cutting the size
- x = the cane production area farmer currently produced for the k -th response
- w_{cut} = a probability weight reflecting change in cane production area of k -th response
- L_{cut} = likelihood probability weights for cutting production size to the value of 50%
- p_{cut} = parameter value of likelihood to cut the size of production of k -th response based on the five-point Likert scale question (105.6) i.e., ‘Very unlikely’ (1), ‘Unlikely’ (0.75), ‘Neither’ (0.5), ‘Likely’ (0.25), and ‘Very likely’ (0)

Second, Eq. 15 represents expected value of change to cane production area due to expanding the size of production.

$$\begin{aligned}
E_{expand}(x) &= \sum_{i=1}^k w_{(expand)i} x_i = w_{(expand)1}x_1 + w_{(expand)2}x_2 + \dots + w_{(expand)k}x_k \\
&= L_{expand}p_{(expand)1}x_1 + L_{expand}p_{(expand)2}x_2 + \dots + L_{expand}p_{(expand)k}x_k \\
&= 1.5p_{(expand)1}x_1 + 1.5p_{(expand)2}x_2 + \dots + 1.5p_{(expand)k}x_k \quad \text{Eq.15}
\end{aligned}$$

Where:

- $E_{expand}(x)$ = the expected value of change in cane production area from expanding the production size
- x = the cane production area farmer currently produced of k -th response
- w_{expand} = a probability weight reflecting change in cane production area of k -th response
- L_{expand} = likelihood probability weights to the value of 50%
- p_{expand} = parameter value of likelihood to expand the size of production of k -th response based on the five-point Likert scale question (105.6) i.e., ‘Very unlikely’ (0), ‘Unlikely’ (0.25), ‘Neither’ (0.5), ‘Likely’ (0.75), and ‘Very likely’ (1)

To calculate expected value of change in cane area from production size expansion, we reversed the parameter value of likelihood (p_{expand}) from the 5-point Likert scale. The total production area changes of farmers who express intention to remaining in cane farming, but varying production size would be the sum of these two expected values (Eq.14 +Eq.15).

In consequence, estimating net changes in cane production area in light of three different scenarios were computed by taking the expected values from Eq.13, Eq.14, and Eq.15 in to account based on following assumption:

$$Net\ area\ loss_i = [(E_{quit(i)}x + E_{cut(i)}x) - (E_{expand(i)}x - x)] \quad \text{Eq. 16}$$

Estimating changes in cane production volume were also calculated in the same manner, i.e. on the basis of estimated area using the same equations. Instead of using the cane area in the equations, cane volume was used, this being calculated by multiplying the cane area and cane production yield.

4.5 Results

4.5.1 Descriptive measures of respondents

In total, there were 462 completed and valid questionnaire responses, stratified by farm size groups, from a database of 430,817 registered cane farmers in Thailand (OCSB, date). Of these, 200 were small (43.29%), 200 medium (43.29%) and 62 (13.42%) from large scale farms. The description of the sample is divided into four broad areas: (1) household characteristics; (2) farm characteristics and ownership profile; (3) farm system characteristics; (4) farmer attitudes, i.e. perception of the impact of policy instruments.

4.5.1.1 Household characteristics

Tables 4.7 and 4.8 present summary statistics for farm household characteristics. The results show that there were statistical differences in all characteristics between the farm size groups, except farmer age. The sample shows that nearly half of cane farmers (45.7%) are aged at least 55 years, reflecting the rapid aging of the farming population generally. The Office of Agricultural Economics reported that the proportion of ‘elderly’ farmers (i.e. age over 60 years) increased continuously from 36% in 2008 to 46% in 2018 (Attavanich et al., 2019).

In terms of gender, level of annual income from agricultural enterprises (i.e. above, or below 1 million Baht per year) and number of family members, the differences among three size groups were statistically significant. When compared with the size groups, the larger-sized farmers are likely to be men, earning much greater annual income from agriculture and having larger families.

Clearly, very few small-scaled farmers (2.5%) earn more than 1 million baht (22,600 GBP) from farming annually, while 70 % of medium -sized and almost all large-scaled commercial farmers (96.8%) can. While larger farms tended to have larger families, the difference in number of children in households was not large across all groups, where the means range between 0.84 to 1.48. Similarly, the number of family members working on the farm did not differ significantly between the groups, where the means range between 2.27 (small-medium farm) to 2.75 (large farm). The plausible explanation for this lack of variation could be that, for all groups, only head of the family and their spouse work on farm, i.e. most farms tended to hire labour to work on farm instead of requiring household workers.

Table 4.7 Farm household characteristics (categorical variables)

Characteristics	Household characteristics				Statistical significance of differences
	Small* (n=200)	Medium** (n=200)	Large*** (n=62)	Pooled (n=462)	
	Counts (%)	Counts (%)	Counts (%)	Counts (%)	
Gender of main farm decision-maker					$\chi^2(2) = 49.220$ P = 0.000
Female	84 (42.0) ^{a, b}	34 (17.0) ^{a, c}	3 (4.8) ^{b, c}	121 (26.2)	
Male	116(58.0) ^{a, b}	166(83.0) ^{a, c}	59 (95.2) ^{b, c}	341 (73.8)	
Age					$\chi^2(2) = 3.489$ P = 0.175
< 55	109(54.5)	102(51.0)	40 (64.5)	251 (54.3)	
≥ 55	91 (45.5)	98 (49.0)	22 (35.5)	211 (45.7)	
Educational level					$\chi^2(2) = 29.305$ P = 0.000
Did not compete high school	132(66.0) ^{a, b}	90 (45.0) ^a	20 (32.3) ^b	242 (52.4)	
Completed high school	68 (34.0) ^{a, b}	110(55.0) ^a	42 (67.7) ^b	220 (47.6)	
Cane farming experience					$\chi^2(4) = 14.653$ P = 0.005
≤ 10 years	40 (20.0) ^a	20 (10.0) ^a	9 (14.5)	69 (14.9)	
11-30 years	70 (35.0)	59 (29.5)	26 (41.9)	155 (33.5)	
> 30 years	90 (45.0)	121(60.5)	27 (43.5)	238 (51.5)	
Income from non-agriculture					$\chi^2(2) = 13.236$ P = 0.001
None	93 (46.5) ^{a, b}	123(61.5) ^a	42 (67.7) ^b	258 (55.8)	
Yes	107(53.5) ^{a, b}	77 (38.5) ^a	20 (32.3) ^b	204 (44.2)	
Average annual income from agriculture					$\chi^2(2) = 264.253$ P = 0.000
< 1 million Baht ¹	195(97.5) ^{a, b}	60 (30.0) ^{a, c}	2 (3.2) ^{b, c}	257 (55.6)	
≥ 1 million Baht ¹	5 (2.5) ^{a, b}	140(70.0) ^{a, c}	60 (96.8) ^{b, c}	205 (44.4)	
Employment status					$\chi^2(2) = 23.010$ P = 0.000
Full time	162(81.0) ^{a, b}	189(94.5) ^a	60 (96.8) ^b	411 (89.0)	
Part time	38 (19.0) ^{a, b}	11 (5.5) ^a	2 (3.2) ^b	51 (11.0)	

Notes: Each common superscript letter denotes a subset of categories whose means differ significantly from each other at the 0.05 level from generated from Post-Hoc Test with Bonferroni Correction

χ^2 (df) denotes Chi-square value (degree of freedom)

* Less than 10 ha; ** 10-80 ha; *** More than 80

¹ 1 million Baht ≈ £22,750

Table 4.8 Farm household characteristics (continuous variables)

Characteristics	Household characteristics				Statistical significance of differences ¹
	Small* (n=200)	Medium** (n=200)	Large*** (n=62)	Pooled (n=462)	
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	
No. of family members	4.57 (1.67) ^{a, b}	5.55 (2.38) ^{a, c}	6.53 (3.01) ^{b, c}	5.26 (2.30)	P = 0.000
No. of family members age < 16	0.84 (0.97) ^a	1.04 (1.32)	1.48 (1.66) ^a	1.01 (1.25)	P = 0.002
No. of family members work on farm	2.27 (1.16) ^a	2.75 (1.63) ^a	2.74 (1.98)	2.54 (1.52)	P = 0.003

Notes: Each common superscript letter denotes a subset of categories whose means differ significantly from each other at the 0.05 level from generated from Turkey Post Hoc test

¹Fishers' Exact test

* Less than 10 ha; ** 10-80 ha; *** More than 80 ha

A statistically significant difference was also found for gender of main farm decision-maker between farm size groups ($\chi^2(2) = 49.220, P = 0.000$). Interestingly, smallholder cane farmers are likely to be female while the larger scaled farmers are likely to be male. This trend is likely to result from Thai agricultural land inheritance tradition, In Thai culture, the standard presumption is that the farm property is distributed equally among all children, except in the case of the child who remained with the parents (typically the daughter and the in-laws), who would inherit the house or extra land (Potter, 1976). A study found that in Thailand, farmland was preferably given only to the daughter while usually the moveable property is given to the sons (Mizuno, 1968). Conversely, the study also found that males are likely to operate more the more commercial farms. The larger the farm size, the greater physical abilities and masculine attributes required for more capital-intensive production (Saugeres, 2002). Like many other countries, modern agriculture and rural constructions are economically male-dominated, particularly relating to larger industrial models of farming and highly commodity-focuses production systems (Saugeres, 2002, Trauger, 2004).

The differences in educational level, employment status, and presence of income from non-agriculture were statistically significant between small sized versus medium sized farm and the small sized versus large-sized farm. Both medium-scaled and large-scaled groups have higher levels of education attainment and tend to be full-time farmers but have less off-farm working than the smallest farms. However, over all size groups, more than half of respondent did not complete high school. This finding is consistent with national census data, which reports that most people (64.8%) who work in agriculture have only received primary education (NSO, 2013). Moreover, the current survey results found that more than 80% of all respondents classify themselves as full-time cane farmers, i.e. commercial farms where the respondent commits a minimum number (unspecified) of hours to farm work each week. In relation to this, the result also reveals that these 'commercial' farmers tend to be less reliant on off-farm income sources than the smallest size group. According to Barnaud et al. (2006), Thai small- scaled farmers, particularly cane, rice and cassava farms, often are not able to meet their basic living costs from farming alone. Hence, they tended to increase their self-sufficiency through off-farm employment.

As shown in Table 4.7, length of cane farming experience varied slightly. In this study, overall, 51.5% of respondents have over 30 years of experience in cane farming. Only 14.9% farmers were in the lowest farming experience group of less than 10 years. Of the three farm sizes, medium-scaled farmers tended to have greatest length of experience.

4.5.1.2 Farm characteristics and ownership profile

As reported in Tables 4.9 and 4.11, this study found statistically significant differences in all farm characteristics (size of arable area, size of cultivated cane area, number of farm workers) and ownership profile parameters between farm size groups. The average cane farming area over the size groups was 920 Rais (147 ha) for the large, 209.5 Rais (33.5 ha) for the medium and 22.7 Rais (3.6 ha) for the small-scaled farm respectively. Moreover, the number of farm workers on large-sized farm was almost three times and eight times that of the medium-sized and small-sized farms, respectively.

Table 4.9 Farm characteristics and ownership profile (continuous variables)

Farm characteristics and ownership profile					
Characteristics	Small* (n=200)	Medium** (n=200)	Large*** (n =62)	Total (n=462)	Statistical significance of differences ¹
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	
Area of arable land area (Rais ²)	33.88 (25.12) ^{a, b}	236.51 (136.72) ^{a, c}	1021.53 (901.68) ^{b, c}	254.14 (465.08)	P = 0.000
Cane farming area (Rais)	22.74 (13.26) ^{a, b}	209.55 (117.10) ^{a, c}	920.00 (736.80) ^{b, c}	224.02 (400.80)	P = 0.000
Average cane yield (Tonnes per rai)	13.02 (3.70) ^a	12.30 (3.26)	11.38 (2.72) ^a	12.49 (3.44)	P = 0.003
Tenure arrangement (% owned farmland)	74.63 (36.43) ^a	61.90 (33.67) ^a	67.03 (31.51)	68.10 (35.06)	P = 0.001
No. of farm workers	4.25 (4.04) ^{a, b}	10.07 (8.76) ^{a, c}	27.48 (37.63) ^{b, c}	9.89 (16.83)	P = 0.000

Notes: Each common superscript letter denotes a subset of categories whose means differ significantly from each other at the 0.05 level based on Turkey Post Hoc test

¹Fishers' Exact test

² 1 Rai = 0.16 Hectare (ha)

* Less than 10 ha; ** 10-80 ha; *** More than 80ha

In terms of productivity by farm size, there was an inverse relationship (Table 4.9). The average yield of small farm (13.02 tonnes/Rai) was significantly higher than medium (12.30 tonnes/ Rai) and large farm (11.38 tonnes/Rai). Yields of a similar magnitude were reported by Tukaew et al. (2016) who observed 270 cane farmers in Thailand, and found average cane yields in Thailand for small, medium and large farms of about 10, 7.4 and 6.6 tonnes/ Rai, respectively. It is noted consistently in the literature that the smaller farms tend to outperform the larger in terms of crop yield (Barrett et al., 2010, Ricciardi et al., 2021). It has been hypothesized that this is due the closer management (i.e. making the most efficient use of land and resources) that is possible when smaller areas are farmed (Cornia, 1985, Rosset, 2000).

Table 4.10 Land ownership arrangement

Land ownership	Small* (n=200)	Medium** (n=200)	Large*** (n =62)	Pooled (n=462)
	(%)	(%)	(%)	(%)
Wholly owned land	61.5%	30.5%	33.9%	44.3%
Partly owned and partly rented land	26.0%	61.0%	59.7%	45.7%
Landless (i.e. no access to land)	12.5%	8.5%	6.5%	10.0%

In this study, land tenure arrangement was classified into two categories: owned and rented land. Table 4.10 shows that 44.3% of respondent have full ownership. Another 45.7% operated partly owned and partly tenanted premises while 10% of overall farmers were wholly tenanted (i.e. no access to land). Almost 70% of both medium and large-scaled farmers operated their farm under some form of tenancy, this being broadly twice the rate of the smallest group (38.5%). The results were very similar to those reported by Tukaew et al. (2016) who found that about 52% of Thai cane farmers cultivate their cane under some form of tenancy agreement. The higher rate of land ownership on smaller farms implied by the data from Table 4.10 on the higher rate of tenanted land on larger farms. could be attributed to the farmland inheritance pattern, where small-scaled Thai farmers tended to farm on inherited farmland (Kwanmuang, 2018).

Table 4.11 Farm characteristics and ownership profile (categorical variables)

Characteristics	Farm characteristics and ownership profile				Statistical significance of differences
	Small* (n=200)	Medium** (n=200)	Large*** (n =62)	Total (n=462)	
	Counts (%)	Counts (%)	Counts (%)	Counts (%)	
Machinery ownership					$\chi^2(8) = 117.173$ P = 0.000
Own all farm machinery	43 (21.5) ^{a, b}	127 (63.5) ^a	46 (74.2) ^b	216 (46.8)	
Rent all machinery	41 (20.5) ^{a, b}	6 (3.0) ^a	1 (1.6) ^b	48 (10.4)	
Borrow all machinery	11 (5.5) ^{a, b}	1 (0.5) ^a	1 (1.6) ^b	13 (2.8)	
Partly own and rent machinery	86 (43.0) ^{a, b}	63 (31.5) ^a	14 (22.6) ^b	163 (35.3)	
Others- (e.g. Hiring services)	19 (9.5) ^{a, b}	3 (1.5) ^a	0 (0.0) ^b	22 (4.8)	
Distance from farm to mill					$\chi^2(6) = 61.660$ P = 0.000
≤ 20 km	87 (43.5) ^a	58 (29.0) ^a	23 (37.1)	168 (36.4)	
21-40 km	47 (23.5) ^a	85 (42.5) ^{a, b}	17 (27.4) ^b	149 (32.3)	
More than 40 km	30 (15.0) ^{a, b}	52 (26.0) ^a	22 (35.5) ^b	104 (22.5)	
Delivery to middlemen	36 (18.0) ^{a, b}	5 (2.5) ^a	0 (0.0) ^b	41 (8.9)	
Cane farming area as a proportion of total farmland					$\chi^2(2) = 44.556$ P = 0.000
≤ 75%	84 (42.0) ^{a, b}	31 (15.5) ^a	7 (11.3) ^b	122 (26.4)	
More than 75%	116 (58.0) ^{a, b}	169 (84.5) ^a	55 (88.7) ^b	340 (73.6)	
Regional location					$\chi^2(4) = 85.879$ P = 0.000
North	85 (42.5) ^a	44 (22.0) ^{a, b}	32 (52.3) ^b	161 (35.2)	
Central	38 (19.0) ^a	122 (61.0) ^{a, b}	20 (30.6) ^b	180 (38.7)	
Northeast-East	77 (38.5) ^{a, b}	34 (17.0) ^a	10 (16.1) ^b	121 (26.2)	

Notes: Each common superscript letter denotes a subset of categories whose means differ significantly from each other at the 0.05 level from generated from Post Hoc Test with Bonferroni Correction

χ^2 (df) denotes Chi-square value (degree of freedom)

* Less than 10 ha; ** 10-80 ha; *** More than 80 ha

Table 4.11 shows that the larger the scale of farms, the higher the proportion of farmland devoted to cane production. About 58% of small-scaled respondents devoted more than 75% of farm to cane production. However, the difference between medium-sized and large-sized respondents was not large as more than 80% of farmers in both groups devoted more than 75% of farmland to cane cultivation. In line with Ricciardi et al. (2021), the study found that smaller farms tended to have greater diversity of traditional crops. This is likely to be related to subsistence farming

on these smaller farms. In contrast, mid-sized and large farms, which tend to be more commercial, are more specialised in cane production and tended to plant monocultures since they are simplest to manage with heavy machinery (Rosset, 1999). With the monocultural systems commercial and more specialised farmers can achieve a high profit margin and tend to have lower labour requirements than mixed and low machinery farms (MacDonald et al., 2013).

An association between farm size and machinery ownership was observed ($\chi^2(8) = 117.17, P < 0.05$). Post Hoc test revealed that the medium and large sized farmers tended to both possess and own a greater proportion of farm machinery used in cane cultivation than the smallest farms. Only 21.5% of small-scaled respondents owned all of their machinery, about 26% rent and borrow all while 43% partly own and rent their machineries (Table 4.11). The study by Attavanich et al. (2019) found that Thai farm households renting machinery were concentrated in the smaller size group as it overcame cost issues, thereby helping give small-scaled farmers more access to technology. However, most small farmers still need to buy a few items to complete the necessary tasks involved in producing crops in a timely manner, which resulted in a large percentage of small farmers adopted a combination of owning machineries and renting (Lynn F. et al., 2016). About 10% of small-scaled respondent used custom hire services provided by other quota heads¹⁰ or sugar millers. According to Chaya et al. (2019), Thai small-scaled cane farmers were likely to hire the services from these service providers because they support the timeline of operations and reduce drudgery. On the other hand, medium and large sized farms tended to own more of their machinery for farm operations than they rented. For larger farms, machinery possession is advisable for economic reason, i.e. these farms could have complete control over primary assets (i.e., farm equipment and machinery) where machinery ownership tend to be more cost effective and least expensive choice in long run especially for the high-use machinery and will best cast back the total means accessible to them because they have ownership of these assets, therefore having something to show for the money spent (Akram et al., 2020, Edwards and Meyer, 2001). In contrast, purchasing machinery may not be economically justified and could be costly for small farms due to high investment and depreciation costs and financial constraints compared to their farm revenues (Najafi and Torabi Dastgerduei, 2018).

¹⁰ Quota head represents large-scale cane farmer who manages the cane quota contract for sugar mills. The head of quota can be both farmer and cane collector at the same time. Quota head commonly farms cane around 100 rai or more and generally owns machineries such as trucks, tractors etc. He or she resorts to wage labour for cane plantation, crop care and harvest.

Two modes of cane transportations are used in Thailand: delivering to sugar mill directly, or through collecting center operated by middlemen known as Quota Heads. The survey of farmers showed that 18% of small-scaled farmers delivered their cane via Quota Head while none of large scaled and very few medium scale farmers did (Table 4.11). There are several plausible explanations for this trend: First, that the locations of those small-scaled farm might be so far away from the mill that the transportation costs could be relatively high relative to the value of their production. Alternatively, would be that their production output was relatively very small so that delivering to mill using their own resources would not be economically profitable. Larger farms did not need to use this service due to the volume of cane produce and the increased likelihood that they possessed their own truck. However, most farms were located close to the sugar factory, i.e. about 68.7% of all respondents operated within a range of 40 km from factory because they normally delivered cane to the closest mill in order to save transportation costs and time (Arjchariyaartong, 2007).

The study also found statistically significant difference in farm size across the cane cultivation regions. According to the data collected, the small-scaled farmers were concentrated in the in the North (42.5%) and Northeast-East regions (38.5%), with these being the regions most recently brought under cane cultivation, due to the expansion of sugar mills from the Central region to the North and Northeast regions. According to Rigg (2019), most Thai rural farmers still live in the countryside in primordial village communities.

4.5.1.3 Farming characteristics

Table 4.12 shows that there is statistically a significant difference in past behaviour in cane farming ($\chi^2(2) = 21.715$, $P = 0.000$) and access to loans ($\chi^2(2) = 7.669$, $P = 0.022$) between farm size groups. However, the differences here are relatively small. Table 4.12 reveals that that vast majority of respondents had continuously farmed cane over the past five years (90.7%). This could be related to the cane's life cycle which is around four years.

Table 4.12 also reveals that the majority of respondents obtained loans at the time of survey to support their cane farming business (80.5%), in particular through the Bank for Agriculture and Agricultural Cooperatives (BAAC). These findings support those of Asian Development Bank (1997) which found that, by 1996, about 82% of Thai agricultural households borrowed from the BAAC. Prasara-A and Gheewala (2021) account for this high rate of borrowing in terms of sugar cultivation in Thailand being more mechanized than other competing crops and also the fact that many larger farms need to borrow to invest in a cane harvester.

Table 4.12. Farming Characteristics (access to loans and past behaviour)

Characteristics	Farming Characteristics				Statistical significance of differences
	Small* (n=200)	Medium** (n=200)	Large*** (n =62)	Total (n=462)	
	Counts (%)	Counts (%)	Counts (%)	Counts (%)	
Borrowing loans					$\chi^2(2) = 7.669$ P = 0.022
No	50 (25.0) ^{a, b}	33 (16.5) ^a	7 (11.3) ^b	90 (19.5)	
Yes	150 (75.0) ^{a, b}	167 (83.5) ^a	55 (88.7) ^b	372 (80.5)	
Past behaviour (having farmed cane continuously for the last five years)					$\chi^2(2) = 21.715$ P = 0.000
No	33 (16.5) ^{a, b}	7 (3.5) ^a	3 (4.8) ^b	43 (9.3)	
Yes	167 (83.5) ^{a, b}	193 (96.5) ^a	59 (95.2) ^b	419 (90.7)	

Notes: Each common superscript letter denotes a subset of categories whose means differ significantly from each other at the 0.05 level from generated from Post-Hoc Test with Bonferroni Correction test
 χ^2 (df) denotes Chi-square value (degree of freedom)

* Less than 10 ha; ** 10-80 ha; *** More than 80

Table 4.13 shows that there was no significant difference in having identified farm successor, employing a farm advisor, or the adoption of burnt cane manual harvesting across the three groups. Overall, 63.2% of respondents reported having identified a farm successor. These results are in line with a study on succession decision and inherited land size in Thailand by Kwanmuang (2018), which found that farm size did not significantly affect the likelihood of a successor being identified.

Table 4.13 Farm characteristics (identifying farm successor, having farm advisor and cane harvesting technique)

Characteristics	Farming Characteristics				Statistical significance of differences
	Small* (n=200)	Medium** (n=200)	Large*** (n =62)	Total (n=462)	
	Counts (%)	Counts (%)	Counts (%)	Counts (%)	
Identified a successor					$\chi^2(2) = 2.682$ P = 0.262
No	82 (41.0)	67 (33.5)	21 (33.9)	170 (36.8)	
Yes	118 (59.0)	133 (66.5)	41 (66.1)	292 (63.2)	
Engage in cane burning					$\chi^2(2) = 2.966$ P = 0.227
No	89 (44.5)	90 (45.0)	35 (56.5)	214 (46.3)	
Yes	111 (55.5)	110 (55.0)	27 (43.5)	248 (53.7)	
Having farm advisor					$\chi^2(2) = 3.711$ P = 0.156
No	74 (37.0)	93 (46.5)	26 (41.9)	193 (41.8)	
Yes	126 (63.0)	107 (53.5)	36 (58.1)	269 (58.2)	

Notes: χ^2 (df) denotes Chi-square value (degree of freedom)

* Less than 10 ha; ** 10-80 ha; *** More than 80 ha

About 58% of respondents in this study reported engaging with a farm advisor. Interestingly, closer inspection of this result reveals that about 67% of those who reported having a farm advisor also reported that this advice came from their family and neighbouring cane farmers, while only 10% reported that this advice came from academics or government officers. This

could imply that social norms could play a significant role in knowledge exchange activities of the Thai cane farming community.

As seen in Table 4.13, adopting the burnt harvesting method was more widespread overall than green harvesting. This finding is broadly consistent with OCSB's data (OCSB, 2019) which shows that despite green harvesting being publicly promoted, the burnt cane still accounted for about 50% of all cane entering the refining process in 2019.

Table 4.14 Farm Characteristics (extension communications)

Characteristics	Farming Characteristics				Statistical significance of differences
	Small* (n=200)	Medium** (n=200)	Large*** (n=62)	Total (n=462)	
	Counts (%)	Counts (%)	Counts (%)	Counts (%)	
Participating in farm visits					$\chi^2(2) = 13.805$ P = 0.001
No	121 (60.5) ^a	103 (51.5) ^b	21 (33.9) ^{a, b}	245 (53.0)	
Yes	79 (39.5) ^a	97 (48.5) ^b	41 (66.1) ^{a, b}	217 (47.0)	
Participating in workshops					$\chi^2(2) = 29.908$ P = 0.000
No	139 (69.5) ^{a, b}	105 (52.5) ^{a, c}	20 (32.3) ^{b, c}	264 (57.1)	
Yes	61 (30.5) ^{a, b}	95 (47.5) ^{a, c}	42 (67.7) ^{b, c}	198 (42.9)	
Participating in cane-related meetings					$\chi^2(2) = 1.782$ P = 0.410
No	10 (5.0)	19 (8.0)	3 (4.8)	29 (6.3)	
Yes	190 (95.0)	184 (92.0)	59 (95.2)	433 (93.7)	

Notes: Each common superscript letter denotes a subset of categories whose means differ significantly from each other at the 0.05 level from generated from Post-Hoc Test with Bonferroni Correction

χ^2 (df) denote Chi-square value (degree of freedom)

* Less than 10 ha; ** 10-80 ha; *** More than 80 ha

As shown in Table 4.14, extension communications were determined by three communication methods: (1) visiting other cane farms, (2) attending in cane related meetings or group discussions and (3) attending workshops or training classes. Apart from attending meetings or group discussions, there were statistically significant differences in the prevalence of extension communications between farm size groups. These trends were also reported by Smith and Kahler (1982). Table 4.14 shows that the larger the farm size, the more likely they had participated in training classes or workshops relevant to cane farming, with 68% of large- farmers engaging in extension communication activity compared to just 30.5% of the small-scaled farms.

A similar trend was observed in the likelihood of visiting other cane farms. These results suggest that larger farmers were more enthusiastic and proactive in seeking information and learn more about farming issues and make clear the realities of farming. The rate of participation in meetings or group discussions was universally high, with a sample average of 93.7%.

4.5.1.4 Perception toward impact of reformed policy instruments

Farmers' perception of changes the different elements of the policy reform packages was also investigated in this study. Overall, in the view of farmers, all of the reform measures were very likely to contribute negatively on the industry. No statistically significant difference was observed in farmers' perception of the impact of ending soft loans across three groups (Table 4.15). More than 84% of respondents said they would be negatively affected from abolition of both soft loans and price supports.

Table 4.15 Perception of changes to different elements of the policy package

Characteristics	Perception toward impact of reformed policy instrument				Statistical significance of differences
	Small* (n=200)	Medium** (n=200)	Large*** (n =62)	Pooled (n=462)	
	Counts (%)	Counts (%)	Counts (%)	Counts (%)	
Ending cheap loans					$\chi^2(4) = 9.471$ P = 0.050
Strong negative impact	111 (55.5)	129 (64.5)	46 (74.2)	286 (61.9)	
Moderate negative impact	55 (27.5)	41 (20.5)	7 (11.3)	103 (22.3)	
Neither to positive impact	34 (17.0)	30 (15.0)	9 (14.5)	73 (15.8)	
Domestic sugar price floatation					$\chi^2(4) = 12.621$ P = 0.013
Strong negative impact	104 (52.0) ^{a, b}	131 (65.5) ^a	45 (72.6) ^b	280 (60.6)	
Moderate negative impact	78 (39.0) ^{a, b}	54 (27.0) ^a	15 (24.2) ^b	147 (31.8)	
Neither to positive impact	18 (9.0)	15 (7.5)	2 (2.3)	35 (7.6)	
Abolition of producer price support					$\chi^2(4) = 7.685$ P = 0.104
Strong negative impact	127 (63.5)	139 (69.5)	41 (66.1)	307 (66.5)	
Moderate negative impact	64 (32.0)	43 (21.5)	17 (27.4)	124 (26.8)	
Neither to positive impact	9 (4.5)	18 (9.0)	4 (6.5)	31 (6.7)	

Notes: Each common superscript letter denotes a subset of categories whose means differ significantly from each other at the 0.05 level from generated from Post Hoc Test with Bonferroni Correction

χ^2 (df) denotes Chi-square value (degree of freedom)

* Less than 10 ha; ** 10-80 ha; *** More than 80 ha

However, a statistically significant difference was found between small-scaled farmer and the larger farms in terms of their opinion of the floatation of the domestic sugar price. Interestingly, small-scaled farmers were a little bit more optimistic about domestic sugar price floatation than the larger farms. However, this difference was not large, i.e. less than 10% of respondents across three sizes said the impact would be neutral or positive (90% negative).

4.5.2 Influence of policy reform scenarios on intention to continue cane farming in the next five years

This focus of this analysis is to determine whether reform scenarios would differentially impact farmer intentions to continue in cane production in the next five years and whether any of the socio-economic and demographic variables moderated this. Pooled ordered probit regression

modelling (Table 4.16) and marginal effect analysis (Table 4.17) was used to investigate respondent's attributes on intention.

Table 4.16 shows that the goodness of fit of the regression model, as measured by Prob > χ^2 , is 0.000 signifying statistical significance at better than 1 per cent. The pseudo R^2 is 0.0843, indicating that 8% of variance in intention is explained by the set of regressor variables.

Table 4.16 Influence of policy reform scenarios on farmers' intention to continue cane farming in the next five years and socio-economic and demographic determinants moderating their intention: the results obtained from the pooled ordered probit regression analysis.

Intention to continue cane farming in the next five years				
Explanatory variable	Coefficient	Std. Err.	z	P>z
<i>Scenario</i>				
Government proposal scenario ^a	0.5035*	0.1313	3.83	0.000
Protectionism scenario ^a	0.6395*	0.1339	4.78	0.000
<i>Farmer characteristics</i>				
Gender	-0.2996**	0.1304	-2.30	0.022
Age	0.0249	0.1353	0.18	0.854
Educational level	-0.0115	0.1272	-0.09	0.928
No. of family members	0.0377	0.0347	1.09	0.278
No. of family members age < 16	-0.1457**	0.0575	-2.53	0.011
No. of family members work on farm	0.0043	0.0397	0.11	0.914
Employment on farm (Full or part time)	-0.1682	0.1896	-0.89	0.375
Cane farming experience ≤ 10 years ^b	0.5300*	0.1747	3.03	0.002
Cane farming experience 11-30 years ^b	0.2088	0.1376	1.52	0.129
Average annual income from agriculture	0.0710	0.1485	0.48	0.632
Having off-farm income	-0.0691	0.1136	-0.61	0.543
Past behaviour ^e (i.e., having farmed cane continuously for the last five years)	0.5033**	0.1985	2.54	0.011
<i>Farm characteristics</i>				
No. of workers on farm	0.0008	0.0042	0.19	0.848
North region ^c	0.3955**	0.1569	2.52	0.012
Central region ^c	0.2744	0.1545	1.78	0.076
Distance from farm to mill ≤ 20km^d	0.4310**	0.2090	2.06	0.039
Distance from farm to mill 21-40km ^d	0.2799	0.2147	1.30	0.192
Distance from farm to mill > 40km ^d	0.4093	0.2256	1.81	0.070
Tenure arrangement (% farmland owned)	0.0009	0.0016	0.53	0.596
Area of arable land	0.0008	0.0008	1.09	0.275
Cane farming area	-0.0008	0.0009	-0.80	0.422
Cane as proportion of farmed area ^f	-0.2459	0.1469	-1.67	0.094
Cane yield	-0.0086	0.0164	-0.53	0.597
Machinery ownership	0.0542	0.0406	1.33	0.182
<i>Farming characteristics</i>				
Borrowing credits	-0.0076	0.1465	-0.05	0.959
Participating in farm visits	-0.0469	0.1181	-0.40	0.692
Participating in workshops	0.1811	0.1249	1.45	0.147
Participating in cane-related meetings	0.2791	0.2189	1.27	0.202
Identified a successor	0.1721	0.1184	1.45	0.146
Have farm advisor	-0.2488**	0.1146	-2.17	0.030
Engage in cane burning	-0.2679**	0.1108	-2.42	0.016
<i>Policy instruments</i>				
Ending cheap loans	0.1448	0.0852	1.70	0.089
Domestic sugar price float	0.1461	0.1150	1.27	0.204
Abolition of cane price support	-0.0439	0.1219	-0.36	0.719
<i>Validity statistics</i>				
Number of observations	462			
Log likelihood	-592.5228			
LR χ^2 (36)	109.04			
Prob> χ^2	0.000			
Pseudo R ²	0.0843			

Notes:

Dependent variable is intention to continue cane farming in the next five years, ranging from very unlikely (1) to very likely (5)

^a Libertarian scenario is reference group/category (scenarios are dummy variables)

^b Cane farming experience > 30 years is reference group/category (cane farming experience as dummy variables)

^c East-Northeast region is reference group/category (regions are dummy variables)

^d Delivering cane to middleman is reference group/category (distance from farm to mills are dummy variables)

^e Farming cane continuously in the past five years

^f Proportion of cane farming areas compared to whole farmland

Significance level * p<0.01, ** p<0.05

The average marginal effects of the significant independent variables from the Table 4.16 are reported in Table 4.17 to provide the insight the magnitude of the effects of these significant determinants of intention.

Table 4.17 Average marginal effects of significant determinants of intention

Variable	Very Unlikely	Unlikely	Neither	Likely	Very likely
<i>Intention to continue cane farming in the next five year</i>					
Government proposal scenario ^a	-0.1314*	-0.0289*	-0.0141*	0.1139*	0.0604*
Protectionism scenario ^a	-0.1669*	-0.0367*	-0.0179*	0.1447*	0.0768*
Gender	0.0782**	0.0172**	0.0084**	-0.0678**	-0.0360**
No. of family members age < 16	0.0380**	0.0084**	0.0041**	-0.0330**	-0.0175**
Cane farming experience ≤ 10 years ^b	-0.1383*	-0.0304*	-0.0148**	0.1199*	0.0636*
Cane farming experience 11-30 years ^b	-0.0545	-0.0120	-0.0058	0.0473	0.0251
Past behaviour ^c	-0.1313**	-0.0289**	-0.0141**	0.1139**	0.0604**
North region ^c	-0.1032**	-0.0227**	-0.0111**	0.0895**	0.0475**
Central region ^c	-0.0716	-0.0158	-0.0077	0.0621	0.0329
Distance from farm to mill ≤ 20km ^d	-0.1125**	-0.0247**	-0.0121***	0.0975**	0.0517**
Distance from farm to mill 21-40km ^d	-0.0730	-0.0161	-0.0078	0.0633	0.0336
Distance from farm to mill > 40km ^d	-0.1068	-0.0235	-0.0115	0.0926	0.0491
Having farm advisor	0.0649**	0.0143**	0.0070**	-0.0563**	-0.0299**
Engage in cane burning	0.0699**	0.0154**	0.0075**	-0.0606**	-0.0322**

Notes:

Dependent variable is intention to continue cane farming in the next five years, ranging from very unlikely (1) to very likely (5)

^aLibertarian scenario is reference group/category (scenarios are dummy variables)

^bCane farming experience > 30 years is reference group/category (cane farming experience as dummy variables)

^cEast and Northeast region is reference group/category (regions are dummy variables)

^dDelivering cane to middleman is reference group/category (distance from farm to mills are dummy variables)

^eFarming cane continuously in the past five years

Significance level * p<0.01, ** p<0.05, *** p<0.1

In this regression analysis, the ‘libertarian’ scenario is the default reference category, while ‘government proposal’ and ‘protectionism’ scenarios were set as dummy variables. As shown in Table 4.16, intention discrepancy with the reference scenario is statistically significant for both the government proposal and protectionism scenarios. Hence, there is heterogeneity in the three scenarios which influence cane farmers’ intention to continue cane farming in the next five years. Farmers’ intention to continue in cane production are higher for the ‘government proposal’ and ‘protectionism’ scenarios than the libertarian scenario. On average, implementing ‘government proposal’ or ‘protectionism’ scenarios increases the probability of being in the ‘Very likely’ category (i.e. very likely to continue cane farming in the next five years) by 6% and 7.7% above that of the ‘libertarian’ scenario, respectively (see Table 4.17).

In terms of socio-demographic variables, eight out of thirty potential determinants of intention tested are found statistically significant at 5% level. From Table 4.16, it can be seen that being a male farmer, number of family members age less than 16, having a farm advisor and practicing cane burnt harvesting are all significant and negative determinants of intention. The marginal effect results demonstrated that, on average, being a male farmer, having a farm advisor, or

practicing cane burnt harvesting technique decrease the probability of being in the Very likely to continue category by 3.6%, 3% and 3.2%, respectively. Number of children below 16 years in the household is also negatively associated with intention to remain in cane farming, such that if the number of children increases by one, there is an associated 1.8% fall in the likelihood of being in the Very likely (to continue in cane farming) category.

On the other hand, we found farmers who had farmed cane continuously for the past five years were more likely to continue cane farming than who reported having discontinuous farming during the past five years. The marginal effects results reveal that having production. Continuous production increases the likelihood of being in the Very likely category by 6 %.

Among the categorical variables, farmers who have experience in cane farming of ≤ 10 years are 6.4% more likely to be in the Very likely category than those who have experience above 30 years. Also, farmers in the North region were 4.8% more likely to be in the Very likely category than those farmers in the Northeast and East regions. Those who delivered cane directly to the mill and who have a cane plantation located ≤ 20 km away from sugar mill are 5.2% more likely to be in the Very likely category than those who delivered cane indirectly through a middleman. However, the study did not find statistically significant differences between farmers in the Central region and the referent category, neither was there a difference between those who had cane farming experience between 11-30 years and the referent category, or those who delivered cane directly from farms located more than 20 km radius from mill, and their referent category.

No other socio-demographic variables were found to be statically significant at 5 % level, i.e. they were not found to influence farmer's intention to continue in cane farming in the next five years.

4.5.2.1 Reported alternative actions of farmers who intended to quit cane farming

Figure 4.6 presents the range of possible actions farmers who intended to quit cane farming would undertake and the frequency of each. The study found that 159 of 462 respondents (34.42% of the sample) expressed no intent to continue in cane farming business. Asked what they would do with the farm instead, the most common response, by some margin, was switch to an alternative crop (43.4% of responses), followed by passing on farmland to their successor (23.3%) and retiring from cane business, but still live on farm (22%). Relatively few farmers stated that they would seek opportunities for off-farm employment (1.3%), or either retire and leave their farm without renting out or selling the land (1.9%).

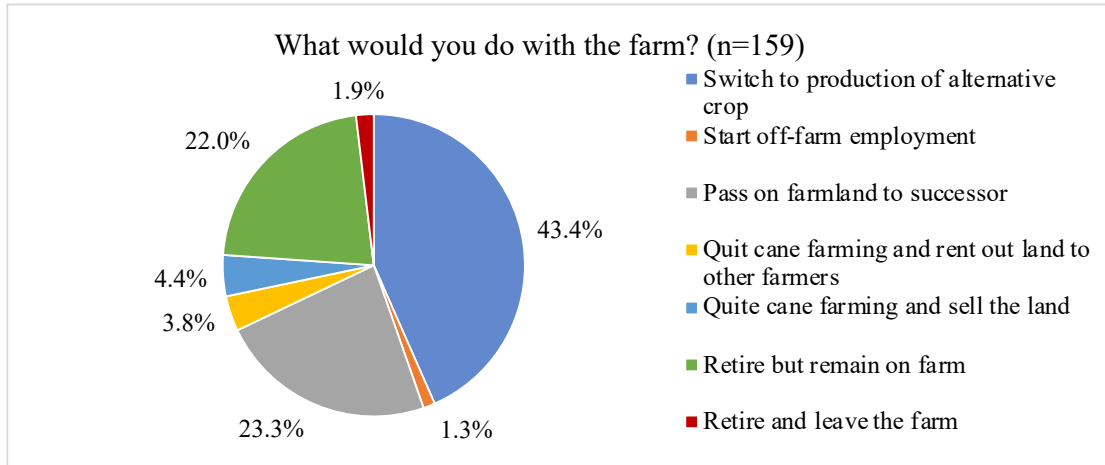


Figure 4.6 Possible actions farmers who intended to quit cane farming would undertake and the frequency of each.

4.5.3 Assessing intention to continue in cane farming under each of three reformed policy scenarios

The aim of this section is to extend the analysis of farmer’s intention to remain in cane farming presented in section 4.5.2. The principal aims of this section are to: investigate Thai cane farmers’ likely response to the three policy scenarios individually; and identify the factors that determine this intention. As a means to understanding the drivers and barriers to farmers continuing in cane production, the conceptual model Theory of Planned Behaviour (TPB) model has been used in predicting farmers’ behavioural intention.

4.5.3.1 Measurement items: variability, reliability, and convergent validity of the TPB components

As illustrated in Section 4.2.2.3.2, separate regression models for direct and indirect constructs were run to check whether indirect or direct measures are the better determinants of intention. Since the predictive power of the indirect TPB construct model is higher than the direct construct, the indirect measurement method was selected for further analysis.

In order to validate and ensuring the coherence of the TPB constructs, two complementary approaches were used to: (i) PCA and (ii) Cronbach’s.

4.5.3.1.1 Test for variability

There are two purposes of performing the principal component analysis (PCA). As illustrated in Section 4.4.1.2, The PCA was performed to validate the TPB constructs and found three factors that were immediately identifiable with the TPB constructs. TPB items from the questionnaire did not always load heavily onto an expected TPB construct and so were removed. The result of this was to reduce the heterogeneity within each TPB construct thereby increasing the coherence of each construct. Table 4.18 presents the retained components of the TPB constructs captured from the PCA analysis.

Table 4.18 Principal components loadings for the three TPB constructs

Variables	PBC (PC1)	ATT (PC2)	SN (PC3)
Have the necessary authority to continue in cane farming	0.930	-0.039	0.242
Have capacity to continue in cane farming	0.930	-0.023	0.257
Have sufficient knowledge to continue in cane farming	0.923	-0.021	0.228
Have got enough skills to continue in cane farming	0.907	-0.020	0.256
Have sufficient resources to continue in cane farming	0.895	-0.012	0.228
Need lots of government support	0.770	0.074	0.156
My business will be strongly negatively affected by the cane price drop	0.083	0.896	-0.069
A drop in domestic sugar price will negatively impact my sugarcane production	0.053	0.890	-0.085
A decrease in domestic sugar price and cane price will negatively affect my income from cane production	0.095	0.857	-0.083
Ending government support will affect my farm business	-0.028	0.820	0.022
Not receiving any price supports will be bad for my cane business ^a	-0.088	0.774	0.081
Not receiving any producer supports related to cane production will be bad for my cane business ^b	-0.078	0.771	0.055
The scenario will damage cane farmers	-0.047	0.648	-0.247
Government	0.251	-0.032	0.890
Sugar millers	0.280	-0.045	0.884
Neighbouring cane farmers	0.285	-0.097	0.856
Family and friends	0.344	-0.052	0.804

Notes: The Kaiser-Meyer Olkin (KMO) is 0.895; The Bartlett's Test is significant = 0.000; The three principal components explain 77.58%; The varimax rotation: values greater than 0.6 are in bold; ^aPrice supports (e.g., guarantee cane price, cane top-up payments); ^b Producer supports (e.g., cheap loans, low credits and interests)

The Kaiser- Meyer Olkin (KMO) test and Bartlett's test were used to test the validity of the PCA outputs as described in Section 4.4.1.2. The results from Kaiser- Meyer Olkin (KMO) test (KMO= 0.895) and Bartlett's test result (p=0.000) supported the use of PCA analysis. The rotated component loadings are presented in Table 4.18. As expected, the statements used to elicit farmer beliefs, i.e. belief-based attitude (ATT), subjective norm (SN), and perceived behavioural control (PBC) can be readily identified with the three principle components (PC) generated. Only six of the original nine beliefs based PBC measures (item 1- 6) and seven out of the original 11 beliefs-based ATT measures (item 1- 5, and item 8-9) were retained in PC1 and PC2, respectively. These are because their PCA factor loadings were all higher than 0.64, i.e above the recommended acceptance value of 0 .5 suggested by Kaiser (1974). PC3 shows

high loadings (>0.8) of all belief-based SN measures presented in the original dataset. Hence, all beliefs-based SN were retained for use in the regression analysis.

4.5.3.2 Descriptive statistics of the TPB components and their reliability

This section presents descriptive statistics results of the TPB components. In addition, as illustrated in Section 4.5.3.1, The Cronbach's α was performed to validate the TPB composite variables for internal coherence of both direct and indirect forms of each TPB dimensions in order to take the decision on whether the direct or indirect forms of each TPB dimension are most correlated with intention.

i) Intention variable

The intention variable has only one component, i.e., it is represented by a single question/variable. The descriptive statistics of this intention variable (or intention statement) under three scenarios is shown in Table 4.19.

Table 4.19 Mean, standard deviation and range for intention component

Scenario	Measure	No. of questions included in the composite measure	Sample mean	Sample SD	Range ¹
Libertarian		1	2.55	1.34	1-5
Government proposal	Intention	1	3.13	1.34	1-5
Protectionism		1	3.36	1.19	1-5

Notes: ¹ Five-point Likert scale where 5=Very likely and 1=Very unlikely

ii) ATT variables (attitude)

Both direct and indirect measures of outcome attitudes/beliefs were taken. Table 4.20 shows the results of the Cronbach's α test for the seven direct measures contributing to the composite TPB measure ATT under each of the 'libertarian', 'government proposal' and 'protectionism' scenarios. These Alpha scores were 0.827, 0.926 and 0.939, respectively, all of which are above the recommended minimum of 0.7 as acceptable alpha recommended by Nunnally (1978), signifying that these different statements can be collated and that the resulting composite represents a coherent TPB dimension. The Cronbach's α score for 11 indirect composite ATT variables ranged between 0.734 and 0.770 (Appendix G). However, removing the four attitude belief components (item 6,7,10 and 11) identified as not strongly loading on the outcome attitude factor in the PCA significantly increases the Cronbach's α score for composite measure under

all scenarios (ranging between 0.890 and 0.923). Hence, these 7 variables are used to define ATT attitudes/beliefs from this point forward.

Table 4.20 Number of items included, mean, standard deviation for direct and indirect composite ATT measure, plus Cronbach's Alpha Coefficients.

Scenario	Measure	No. of questions included in the composite measure	Sample mean ¹	Sample SD	Cronbach's Alpha
Libertarian	ATT (Direct)	7	1.59	0.66	0.827
	ATT (Indirect)	7	4.28	0.70	0.921
Government proposal	ATT (Direct)	7	1.88	0.95	0.926
	ATT (Indirect)	7	4.21	0.66	0.923
Protectionism	ATT (Direct)	7	2.41	1.09	0.939
	ATT (Indirect)	7	4.14	0.77	0.890

Notes: ¹ Sample mean of direct ATT is calculated by mean of Five-point Likert scale e.g. where 5=Bad and 1=Good. The sample means of indirect ATT form is calculated by mean of expectancy value of indirect ATT measure.

iii) SN variables

Both direct and indirect measures of normative beliefs were available for subjective norms. The direct variable had only one component. The Cronbach's α score for the four indirect composite SN variables were high under all scenarios ranged between 0.918 to 0.937 (see Table 4.21), indicating that combining the four together results in a coherent indirect SN construct.

Table 4.21 Number of items included, mean, standard deviation for direct and indirect composite SN measure, plus Cronbach's Alpha Coefficients

Scenario	Measure	No. of questions included in the composite measure	Sample mean ¹	Sample SD	Cronbach's Alpha
Libertarian	SN (Direct)	1	2.74	1.24	-
	SN (Indirect)	4	2.90	0.98	0.918
Government proposal	SN (Direct)	1	3.05	1.21	-
	SN (Indirect)	4	3.32	0.95	0.930
Protectionism	SN (Direct)	1	3.39	1.16	-
	SN (Indirect)	4	3.46	0.97	0.937

Notes: ¹ Sample mean of direct SN is calculated by mean of Five-point Likert scale i.e. where 5=Very likely 1=Very unlikely. The sample mean of indirect SN form is calculated by mean of expectancy value of indirect SN measure.

iv) PBC variables

Both direct and indirect measures of PBC beliefs are. The composite direct PBC measure was created by summing four individual components and the mean score was used to represent this measure. The Cronbach's Alpha scores for PBC-direct under all scenarios ranged between 0.763 and 0.836. The Cronbach's α scores for PBC-indirect before PCA analysis ranged between 0.916

and 0.928. By removing three out of nine items on the basis of the PCA results (item 7-9), the Cronbach's α scores increased to between 0.959 and 0.968 (see Table 4.22). Hence, the retaining six components were accepted into the aggregate PBC variable.

Table 4.22 Number of items included, mean, standard deviation for direct and indirect composite PBC measure, plus Cronbach's Alpha Coefficients

Scenario	Measure	No. of questions included in the composite measure	Sample mean ¹	Sample SD	Cronbach's Alpha
Libertarian	PBC (Direct)	4	3.68	0.82	0.767
	PBC (Indirect)	6	3.98	0.69	0.959
Government proposal	PBC (Direct)	4	3.80	0.76	0.763
	PBC (Indirect)	6	4.04	0.65	0.968
Protectionism	PBC (Direct)	4	3.88	0.94	0.836
	PBC (Indirect)	6	4.19	0.60	0.963

Notes: ¹ Sample mean of direct PBC is calculated by mean of Five-point Likert scale i.e. where 5=Very likely 1=Very unlikely. The sample mean of indirect PBC form is calculated by mean of expectancy value of indirect PBC measure.

While both direct and indirect composite ATT measures correlated significantly with intention (see Appendix H), only the indirect composite form was chosen for use in the regression analysis because its Cronbach's α score (see Table) is higher than the direct form, and also because it is more highly correlated with intent (see Appendix H). For additional verification of this choice, we ran two separate regression models, i.e., one using the direct and the other the indirect forms of the composite measure of TPB dimensions and we found that the indirect measures performed better than the direct, in terms of R² score. All these lines of evidence confirm that the indirect composite of subjective norm (SN) and perceived behavioural control (PBC) should be used in the regression analysis of the drivers of intention to remain in cane farming.

4.5.3.3 Descriptive results of TPB components

Tables 4.19-4.22 present descriptive statistics for intention to continue cane farming, as well as the direct and indirect measures for each of the three scenarios. As shown in Figure 4.7, about 63% of respondent under protectionism scenario express an intention to continue in cane production, followed by 'government proposal' (55%) and 'libertarian' (37%) scenarios, respectively. About 12-15% of the sample under each scenario are uncertain about the likelihood of remaining in cane production within the next five years

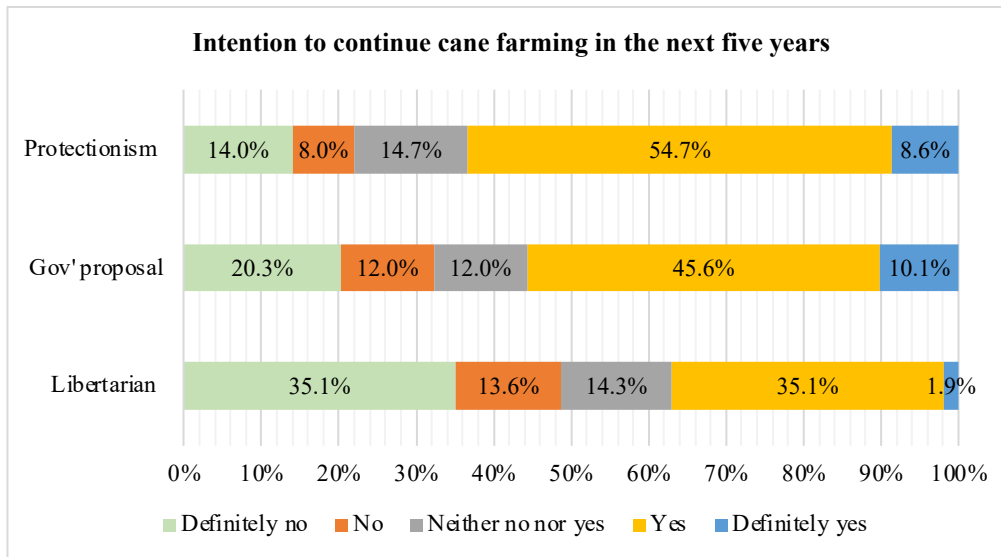


Figure 4.7 Intention to continue cane farming in the next five years

As shown in Table 4.20, direct attitude toward remaining in cane production is quite unfavourable across all three scenarios with a mean value below neutral point, and a high (protectionism scenario) of just 2.41. This suggests that farmers themselves do not have particularly positive attitude towards remaining in cane production across the scenarios. The direct measure of subjective norms shows a slight positive average score under ‘government proposal’ and ‘protectionism’ scenario indicating that farmers perceive that their important others would be moderately supportive of their decision to continue in cane production under those scenarios. However, a value close to the mid-point (2.74) indicates that under the libertarian scenario farmers are uncertain about how approving their important others would be. Average rating scores for perceived behavioural control (direct) under all scenarios were above 3.6, with very small variation indicates. This indicates that scenario does not appear to much affect farmers’ positive opinions about their ability to continue in cane farming (see Table 4.22).

However, to get insight into why farmers hold certain attitudes, and perceptions about subjective norms and level of control, it is significant to consider the beliefs. Beginning with belief-based attitude, we found high average scores with very small variation across scenarios (ranging between 4.14 - 4.28). Since the all statements represent belief-based attitude are all negative, we must inverse the interpretation. Hence, this can be interpreted as farmers having a negative attitude toward the policy scenarios. The mean score of normative beliefs were similar to mean score of direct measure under all scenario, suggesting that farmers under ‘government proposal’ and ‘protectionism’ scenario somewhat perceive encouragement from their important others to continue while those under libertarian scenario appear to be uncertain about the possibility to continue considering perceive encouragement from other important referents. In terms of

perception of control, as shown in Table 4.22, overall, farmers perceive positively that they have sufficient knowledge and resource and necessary authority in successfully farm cane under given policy conditions since the mean scores of all scenarios are above 3.95. However, there are some small variations between scenarios. The mean score of six PBC beliefs were lowest under libertarian scenario (3.98), indicating farmers perceive least control over the cane farming operation under libertarian conditions while farmers are most confident about having sufficient capability, resource and knowledge to farm (4.19) when protectionism scenario is given.

4.5.3.4 Intention to continue in cane farming under three alternative policy scenarios

This section seeks to determine which factors, either policy-related, or inherent in the farm and farmer, determine intention to continue in cane production in the case of each of the three policy packages. Three ordered probit regression models are therefore derived, representing each scenario. Included among the variables tested are the three TPB variables dimensions to capture the effects of attitudes towards the scenarios, peer influence and belief in own ability to continue producing cane and to test the hypothesis H7 is that *farmer decision regarding continuing in cane farming are likely to be influenced by not only the socio-economic and demographic factors but also the TPB dimensions*. The analysis results are summarized in Table 4-23 and Table 4-24 for libertarian scenario, Table 4-25 and Table 26 for government proposal scenario and Table 27 and Table 28 for protectionism scenario.

As shown in Tables 4.23, 4.25 and 4.27, the overall goodness of fit of three scenario regression models, as measured by $\text{Pr} > \chi^2$, are 0.0000 which implies significance at the one percent level. The pseudo R^2 of the libertarian, government proposal and protectionism models are 0.20, 0.27 and 0.28 respectively, indicating that the regression models account for between 20 and 28% of the variance in intention.

4.5.3.4.1 TPB dimensions as drivers of intention

Of the TPB dimensions, all three constructs were found to be significant determinants of intention for all three scenarios. Under all scenarios, attitude about a given policy scenario had a negative and significant influence on intention (All scenarios sig., $p < 0.05$), whereas subjective norm (Libertarian sig., $p < 0.05$ and Government proposal and Protectionism sig., $p < 0.01$) and perceived behavioural controls (All scenarios sig., $p < 0.01$) are found significant and positively associated with intention across all scenarios (Table 4.23, Table 4.25, and Table 4.27).

The marginal effects presented in Table 4.24, Table 4.26 and Table 4.28 provide greater insight into the magnitude of these effects of significant independent variables on the intention under the ‘libertarian’, ‘government proposal’ and ‘protectionism’ scenarios, respectively. All three TPB explanatory variables generate statistically significant marginal coefficients under all scenarios. However, we found that even though all three TPB explanatory variables generate statistically significant marginal effect coefficients, these were relatively small compared to other significant demographic and socio-economic variables. For example, under the ‘libertarian’ scenario (Table 4.24), as the ATT score increases by one unit, the probability of being extremely likely and likely to intend to continue in cane farming decrease by 0.04% and 0.20% respectively. The magnitude of the marginal effects for both SN and PBC were similarly very small. However, in both these cases the association with intention is positive, i.e. a one unit increase in both SN and PBC increase the likelihood being in the Very Likely (to continue cane farming) category by 0.07%. For all three TPB, dimensions the marginal coefficient for ‘neither unlikely nor likely’ is N.S.

Under ‘the government proposal’ scenario, as shown in Table 4.26, it can be observed that a one unit increase in negative attitude towards the government proposal scenario decreases the extreme likelihood of intention to continue by 0.11%. In contrast, a one unit increases in both SN and PBC increases the extreme likelihood of intent to continue by 0.34% and 0.28%, respectively.

Under the ‘protectionism’ scenario, as shown in Table 4.28, a one unit increase in negative attitude towards the protectionism scenario decreases the extreme likelihood of intention to continue by 0.08%. In contrast, a one unit increase in both SN and PBC increases the extreme likelihood of intent to continue by 0.41% and 0.15%, respectively.

4.5.3.4.2 Demographic and socio-economic drivers of intention

Despite the similarities and consistencies of the effects of the TPB variables across of the three scenarios, there is heterogeneity in the other factors which influence cane farmers’ intentions when deciding to continue cane farming across scenarios.

i) The libertarian scenario

As shown in Table 4.23, having off-farm income ($p=0.029$) and having a farm advisor ($p=0.012$) are significant determinants that have a negative impact on intention to remain in cane production, indicating that farmers who have other source of income in addition to agriculture

and farmers who have consulted about cane farming operation with other people, are less likely to continue in cane farming under given libertarian policy conditions. The marginal effects in Table 4.24 reveal that that having access to income from non-agriculture results in a 11.9% decrease in the likelihood that a respondent will score their intention to continue cane farming as 'likely' (the marginal effect coefficient for 'very likely' is N.S.) and having a farm advisor decreases the likelihood of extreme intent to continue by 2.32%.

Past behaviour, i.e. continuously farming cane for the last 5 years ($p=0.043$) and farmer's perception of the ending of cheap loans ($p=0.008$) have a positive effect on intention, indicating that, under this scenario, farmers who have farmed cane continuously in the past five years and perceive that ending soft loans provided by government will have positive impact to their farm operations were more likely to continue in cane farming than those who did not. The marginal effects indicate that past behaviour results in an 11.9% increase in likelihood that a respondent will score the intent as 'likely' (the marginal effect coefficient for 'very likely' is N.S.) and a one unit increase in the positive perceived impact score of change to ending cheap loans increases the likelihood of extreme intention to continue by 1.81%.

For categorical variables, farmers who have 10 years experience or less in cane farming ($p=0.040$) were more likely to remain in cane production than those who have more than 30 years experience (reference category). The marginal effects show that farmers who had ≤ 10 years experience are 16.56 percentage points more likely than farmer with more than 30 years experience to say their intention to continue is likely (the marginal effect coefficient for 'very likely' in N.S) However, no significant difference is found between those who have experienced between 11-30 years ($p=0.702$) and those who have experience above 30 years.

Table 4.23 The influence of TPB variables and socio-economic and demographic determinants on farmers' intention to continue cane farming in the next five years under the libertarian scenario (results from the ordered probit regression model)

Libertarian scenario (n=154)				
Explanatory variable	Coefficient	Std. Err.	z	P>z
<i><u>TPB variable</u></i>				
Attitude	-0.0097**	0.0041	-2.40	0.017
Subjective norms	0.0188**	0.0074	2.56	0.011
Perceived behavioural control	0.0182*	0.0042	4.36	0.000
<i><u>Farmer characteristics</u></i>				
Gender	-0.0801	0.2726	-0.29	0.769
Age	0.2213	0.2920	0.76	0.449
Educational level	0.1260	0.2498	0.50	0.614
No. of family members	0.0037	0.0781	0.05	0.962
No. of family members age < 16	0.0099	0.1263	0.08	0.938
No. of family members work on farm	-0.0385	0.0877	-0.44	0.661
Employment on farm (Full or part time)	-0.0230	0.4430	-0.05	0.959
Cane farming experience ≤ 10 years^a	0.8022**	0.3911	2.05	0.040
Cane farming experience 11-30 years ^a	0.1164	0.3040	0.38	0.702
Average annual income from agriculture	0.0795	0.2899	0.27	0.784
Having off-farm income	-0.5764**	0.2643	-2.18	0.029
Past behaviour^b	0.7954**	0.3926	2.03	0.043
<i><u>Farm characteristics</u></i>				
No. of workers on farm	0.0017	0.0062	0.28	0.782
North region ^c	0.1585	0.3463	0.46	0.647
Central region ^c	-0.4018	0.3311	-1.21	0.225
Distance from farm to mill ≤ 20km ^d	0.2302	0.4828	0.48	0.634
Distance from farm to mill 21-40km ^d	0.1378	0.4733	0.29	0.771
Distance from farm to mill > 40km ^d	0.2051	0.5443	0.38	0.706
Tenure arrangement (% farmland owned)	0.0004	0.0035	0.12	0.905
Area of arable land	-0.0013	0.0021	-0.62	0.534
Cane farming area	0.0015	0.0024	0.62	0.536
Cane as proportion of farmed area ^e	0.1262	0.3356	0.38	0.707
Cane yield	-0.0020	0.0328	-0.06	0.951
Machinery ownership	-0.0424	0.0999	-0.43	0.671
<i><u>Farming characteristics</u></i>				
Borrowing credits	0.1642	0.3050	0.54	0.590
Participating in farm visits	-0.3574	0.2402	-1.49	0.137
Participating in workshops	0.2427	0.2577	0.94	0.346
Participating in cane-related meetings	0.1625	0.4052	0.40	0.688
Identified a successor	-0.3296	0.2515	-1.31	0.190
Have farm advisor	-0.5901**	0.2362	-2.50	0.012
Engage in cane burning	-0.4121	0.2340	-1.76	0.078
<i><u>Policy instrument</u></i>				
Ending cheap loans	0.4600**	0.1725	2.67	0.008
Domestic sugar price float	0.2674	0.2673	1.00	0.317
Abolition of cane price support	-0.2420	0.2831	-0.85	0.393
<i><u>Validity statistics</u></i>				
Observation	154			
Log likelihood	-156.7366			
LR χ^2 (37)	105.82			
Prob> χ^2	0.000			
Pseudo R ²	0.2524			

Notes: Dependent variable is intention to continue cane farming in the next five years, ranging from very unlikely (1) to very likely (5)

^a Cane farming experience > 30 years is reference group/category (cane farming experience as dummy variables)

^b Farming cane continuously in the past five years

^c East and Northeast region is reference group/category (regions are dummy variables)

^d Delivering cane to middleman is reference group/ category (distance from farm to mills are dummy variables)

^e Proportion of cane farming areas compared to whole farmland

Significance level * p<0.01, ** p<0.05

Table 4.24 Marginal effects for explanatory variables on likelihood of continuing cane farming (libertarian scenario)

Variable	Very Unlikely	Unlikely	Neither	Likely	Very likely
<i>Intention to continue cane farming in the next five year</i>					
Outcome attitude	0.0021**	0.0003**	0.0000	-0.0020**	-0.0004***
Subjective norms	-0.0041*	-0.0005**	0.0000	0.0039*	0.0007***
Perceived behavioural control	-0.0040*	-0.0005**	0.0000	0.0037*	0.0007**
Cane farming experience ≤ 10 years ^a	-0.1758**	-0.0218***	0.0005	0.1656**	0.0315
Cane farming experience 11-30 years ^a	-0.0255	-0.0032	0.0001	0.0240	0.0046
Having off-farm income	0.1263**	0.0156***	-0.0003	-0.1190**	-0.0226
Past behaviour ^b	-0.1743**	-0.0216***	0.0005	0.1642**	0.0312
Have farm advisor	0.1293**	0.0160**	-0.0004	-0.1218**	-0.0232***
Ending cheap loans	-0.1008*	-0.0125**	0.0003	0.0949*	0.0181***

Notes:

Dependent variable is intention to continue cane farming in the next five years, ranging from very unlikely (1) to very likely (5)

^a Cane farming experience > 30 years is reference group/category (cane farming experience as dummy variables)

^b Farming cane continuously in the past five years

Significance level * p<0.01, ** p<0.05, *** p<0.1

ii) The government proposal scenario

As shown in Table 4.25, male farmers, those having greater numbers of children age less than 16 and greater numbers of household members working on the farm are the least likely to continue in cane production under the ‘government proposal’ scenario as these variables were found significantly negative (p<0.05). The marginal effects in Table 4.26 demonstrate that being a male farmer decreases the likelihood of the highest intention to continue by 7.89%. It can also be observed that if the number of household members aged less than 16 and the number of household members working on the farm increases by one person, the extreme likelihood of intent to continue decreases by 3.28% and 2.03%, respectively.

Conversely, farmers who obtained an average annual income from agriculture of more than 1 million Bath, those who owned a greater proportion of the land they farmed demonstrate an increased likelihood of continuing in cane production. Based on marginal effects, each additional one percent increase in proportion of farmland owned over rented by farmers increases the likelihood of being in the Very likely category by 0.07% and if a farmer is able to generate average annual income above 1 million Bath, their probability of being in the Very likely intention category increases by 7.25%.

Moreover, for the categorical variables, we also found that farmers who deliver cane directly from farm to mill, regardless of how far their cane plantation is located away from sugar mill (i.e. under all observation groups except reference group), have higher intention ranks than those who delivered cane through middlemen (i.e. reference group) i.e. - an increased likelihood of between 14.14%- 16.85%.

Table 4.25 The influence of TPB variables and socio-economic and demographic determinants on farmers' intention to continue cane farming in the next five years under the government proposal scenario (results from the ordered probit regression model)

Government proposal scenario (n=158)				
Explanatory variable	Coefficient	Std. Err.	z	P>z
<i>TPB variable</i>				
Attitude	-0.0100**	0.0039	-2.56	0.010
Subjective norms	0.0316*	0.0067	4.69	0.000
Perceived behavioural control	0.0264*	0.0043	6.18	0.000
<i>Farmer characteristics</i>				
Gender	-0.7416*	0.2776	-2.67	0.008
Age	0.1187	0.2607	0.46	0.649
Educational level	-0.4419	0.2661	-1.66	0.097
No. of family members	0.1374	0.0781	1.76	0.078
No. of family members age < 16	-0.3084*	0.1180	-2.61	0.009
No. of family members work on farm	-0.1909**	0.0892	-2.14	0.032
Employment on farm (Full or part time)	0.3334	0.4011	0.83	0.406
Cane farming experience ≤ 10 years ^b	0.5508	0.3608	1.53	0.127
Cane farming experience 11-30 years ^b	0.0439	0.2761	0.16	0.874
Average annual income from agriculture	0.6814**	0.3376	2.02	0.044
Having off-farm income	-0.1402	0.2523	-0.56	0.578
Past behaviour ^c	0.5581	0.4111	1.36	0.175
<i>Farm characteristics</i>				
No. of workers on farm	0.0072	0.0144	0.50	0.616
North region ^c	0.4816	0.3000	1.61	0.108
Central region ^c	0.5157	0.3150	1.64	0.102
Distance from farm to mill ≤ 20km^d	1.5367*	0.4644	3.31	0.001
Distance from farm to mill 21-40km^d	1.5844*	0.4645	3.41	0.001
Distance from farm to mill > 40km^d	1.3296*	0.4722	2.82	0.005
Tenure arrangement (% farmland owned)	0.0065***	0.0033	1.99	0.047
Area of arable land	0.0021	0.0014	1.48	0.139
Cane farming area	-0.0029	0.0019	-1.52	0.128
Cane as proportion of farmed area ¹	-0.5000	0.2884	-1.73	0.083
Cane yield	-0.0072	0.0357	-0.20	0.840
Machinery ownership	-0.0249	0.0800	-0.31	0.756
<i>Farming characteristics</i>				
Borrowing credits	-0.1925	0.3103	-0.62	0.535
Participating in farm visits	-0.2469	0.2374	-1.04	0.298
Participating in workshops	0.2181	0.2615	0.83	0.404
Participating in cane-related meetings	0.6445	0.4361	1.48	0.139
Identified a successor	0.3732	0.2394	1.56	0.119
Having farm advisor	-0.2180	0.2622	-0.83	0.406
Engage in cane burning	-0.4372	0.2343	-1.87	0.062
<i>Policy instrument</i>				
Ending cheap loans	-0.1630	0.1520	-1.07	0.284
Domestic sugar price float	0.3527	0.2052	1.72	0.086
Abolition of cane price support	-0.0229	0.2196	-0.10	0.917
<i>Validity statistics</i>				
Observation	158			
Log likelihood	-141.12846			
LR χ^2 (36)	167.38			
Prob> χ^2	0.000			
Pseudo R ²	0.3723			

Notes: Dependent variable is intention to continue cane farming in the next five years, ranging from very unlikely (1) to very likely (5)

^a Cane farming experience > 30 years is reference group/category (cane farming experience as dummy variables)

^b Farming cane continuously in the past five years

^c East and Northeast region is reference group/category (regions are dummy variables)

^d Delivering cane to middleman is reference group/category (distance from farm to mills are dummy variables)

^e Proportion of cane farming areas compared to whole farmland

Significance level * p<0.01, ** p<0.05

Table 4.26 Marginal effects for explanatory variables on likelihood of continuing cane farming (government proposal scenario)

Variable	Very Unlikely	Unlikely	Neither	Likely	Very likely
<i>Intention to continue cane farming in the next five year</i>					
Outcome attitude	0.0013*	0.0003**	0.0003**	-0.0009**	-0.0011**
Subjective norms	-0.0041*	-0.0011*	-0.0010*	0.0028*	0.0034*
Perceived behavioural control	-0.0034*	-0.0009*	-0.0008*	0.0023*	0.0028*
Gender	0.0954*	0.0252**	0.0227**	-0.0645**	-0.0789*
No. of family members age < 16	0.0397*	0.0105**	0.0094**	-0.0268**	-0.0328**
No. of family members work on farm	0.0246**	0.0065***	0.0058***	-0.0166**	-0.0203**
Average annual income from agriculture	-0.0876**	-0.0232***	-0.0209***	0.0592***	0.0725**
Distance from farm to mill ≤ 20km ^a	-0.1977*	-0.0523*	-0.0471**	0.1336*	0.1634*
Distance from farm to mill 21-40km ^a	-0.2038*	-0.0539*	-0.0485**	0.1377*	0.1685*
Distance from farm to mill > 40km ^a	-0.1710*	-0.0453**	-0.0407**	0.1156**	0.1414*
Tenure arrangement (% farmland owned)	-0.0008**	-0.0002***	-0.0002***	0.0006***	0.0007***

Notes:

Dependent variable is intention to continue cane farming in the next five years, ranging from very unlikely (1) to very likely (5)

^a Delivering cane to middleman is reference group/category (distance from farm to mills are dummy variables)

Significance level * p<0.01, ** p<0.05, *** p<0.1

iii) The protectionism scenario

Under the ‘protectionism’ scenario (see Tables 4.27 and 4.28), it was observed that farmers who farm cane as part-time job, those who had visited other farms in the past five years as part of extension communication and those who have higher numbers of children aged < 16 in the household are less likely to continue in cane farming under this scenario. The marginal effects suggest that farming cane as part-time job decrease the probability of being extremely likely to intend to continue in cane farming by 13.62%. Moreover, for each one additional child aged < 16 in the household, there is 3.43% fall in the extreme likelihood of intention to continue and having been on farm visits in the past five years decreases the extreme likelihood of intention to continue by 6.14%.

Conversely, we found that farmers who reported practicing burnt cane harvesting are more likely to have an intention to continue under this scenario than those who fully adopted fresh cane harvesting technique, as engaging in the burnt harvesting technique increases the extreme likelihood of intention to continue by 4.88%.

Moreover, the result reveals that farmers who had cane farming experience ≤ 10 years are more likely to continue than those who had experience above 30 years. Membership of a farmer group with 10 years experience or less in cane farming increases the likelihood of being in the extreme likelihood category by 8.11%. However, a group of farmers who have experience between 11-30 years is not significant.

Table 4.27 The influence of TPB variables and socio-economic and demographic determinants on farmers' intention to continue cane farming in the next five years under the protectionism scenario (results from the ordered probit regression model)

Protectionism scenario (n=150)				
Explanatory variable	Coefficient	Std. Err.	z	P>z
<i><u>TPB variable</u></i>				
Attitude	-0.0085**	0.0039	-2.20	0.028
Subjective norms	0.0444*	0.0078	5.73	0.000
Perceived behavioural control	0.0158*	0.0050	3.18	0.001
<i><u>Farmer characteristics</u></i>				
Gender	-0.0895	0.2818	-0.32	0.751
Age	-0.2826	0.3278	-0.86	0.389
Educational level	0.1737	0.2893	0.60	0.548
No. of family members	0.0432	0.0712	0.61	0.544
No. of family members age < 16	-0.3707*	0.1300	-2.85	0.004
No. of family members work on farm	-0.1059	0.0989	-1.07	0.284
Employment on farm (Full or part time)	-1.4732*	0.4439	-3.32	0.001
Cane farming experience ≤ 10 years^b	0.8770**	0.3639	2.41	0.016
Cane farming experience 11-30 years ^b	0.3075	0.3119	0.99	0.324
Average annual income from agriculture	0.0574	0.4058	0.14	0.888
Having off-farm income	-0.4789	0.2451	-1.95	0.051
Past behaviour ^c	0.3379	0.4408	0.77	0.443
<i><u>Farm characteristics</u></i>				
No. of workers on farm	-0.0088	0.0159	-0.56	0.578
North region ^c	-0.1539	0.3643	-0.42	0.673
Central region ^c	-0.3438	0.3915	-0.88	0.380
Distance from farm to mill ≤ 20km ^d	-0.3724	0.4291	-0.87	0.385
Distance from farm to mill 21-40km ^d	-0.1126	0.4501	-0.25	0.802
Distance from farm to mill > 40km ^d	0.4281	0.4669	0.92	0.359
Tenure arrangement (% farmland owned)	-0.0002	0.0038	-0.05	0.964
Area of arable land	-0.0030	0.0023	-1.26	0.206
Cane farming area	0.0037	0.0027	1.36	0.173
Cane as proportion of farmed area ^f	0.2426	0.3484	0.70	0.486
Cane yield	-0.0037	0.0347	-0.11	0.916
Machinery ownership	0.0370	0.0893	0.41	0.678
<i><u>Farming characteristics</u></i>				
Borrowing credits	0.0017	0.3293	0.01	0.996
Participating in farm visits	-0.6644**	0.2773	-2.40	0.017
Participating in workshops	0.1278	0.2780	0.46	0.646
Participating in cane-related meetings	0.5941	0.5577	1.07	0.287
Identified a successor	0.5328	0.2772	1.92	0.055
Having farm advisor	-0.4557	0.2560	-1.78	0.075
Engage in cane burning	0.5283**	0.2485	2.13	0.033
<i><u>Policy instrument</u></i>				
Ending cheap loans	-0.1605	0.2158	-0.74	0.457
Domestic sugar price float	0.4338	0.2753	1.58	0.115
Abolition of cane price support	-0.4159	0.2519	-1.65	0.099
<i><u>Validity statistics</u></i>				
Observation	150			
Log likelihood	-126.50097			
LR χ^2 (37)	137.28			
Prob> χ^2	0.000			
Pseudo R ²	0.3518			

Notes:

Dependent variable is intention to continue cane farming in the next five years, ranging from very unlikely (1) to very likely (5)

^a Cane farming experience > 30 years is reference group/category (cane farming experience as dummy variables)

^b Farming cane continuously in the past five years

^c East and Northeast region is reference group/category (regions are dummy variables)

^d Delivering cane to middleman is reference group/category (distance from farm to mills are dummy variables)

^e Proportion of cane farming areas compared to whole farmland

Significance level * p<0.01, ** p<0.05

Table 4.28 Marginal effects for explanatory variables on likelihood of continuing cane farming (protectionism scenario)

Variable	Very Unlikely	Unlikely	Neither	Likely	Very likely
<i>Intention to continue cane farming in the next five year</i>					
Outcome attitude	0.0009**	0.0003***	0.0004***	-0.0009**	-0.0008**
Subjective norms	-0.0049*	-0.0016*	-0.0022*	0.0046*	0.0041*
Perceived behavioural control	-0.0017*	-0.0006**	-0.0008**	0.0016*	0.0015*
No. of family members age < 16	0.0411*	0.0132**	0.0180**	-0.0381*	-0.0343*
Employment on farm (Full or part time)	0.1634*	0.0526**	0.0716*	-0.1513*	-0.1362*
Cane farming experience ≤ 10 years ^a	-0.0973**	-0.0313**	-0.0426**	0.0901**	0.0811**
Cane farming experience 11-30 years ^a	-0.0341	-0.0110	-0.0149	0.0316	0.0284
Participating in farm visits	0.0737**	0.0237**	0.0323**	-0.0683**	-0.0614**
Engage in cane burning	-0.0586**	-0.0188***	-0.0257***	0.0543***	0.0488**

Notes:

Dependent variable is intention to continue cane farming in the next five years, ranging from very unlikely (1) to very likely (5)

^a Cane farming experience > 30 years is reference group/category (cane farming experience as dummy variables)

Significance level * p<0.01, ** p<0.05, ***p<0.1

4.5.4 The impacts of the policy scenarios on the number of active producers and the volumes of cane produced

In this section, farmers stated intentions with respect to remaining in cane production, the alternative actions they might take, together with their self-assessment of the likelihood of these alternative actions, has allowed the estimation of the impact of these reform scenarios on the number of active producers and the volumes of cane produced where expected-value approach was used to estimate these changes. Table 4.29 and Figures 4.8 and 4.9 present the results generated from expected-value approach as demonstrated in Section 4.4.1.4.

4.5.4.1 Overall impacts of scenarios

As shown in Table 4.29, the results support the hypothesis H8 that all reformed scenarios will have negative impact on the Thai cane-farming sector, but the degree of these impacts is uneven. In terms of impact on number of producers, under the ‘protectionism’ scenario, farmers are more likely to continue cane farming than under other scenarios so that about 78% of respondents would continue their cane farming operations. In contrast, the ‘libertarian’ scenario is likely to result in greatest losses in terms of number of farmers, so that nearly half of respondents (48.7%) indicated they would quit cane production if this scenario is to be implemented.

Table 4.29 The results of impacts of scenarios on the number of active farmers and the volumes of cane produced.

Impacts	Libertarian scenario	Government proposal scenario	Protectionism scenario
% of cane loss volume (Quit)	34.42%	26.95%	15.67%
% of cane loss volume (Reduce)	3.63%	0.82%	4.79%
% of cane volume increase from production expansion	0.49%	0.60%	1.07%
<u>% of net volume loss</u>	<u>37.56%</u>	<u>27.16%</u>	<u>19.39%</u>
% of farmers indicating they would quit cane production	48.70%	32.28%	22.00%
% of farmer intended to continue with same production size	42.21%	62.03%	68%
% of farmers intended to continue but reduce production size	8.44%	3.16%	8.00%
% of farmers intended to expand cane production	0.65%	2.53%	2.00%
<u>% of farmers would remain in cane farming</u>	<u>51.30%</u>	<u>67.72%</u>	<u>78.00%</u>
<u>Tonnage of cane lost* (million metric tons)</u>	<u>49.19</u>	<u>35.57</u>	<u>25.40</u>
<u>Market value**</u>	<u>-42.02%</u>	<u>-24.56%</u>	<u>-2.12%</u>

*Note: *** Compared to government 2018/19 database (period when survey was collected)

Of those farmers who intended to stay in cane production, three likely responses were indicated: (1) continuing cane farming just like they do today without change to production scale, (2) reducing cane production scale, and (3) expanding cane production scale.

The results in Table 4.29 reveal that a majority of farmers who intended to stay in cane farming are likely to continue without making changes to the scale of their cane production, especially under the ‘protectionism scenario. As expected, the greatest number of farmers who intended to reduce the scale of their production was under the libertarian scenario (8.44%), but the differences from the other scenarios are not large. However, it is notable that only a very small minority of farmers would expand their production under any scenario (maximum of 3%). Under the libertarian scenario, almost no farmers intended to expand their production size (0.65%).

In terms of impact on volume of cane produced, as expected, the libertarian scenario (37.56%) is likely to result in the greatest losses in terms of cane production volume, a fall of 37.5%, followed by government proposal scenario (27.16%) with losses under libertarian scenario was almost double to protectionism scenario (19.39%). These production losses in terms of cane market values are found to be considerable across three scenarios. By comparing with market value data from the OCSB’s cane and sugar MY 2018/19 report (this is the period that they survey was undertaken), it can be seen that if the libertarian scenario was implemented, the cane industry would face market value loss of about 42.02%. This is due to the lost production

volume, compounded by the cut on the price of cane (this scenario has the largest cut in price of any scenario). This impact is almost double that of the government proposal scenario (-24.56%).

Since the cane price used for government proposal scenario was slightly above the actual cane price in MY2018/19 (i.e. 725 Baht/tonne (£16.69) under the scenario and 700 Baht/tonne (£16.12) in reality), the market loss estimated from the survey (24.56%) is slightly lower than the actual cane volume loss observed (27.16%), but the real-world losses are still quite large. Most importantly, even though the volume of cane produced is projected by the survey to decrease by 19.39% under the protectionism scenario, the associated loss of market value would be minimal, decreasing only 2.12% compared to reference year, due to the higher cane price presented under this scenario.

4.5.4.2 Thai cane farmers' intentions for cane farming in the next five years under the three scenarios by farm size

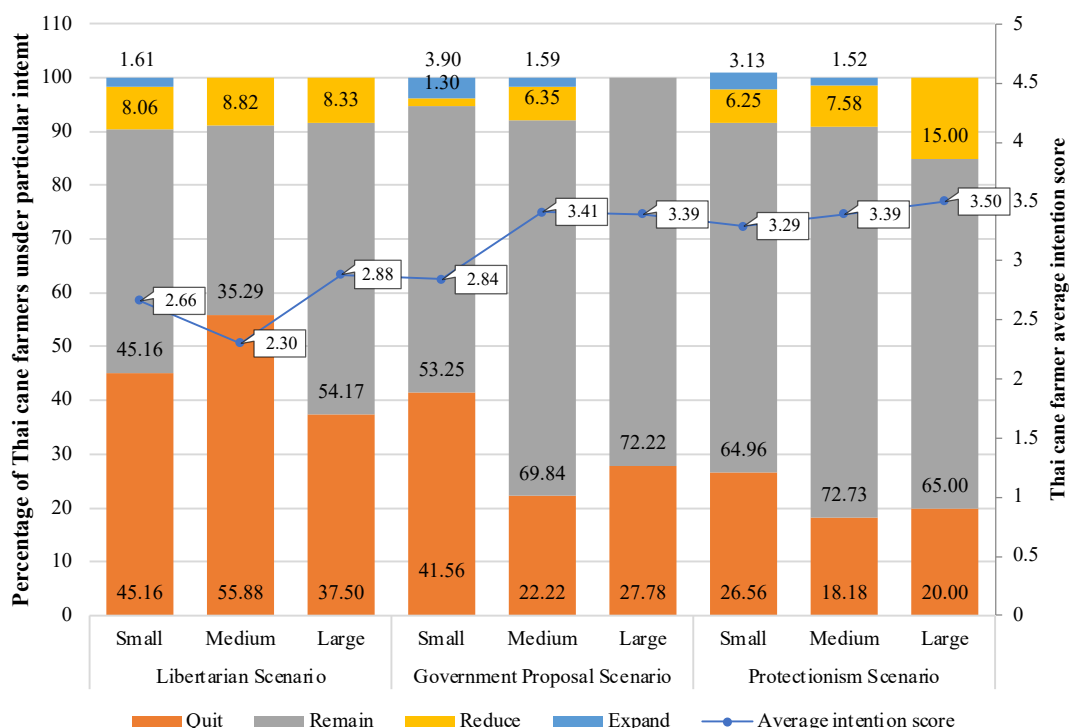


Figure 4.8 Producers farming responses to the scenarios by farm size.

Figure 4.8 elucidates Thai cane farmers' intention and likely responses under the three scenarios classified by farm size. The average intention scores show significant difference in relation to continuing in cane farming between first four bars in the diagram and the rest, indicating that

farmers of all sizes under the ‘libertarian’ scenario and small-scaled farmers under ‘government proposal’ scenario were uncertain about staying in cane production in the next five years, as their average intention scores are close to the neutral point (ranging between 2.30 to 2.88) while medium to large sized farmers under ‘government proposal’ scenario and farmers of all sizes under ‘protectionism’ scenario are likely to continue in cane production since the average intention score were above 3.25.

The results reveal that mid-sized producers are the group that are likely to be most affected by the libertarian scenario, as over half of them (55.88%) express the intention to quit cane farming if this scenario is to be implemented. This result is in line with the average intention score of this group (2.30) which was below the neutral point and found to be lowest across all categories. Small-scaled farmers are likely to be the most affected group under ‘government proposal’ and ‘protectionism’ scenarios with 41.56% and 26.56% quitting cane production, respectively.

Table 4.30 Net loss in cane volume under each scenario by farm size

	% Vol. loss (Quit)	% Vol. loss (Reduce)	% Vol. increase (Expand)	% Total loss Vol.
Libertarian Scenario	34.42%	3.63%	0.49%	37.56%
Small	35.13%	6.05%	2.26%	38.92%
Medium	51.27%	3.97%	0.24%	55.00%
Large	24.89%	3.29%	0.52%	27.67%
Government Proposal Scenario	26.95%	0.82%	0.60%	27.16%
Small	34.32%	0.91%	1.58%	33.65%
Medium	24.74%	1.58%	1.05%	25.27%
Large	28.27%	0.00%	0.00%	28.27%
Protectionism Scenario	15.67%	4.79%	1.07%	19.39%
Small	17.77%	2.18%	1.36%	18.59%
Medium	12.97%	3.26%	2.12%	14.12%
Large	18.09%	6.57%	0.00%	24.67%

No large-scaled farmers, under any scenario, intended to expand cane production, while only a few small to medium sized farmers did. While the largest farms are most likely to remain in cane production under any scenario, considerable production volume losses do still occur as shown in Table 4.30, due to farmers at this commercial production scale quitting cane or reduce their cane production volume. These data, therefore, support the hypothesis H9 i.e. *There are differences in business response to the reform scenarios among farmers in different farm size class.*

4.5.4.3 Thai cane farmers' intention toward cane farming in the next five years under the three scenarios based on proportion of farm devoted to cane production

Figure 4.9 illustrates Thai cane farmers' intention and likely responses under the three scenarios based on proportion of the farm devoted to cane production. The results reveal that the percentage of farmers who intended to quit cane production for the groups who devoted more than 75% of the farm to cane production were lower than those who devoted less than 75% under any scenario, suggesting that the more specialized the farmer in cane production, the more likely they are to remain in cane production under any policy reform. In general, therefore, this finding suggested that the hypothesis H10 i.e. *there are differences in business response to the reform scenarios between farmers with high degree of specialisation in cane farming and those are more diversified* was supported. Most importantly, the percentage of these cane-specialized farmers that they intended to stay in cane production increases remarkably when moving from the libertarian to the government proposal and protectionism scenarios, respectively.

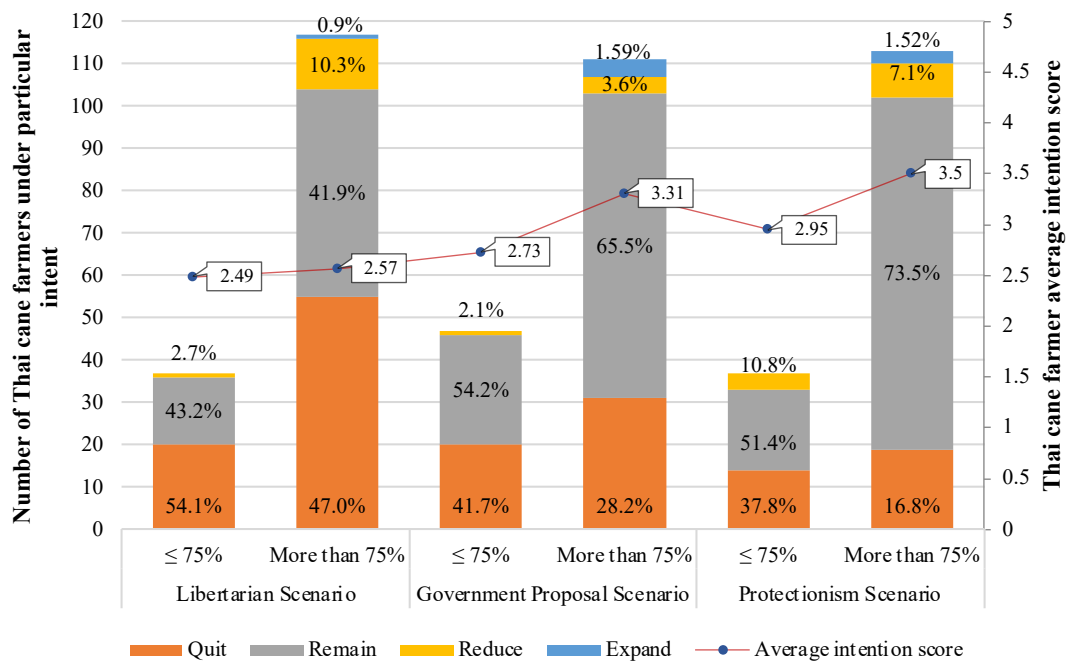


Figure 4.9 Producers farming responses to scenarios by proportion of farm devoted to cane production.

However, it is worth noting that under the 'libertarian' scenario, nearly half of farmers devoting less than 75% (54.1%) or devoting more than 75% (47%) of farm to cane production groups intended to quit cane farming. The findings were also in consistent with the average intention scores, where the scores for both classified groups under this scenario were very close to the neutral point, suggesting that about half of farmers, regardless proportion of the farm devoted to

cane production, were uncertain about their intention to continue in cane farming if the ‘libertarian’ scenario was to be implemented.

Finally, the results also showed that farmers, under any scenario, did not intend to expand cane production, except a few of the most cane-specialized producers.

4.6 Discussion

4.6.1 Influence of reformed scenario on intention to continue in cane farming

From pooled regression modelling we found that the policy scenarios themselves are the primary determinant of intention, but there are also secondary socio-economic and demographic influences. Therefore, the hypothesis H6 was supported. The picture that emerges from this analysis is that farmers across the entire study area are less likely to continue in cane production under the ‘libertarian’ scenario, with the greatest level of intention under the ‘protectionism’ scenario.

The analysis has also uncovered that several farm and farm household characteristics influence intentions. Female farmers are more likely to continue in cane production than males. A possible explanation for this is that Thai female farmers are more likely to own the land they farm, having smaller farms, have fewer on-farm workers and make less use of credit markets, so they are less likely to have debts than male (Bryant and Gray, 2005). Hence, it can be implied that Thai female farmers, may have better economic resources and less worker responsibility and so are better equipped to remain in cane production, small-scaled farms in particular, than their male counterparts.

The more children age less than 16 in the farm household, the higher intention to discontinue in cane farming. This result could be attributed to an income effect. The possibility of fall in income resulting from cuts in cane price is likely to have more damaging effect on the farm households with larger numbers of children, because income needs are higher.

The most experienced farmers are less likely to continue in cane farming as policy protections are withdrawn than the least experienced group. This observation is attributed to the fact that farmers in the most experienced group are much nearer to retirement and experiencing declining physical strength and so feel they lack the personal resources required to adapt their agricultural production process survive under a more challenging trading environment (Guo et al., 2015). Ma and Yang (2005), Zhou (2009), Genius et al. (2008) and others have shown that policy reforms leading to new and more difficult macroscopic conditions, such as the need to introduce

more industrial management, loss of agricultural subsidies and lower production prices can often trigger retirement plans.

Farmers in the North region were more likely to continue in cane production than those in the Northeast and East regions. However, no statistical significance was found between Central and Northeast and East regions. These results are likely to be driven by higher average cane yields on farms and lower costs of production in the North region. As observed in this study, average cane yield in the North, Central, Northeast and East regions were 13.2, 12.5, 11.8, and 10.6 tonnes per rai, respectively. Arjchariyaartong (2007) also found lower costs of production per tonne of cane in the North region (3,725 Baht/rai, compared with 4130 Baht/rai in the Northeast and (4,200 Baht/rai in the Central region).

The study also found that those farmers who had continuously farmed cane in the previous five years were also more likely to remain in cane production under declining policy protections. Indeed, factor had as large an effect on intention as the scenario itself. Ouellette and Wood (1998) suggested that past behaviour is likely to be a contributing factor that can affect intention directly through automatic repetition of previously established habitual routines. In line with present results, several studies have demonstrated that past behaviour has a stronger influence on agricultural intention than the standard socio-economic factors and even a change in government supports such as subsidy payments (Barnes et al., 2016, Lobley and Butler, 2010).

Surprisingly, farmers who reported not using advisor services were more likely to express an intention to continue under conditions of removal of policy supports than those who did report being proactive about getting farm advice. This observation could be attributed to the fact that farm advisors can provide the information beyond agronomic such as relating to the economic and market situation. Therefore, if these farmers who might be judged as more progressive are being alerted by their advisor about negative consequences of policy changes, they will be more likely to be willing to adapt to the new policy regime through using formalized judgments about farm operations and want to take remedial actions, including leave farming.

Another important finding was that farmers who practiced green harvesting, by both mechanical and manual techniques, are more likely to express an intention to continue in cane farming with falling farm supports than those who either semi or entirely adopt burnt cane harvesting, possibly due to the price premium paid by sugar mills for green cane relative to burnt cane (Sawaengsak and Gheewala, 2017) because of its higher weight and CCS level (commercial cane sugar value) (Boontum et al., 1995). In contrast, explanation for farmers who adopted burnt cane harvesting

are less likely to continue in cane farming could be attributed to price deduction applied to the basic cane price for burnt cane (Pornprakun et al., 2019, Wirochthanachai, 2021)

4.6.2 Intention to continue in cane farming under three reformed policy scenarios

Since the reform scenarios were found to influence farmers' intention to remain in cane production, this study also sought to determine which factors within the reform package most influenced farmers' intention. Most previous studies of this nature predominantly tend to focus on socio-economic drivers of change, with little emphasis on the psychological factors that affect farmers' intentions. For example, Barnes et al. (2016) and Lobley and Butler (2010) investigated farmers' responses to CAP reform and sought drivers of responses based on socio-economic factors alone. In an attempt to avoid this limitation, this study adopted an integrative approach, examining how a mix of socio-economic and psychological factors affect farmers' response to the policy reforms.

Comparison across the three sets of regression results, i.e., one for each policy scenario, shows that there are both similarities and inconsistencies in the significance of drivers of intention to continue in cane farming in the next five years. The study found that both economic and non-economic factors are significant determinants of farmer's intent.

4.6.2.1 Socio-psychological drivers of intention

In terms of psychological variables, there was a good deal of consistency across the three scenarios. Among these psychological factors was: (1) the extent to which farmers believed the removal of government supports will damage profitability; (2) Social pressure; and (3) farmers' belief in their own ability to successfully farm cane under the new sugar regimes, i.e. – the three components of TPB. This confirms the applicability of this conceptual framework to this context, and the necessity of taking farmers' beliefs into account when seeking to explain farmer decisions. Surprisingly, despite being statistically significant determinants of farmers' intention, none of the TPB variables are particularly dominant factors under any of the scenario. This low explanatory power is signalled by the low R^2 values obtained from regression models (i.e., R^2 values of the protectionism, government proposal, and libertarian scenarios were 0.35, 0.37, and 0.25, respectively). This low discriminatory power results from the high degree of consistency in attitudes towards the three policy scenarios. To illustrate, the liberalisation scenario, being the most extreme scenario, is perceived, almost universally, as likely to have a negative impact on farmers, resulting the weakest explanatory power for the TPB variables across all scenarios.

However, despite the low discriminatory power of the TPB variables, adding the TPB variables into the regression models did modestly increase the total explanatory power of the models.

4.6.2.1.1 Attitudes towards outcomes (the policies)

The negative significant effect of attitude toward continuing in cane production found here suggests that farmers' intention, under all scenarios, is influenced by the extent to which they believe the policy package will be damaging to their cane farming business. This means farmer may have a general interest in continuing, but may feel they would be unable to do so due to the new policy environment. This finding is in line with Gorton et al. (2008) who found that farmers' beliefs about the survival of their farm business depends on agricultural policy regimes.

4.6.2.1.2 Perceived Behavioural Control

Consistent with other studies (Borges et al., 2014, Daxini et al., 2018, Yanakittkul and Aungvaravong, 2020), it was found that intention to continue in cane farming under any scenario, is also driven by the strength of farmers' intrinsic belief in their own capability, skill, knowledge and resources, and necessary authority over farm management decisions. This means that farmers who believe that they have sufficient and necessary control-capability to continue in cane are more likely to express an intention to continue. This is consistent with the findings of past studies that farmers can be driven by 'stewardship motives' which is continuing simply in cane production regardless the scenarios because they know they can (Chouinard et al., 2008, Mutyasira et al., 2018)

4.6.2.1.3 Social norms

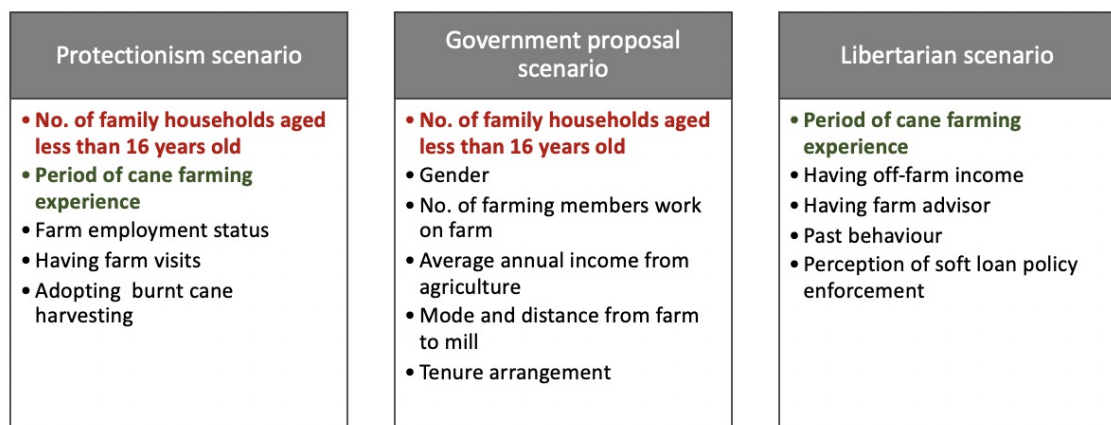
According to Burton (2004), social norms influenced farmers' intention because farmers do not make decisions in isolation and are impacted by dependent on social and cultural influences, e.g. the views of family members, friends, neighbouring farmers, and others (Borges et al., 2014, Senger et al., 2017). Similarly Chin et al. (2016) extended this list, identifying customers, such as processing companies, as also having an influence. The positive significant effect of subjective norms on intention in all models provides strong evidence that social drivers exist and support this assertion where farmers perceive encouragement of their important referents to continue. The study identified that subjective norms are the strongest psychological predictor on intention of all the TPB variables, an effect also found by Laple and Kelley (2013) However,

Garforth et al. (2004) suggested that there is heterogeneity in the degree to which farmers are motivated to comply with different important referents and this suggest that efforts should be made to identify those which have greater impact.

This study was able to obtain insights into the degree of effect of important referents. It was found that, consistent with the findings of Donati et al. (2015) “neighbouring behaviour”, impacts intention under the sector liberalisation and government proposal scenarios. The strong influence of family and friends is consistent with the results of Borges et al. (2014), Martínez-García et al. (2013) and Senger et al. (2017) who pointed out that the closer persons are to farmers, the greater the influence on decisions they have. On the other hand, under the protectionism scenario the support of sugar millers and government are considered most important. This must be a consequence of the greater availability of income support from these sources under this scenario, and the greater dependence on these institutions, an effect also found Donati et al. (2015).

4.6.2.2 Socio-economic drivers of intention

This study found that the most dominant determinants of farmers’ intention are demographic and socio-economic variables. However, there were both similarities and inconsistencies in the significance of these drivers of intention across three scenarios, as shown in Figure 4.10.



Notes: Colour codes identify variables that are common between scenarios

Figure 4.10 The similarities and inconsistencies of demographic and socio-economic determinant of farmers' intention under three scenarios.

4.6.2.2.1 The Libertarian scenario

i) Access to off-farm income

Under Libertarian scenario, farmers who have off-farm income sources are more likely to state they intend to continue in cane farming than those who have no access to off-farm income. In reviewing the literature, a possible explanation for this might be that farmers without alternative income sources are often older and have restricted to off-farm employment, thus they are generally reluctant to change their current production practices in the face of uncertain situations (Xie and Wu, 2020). In contrast, the effect of liberalisation policy is likely to influence farmers who had access to off-farm incomes to actively disengage from cane farming operations due to uncertainty and instability associate with cane farming under such a scenario.

Since these diversified farmers are often less risk averse, than undiversified farmers due to having alternative sources of income that can provide more income stability to cover the family's basic needs, this means these farmers are likely to have greater ability to withdraw from farming, particularly if non-agricultural income can offset loss of farming income (Xie and Wu, 2020, Zhang et al., 2018). The finding is consistent with that of Lobley and Butler (2010) who investigated farmer intentions about farming following the implementation of the 2003 CAP reforms and that of Lobley and Potter (2004) who investigated farmers' response to agricultural restructuring in the UK, both of which found that farmers most likely to cease farming are those who are least dependent on agricultural income.

ii) Past behaviour

Past behaviour, i.e., continuous farming of cane over the past five years, was found to have the large positive effect on likelihood of intent to continue. Ouellette and Wood (1998) offer an explanation for this observation, arguing that behaviour is often initiated by automatic operations and lines in conjunction with conscious intentions. On this basis, past behaviour can be conceived as an auto-regressive predictor of current/future behaviour.

iii) What aspects of the policy reforms has the most impact?

Farmers' perception of changes to different elements of the policy packages was also investigated in this study, in determining intention alongside the socio-economic and psychological predictors. Interestingly, ending soft loans was found to be only policy

determinant on intention under this scenario. Clearly, farmers who perceived themselves as more dependent on cheap loans from government are unlikely to remain in cane production under the Libertarian scenario. These farmers tend to face income insufficiency leading to low-saving and indebtedness and where their farm operations are dependent on use of agricultural rural credit (Attavanich et al., 2019). Attavanich et al. (2019) found that Thai farming household debt and its accumulation had been increasing over time where debt is incurred most for working capital, followed by agricultural investment. Yanakittkul and Aungvaravong (2020) investigated Thai rice farmers' intention toward farming and showed that if farmers evaluate support of government low-interest loan as positive to farming, they will intend to grow the crop. The results from policy consultation also provide evidence of the extreme importance of cheap loans policy. Several policy stakeholders pointed out that lack of financial capital has already been a major barrier for farming development, and so the cheap loans scheme must be the last policy instrument to be taken away, especially if farmers are also having to incur huge price cuts and decreased income support (Interviewee 11 and 17). By contrast, Yanakittkul and Aungvaravong (2020) did not find that income or price support policy affected Thai farmers' intention about farming, but investment and infrastructure assistance, cultivation knowledge and techniques and low-interest loans did.

This study found that two types of farmers were most likely to express an intention to remain in cane production. First, independent farmers who perceived themselves as less dependent on state support tended to intend to stay in production. These farmers were also less reliant on borrowing to invest and so they have better control over resources and fewer liquidity constraints. The second group were those with status quo bias who were optimistic about the impact of implementing this policy. Attavanich et al. (2019) used a survey and game styled questions to elicit aspects of behavioural biases known to affected Thai farmers and found that about 60% of Thai farmers convey some degree of status quo bias and are generally more optimistic than others. This may lead them to underweight the probability of loss while the probability of gain may be overweight. As a result, they will be more accepting the current circumstances, with increased likelihood of staying as they are.

iv) Engaging with farm advisors

Interestingly, the study result reveals that farmers under libertarian scenario who did not engage with farm advisors are more likely to continue in cane farming than those who did. Without any farm consultant, farmers tended to lack up-to-date information on the economic and market

situation. They tended to have not been made fully aware of the impacts of policy changes. This, when combined with status quo bias, leads them to reject change (Attavanich et al., 2019, Dockès et al., 2019, Siebrecht, 2020). In contrast, we also found that farmers who reported getting farm advice are more likely leave cane farming. This finding can be explained by further result we observed in our analysis that the majority of farm advice (81%) came from other cane farmers, family members and millers while less than 10% reported getting farm advice from academics, extension advisors or government officers.

It is possible to hypothesis that farmers who did engage with farm advisor in this study tended to be more passive about seeking information and getting farm advice. They usually got the advice from their neighbouring cane farmers and friends, therefore, they tended not getting proper scientific-based advice. If these farmers are being told by other cane farmers that they are not going to continue cane farming under this new policy environment, they would likely to follow the others because they tended to make their decision about farming based on subjective norms of what they perceived from the views of other people they value. It is possible that these farmers may be less sufficient, unable to make much improvement compared to those who were advised by professional and independent advisors and may believe that they cannot success in cane farming under the new policy environment. Therefore, they are more likely to want to leave cane farming.

v) Period of cane farming experience

Finally, the farmers with the longest experience in cane farming (i.e., more than 30 years) are more likely to abandon cane farming than the least experienced farmers under this scenario and also under the protectionism scenario. In general, it could be assumed that these longer-established farmers tended to be more elderly, are much nearer to retirement, and so are likely to have less physical resources than their younger counterparts (Xie and Wu, 2020). Moreover, being older, they tended to have lower levels of education and extension communication service attainment. These factors taken together suggest that this group are both less able to find adaptation strategies and have less energy to deliver them. Confronted with major cuts in government support, coupled with already low profit margins, this group are much more likely to accelerate retirement plans than younger farmers. In contrast, based on past studies (Barnes et al., 2016, Douarin et al., 2007, Willock et al., 1999), this study assumed that younger farmers tend to be more innovative and seek a change in farm operations with respect to agricultural adaptation and associated activities rather than withdrawing from farming.

All in all, under the libertarian scenario, farmers with better capital resources who did not rely on low-interest credit for farm operations, farmers who had access to off-farm income, who tended to have less degree of risk aversion and younger farmers were least likely to remain in cane production. Hence, these farmers are more likely to be more adaptive to the new policy regimes and able to improve their level of self-sufficiency than older farmers and those more dependent on cheap borrowing. Moreover, the absence of farm advisor or lack of professional and scientific farm advice could be barrier to change and make and improvement in the face of loss of extreme policy change. Whilst certain degree of price cuts and deduction of government supports result under all of the scenarios, the losses under this scenario are by far the most severe. Therefore, the pressure to innovate and increase level of self-sufficiency are lower under the other scenarios, meaning that it does not matter so much if farmer have access to farm advisor or off farm income or not, because farmers can continue to rely on government support schemes such as cheap loans and higher cane price. In this sense, farmers under the libertarian scenario seemed to experience higher degree of both loss and risk than other scenarios. According to Attavanich et al. (2019) when loss and risk are high, this could significantly decrease Thai farmers' incentives to invest.

4.6.2.2.2 The Government Reform Proposal scenario

i) Mode of cane delivering

Under the government proposal scenario, it was found that mode of cane delivering and exerts the maximum effect on intention to continue in cane production. Farmers who delivered cane directly from their farm to mill using their own haulage vehicles are much more likely to stay in cane production than those who selling their harvested cane to an intermediary known as a Quota Head. Quota Heads are often very large-scaled cane growers who manage the quota contract for other, smaller millers, who cannot afford their own haulage equipment and who may be located far from the receiving mill. A study by Arjchariyartong (2007) suggests that mode and distance of cane transportation from farm to factory is significant factor affecting the competitiveness of cane producers, because delivery to an intermediary involves lower prices. In the extra time cane spend at the collect center before being delivered to mill, results in a loss of CCS, further reducing price. Moreover, we also found that the shorter distance from mill, the higher likelihood of intention to continue. The reason is evident, lower transportation costs, and higher cane sweetness content (CCS.) leads to higher prices. Donati et al. (2015) also found that farm distance from mill also influenced farmers' behavioural intention to change durum wheat acreage in response to CAP reform.

ii) Land ownership

As hypothesized, in addition to mode of cane delivery, land ownership matters a great deal in this scenario. We found that the farmers with higher proportion of rented agricultural land are less likely to stay in cane production under government proposal scenario. This result may be explained by the fact that renters need higher returns to pay land rent and this is therefore likely to make them more risk averse, because they cannot afford mistakes. Kahan (2008) defined risk-averse farmers as those who tend to be more cautious with preferences for less risky sources of income. In this case, if rents have to be found, a minimum return from each hectare of land is required. Hence, if cane no longer provides these farmers a minimum return, staying in cane production with lower profit margin under the government proposal scenario could be seen as an elevated risk. As a result, these farmers would switch to another crop. On the other hand, owner occupiers are more likely to accept higher opportunity costs of their own capital. They could be prepared to accept lower returns than renters because they do not have to find rent. Moreover, the lower intention to exit cane farming observed in farmers with a greater proportion of owned land may be attributed to land tenure security, as higher proportions of owned land is related to greater stability of land control and better wealth (Velandia et al., 2009), thus these could reduce the probability of exiting.

iii) Gender

The results of this study also demonstrated that female farmers intended to stay in cane production more than men. Here as structural inequalities of gender may be causative, i.e. female farmers would usually face greater constraints to diversification, such as access to irrigation, extension services, and credit (leading to lower levels of mechanization) and agricultural inputs, (Agarwal, 2013, Agriculture Organization & International Fund for Agricultural Development, 2009) and often bear much more burden of domestic and farm work (Agarwal and Agrawal, 2017). However, past studies have shown that in a great number of developing countries, a greater proportion of men than women tend to leave farming, especially at times of agrarian crisis, (Pattnaik et al., 2018, Slavchevska et al., 2016). This finding may be explained by the fact that women tend to have fewer options and viable livelihood alternative outside agriculture due to lower education attainment than men on average and be forced to undertake farm activities that have been left by men.

iv) Gross annual income from agriculture

Farmers who are able to generate annual farm income more than 1 million Baht are more likely to stay in cane production than the others. In this case, it is most evident that this binary variable is operating as a proxy of farm size which may more plausibly explain intention. This result may be explained by the fact that these larger farms are wealthier and more resource-use efficient, having more confidence in their skill, having higher possibility to adjust themselves into the new environment (Douarin et al., 2007, Genius et al., 2008). Hence, they tend to be more flexible in their response, thus the less probability to exist farming business. The study of Mbowa (1996) who investigated farm size and economic efficiency in sugarcane production also demonstrated that large cane farms had better efficiency in resource utilization as they are better endowed in human resource capital, higher incentives to acquire more farming knowledge and face lower input cost relative to farm income. On the other hand, smaller farmers often constrained by significant lower farm income, access to modern technologies and agricultural service, deficit resource captive and face high input cost relative to farm income which restrict their productive capacity (Das and Ganesh-Kumar, 2017, Mbowa, 1996). Moreover, through the nature of monocrop culture of cane farming, these small-scaled farmers are unlikely to undertake crop diversification. An implication for this is the possibility that larger and more efficient farms are able to maintain higher profit levels in the face of price and support cuts than smaller and less efficient farmers, who may see revenues fall below costs of production.

v) Number of household members aged less than 16 years old

Number of household members aged less than 16 was the only common determinant of intention to continue in cane production under the 'government proposal' and 'protectionism' scenarios. The more children and teenagers there are in a family, the less likely the farmer is to report an intention to continue in cane farming under both scenarios, while under libertarian scenario, the price drop so great so that difference in number of children and teenagers does not make any difference toward continuation. A possible explanation for this trend is provided by Väre (2007), who observed that the more children there were in a farming household, the more likely early retirement is. The explanation for this is that larger numbers of children are usually associated with older eldest children, who may present succession opportunities.

A second possible explanation is that having larger number of children in Thai farm households often do not provide more family labour for the farm. Specifically in the case of Thai agriculture, as the Labour Protection Act sets the minimum age of child labour for agricultural work at 15

and The Thai Sugarcane Association has signed a Declaration of Commitment to Combat child Labour, expressed in their intention to be certified as a workplace free of child labour at farm level (Rachelle et al., 2017). The hypothesis that child labour is not extensively used on Thai cane farms is also supported by the results from descriptive analysis which found that the mean of number of family members work on farm in this study is about 2.5 (SD=1.52), suggesting that parents are the only family members working on-farm. Therefore, the more children are in the family, the more greater and more stable the income required. Hence, it is possible that these farms are more likely to exit farming under conditions of falling farm income than those who have less responsibility to childcare expenses.

4.6.2.2.3 The Protectionism Scenario

Under the Protectionism scenario which represents the least extreme scenario of government support removal and policy deregulation, the findings reveal that despite receiving the healthiest price and highest level of protection compared to the other scenarios, respondents in this group still have negative views about the impact of this scenario on their farming operations.

i) Employment on farm

Full-time cane farmers are more likely to continue in cane farming than part-time cane farmers, likely because they are better equipped with more flexible production technologies, may be more experienced, and may be better able to adjust labour to changing needs, and thus lower the variability of aggregate output (Weiss, 2001). For this type of farmers, the picture is one of adaption and retrenchment rather than determined discontinuation from cane farming. Moreover, Pfeffer (1989) reported that compared to full-time farmers, part-time farmers tended to have lower expectations about continuing to farm in both short and long run, Similarly, access to off-farm work is found to have a positive effect on the exit probability of American (Roe, 1995) and Australia farmers (Weiss, 1999). In this study, part-time cane farmers can be classified into two types: (i) operating full-time agricultural farming but farming cane as part-time job; and (ii) having off-farm job as a means of supporting the family. In the first case, if the farmers believe that continuing in cane farming under given circumstances will damage profitability, these farmers have the option to switch from cane production to their permanent crop production. In terms of farmers whose off-farm work is their major source of income, often these farmers operate small farms. Hence, it has been suggesting that part-time farming facilitates an easier exit than full-time farming. Several studies concluded that having off-farm work is the first step

to farm exit (Bollman, 1982, Kimhi, 2000). However, Bollman (1982) argue that employment status was not an indicator of farm abandonment, finding that full-time and part-time farmers exit farming at about the same rate. However, several studies concluded that the greater the proportion of household income derived from off-farm work, the greater tendency to exit (Ali and Peerlings, 2011, Boyd, 1998, Raggi et al., 2013). The plausible reason behind farm exit of part-time farmers is that with income from cane farming falling, the opportunity cost of labour committed to cane farming becomes too high and so part-time farmers switch to fully off-farm income, with their previous experience of it making the transition easier.

ii) Participating in farm visits

Surprisingly, we found that farmers who had visits to other cane farms during the past five cropping years are less likely to continue in cane farming under protectionism scenario. Based on descriptive analysis, these farmers do not operate large-scaled farms. They tended to have higher education level, having farm advisor and participated more in other extension communication mechanism such as attending in farming workshops but seem to have lower productivities in terms of cane yield. Hence, it can be implied that they tended to have better capability to evaluate the future economic consequence in respect to policy reforms that will impact their farm operation and seek advice more widely from other important referents in the communities and often have better scientific advice from academics and agricultural extension officers. These qualities, together with their better level of educational attainments, mean that they are more likely to be able to identify opportunities to diversify out of cane production and/or engage in off-farm jobs. The fact of their lower cane productivity means that they are more vulnerable to cuts in cane revenues than more productive producers. This result is consistent with the findings of other studies such as Morgan-Davies et al. (2012) who studied farmers' responses to Scottish policy reform. They found that farmers who operated medium-sized farms at low levels of productivity, tended to be most educated, and usually take neighboring farmers' decision and views into account before making their own decisions. Such farmers tended to be more adaptive and more likely to start ventures outside farming.

iii) Cane harvesting technique

Lastly, cane harvesting technique was also found to be determinant of farmer intention under this given policy scenario. In contrast to the result from pooled regression model, farmers who reported adopting burnt-harvesting method to their cultivating practices are more likely to

continue in cane production than those who fully adopt green harvesting. According to Sawaengsak and Gheewala (2017) and Tukaew et al. (2016), using mechanized green harvesting would affect production costs due to longer harvesting time and higher labour requirement. These higher labour and fuel costs could negatively affect income even with the higher prices, especially for small and medium-scaled farmers who would be more adversely affected by cane price cuts than their larger counterparts.

4.6.2.3 Summing up

In sum, according to these data, we can infer that the principal determinants of intention to continue cane farming under the three scenarios are farm and farming characteristics, while socio-psychological factors, including outcome attitude toward impact of policy, social pressure and their belief in their own ability to successfully farm cane under the new policy regimes are not such dominant factors. By inferring the regressions, the TPB variables may not be good at explaining the differences in intention between respondents in this study. This may be explained by the fact that most farmers had similar: perceived levels of encouragement from important others, perception of their own ability to continue, and attitudes towards the reform scenarios. In support of this explanation it is observed that the explanatory power of the outcome attitudes variable is weakest under the Libertarian scenario, which represents the most extreme loss of government support, due to the uniformity of attitudes (i.e., entirely negative) toward the scenario.

It is somewhat surprising that no variable was found to be significant determinants on intention in all three scenarios. This result may be explained by the fact that as the scale of revenue losses increases, new factors become important in determining intention. For example, number of children may be a key determinant on intention to continue cane farming when revenue cuts are modest (i.e., under the ‘protectionism’ and ‘government proposal’ scenarios) as fewer number of children, the less responsibility to children expense. Thus, the smaller and less stable the income required may be able to help reduce damaging effect on the farm households’ expenses to offset these modest income losses, but it may be overtaken by the presence of off-farm income opportunities when income losses become severe (i.e., under the ‘libertarian’ scenario). It is possible, therefore, that there may be no means to offset severe losses with tweaks to households’ expenses. Hence, alternative income sources needed to be sought. Some variables such as cane harvesting technique and employment status, which were only found to be significant under protectionism scenario is another example explanation to farmers’ intention to stay in cane

production under different scales of revenue losses. Despite giving the healthiest and highest cane price compared to other scenarios, somewhat degree of price cuts would still emerge under the protectionism scenario. Full-time cane farmers who are better equipped with more flexible production technologies and better at adaptation to changing needs and those who face lower production costs occur during harvesting may be able to stay in cane production under this circumstance than the others, but none of these farmers may not be able to continue in cane production when revenue losses from price cuts and removal of government supports become larger than that point (i.e., under the ‘government proposal’ and ‘libertarian’ scenario).

On the other hand, difference in terms of gender, farmland tenure arrangement, farm size, and mode and distance of cane transportation significantly affect farmer’s intention, but only through government proposal scenario. An implication of this is the possibility that maybe there is different “price threshold’ of which each type of farmers decide that they can or cannot continue. Given the gender dimension as an example, female farmers are more likely to stay in cane farming than men under ‘government proposal’ scenario. But, in libertarian scenario, due to remarkable drop in cane price, thus gender does not contribute any differences since it is possible that most people whose even gender it is could say they could not continue under those circumstance. At the other end of ‘protectionism’ scenario where cane price is highest, more men may be willing to continue than ‘government proposal’ scenario. Hence, gender may become neutrality.

4.6.3 The effect of policy reforms on future planning behaviour and farming practice

The results of the study show that the three policy scenarios would have a significant impact on future farm planning and management. Specifically, the scenarios would impact on the number of active cane producers and the areas and volumes of cane produced. Far from ushering in period of rapid industry restructuring in a wake of WTO-enforced changes to Thai cane and sugar regimes, the results of this research suggest that any type of possible policy reforms will only likely reinforce many existing trends. However, the study suggests that the scale of these accelerated trends, under any type of policy scenario, is likely to have a significant impact on the future shape of cane farming.

Farmers are most likely to continue cane farming under the ‘protectionism’ scenario and least likely under the Libertarian scenario – the numbers exiting are twice as high. In terms of the impact on production volumes, due to the effect of the extreme cane price cut, compounded by effect of loss of support under the ‘libertarian’ scenario, the value of cane produced would fall

by half compared to 2019/20, while under the Protectionism scenario the market value loss would be modest at -2.12%. Secondly, very few of the farmers remaining in production would consider expanding their cane production under any scenario. This finding is not surprising since all scenarios would result in less favourable trading conditions compared to 2019. This finding accords with studies on CAP reform scenarios which found that the reduction or removal of public support payments tends to decrease the expansionist tendencies within the EU livestock farming population (Barnes et al., 2016) and the EU farm sector in general (Bartolini and Viaggi, 2013). The majority of farmers who intended to stay in cane production indicated that they intended to continue with their pre-reform production patterns post reforms. Under any scenario, only a minority of producers (around 10%) indicated that they intended to remain in cane production but downsize their cane farming operations. What is apparent is that Thai cane farmers are making binary choices about future cane production, i.e., to either continue producing cane on the same scale as before the reforms, or quit cane production altogether, but rarely vary their scale of production. Several studies provided some context for explaining these trends. Such ‘tenacity’ in the face of adverse policy changes may have a number of causes (Lobley and Butler, 2010). First reason relates to the underlying fixity of assets in agriculture and high exit costs, such as facing penalties for early contract terminations and having to continue to pay loans, which makes discontinuation in cane farming become more difficult. Second, due to the specialist nature of the education and skills in cane farming, farmers could be relatively immobile (Latruffe et al., 2013). Also, like most Australian cane growers (Windle and Rolfe, 2003), the experience of most Thai cane farmers is with monoculture cropping alone, hence they may have limited experience with managing other crops. This could lead to reluctance in farmers to consider diverting some land out of cane production to unfamiliar crops, particularly due to associated issues such as risk, lack of training and skills, and lack of equipment. Other possible reasons for preferring to remain in cane farming in the face of deteriorating trading conditions are: the non-pecuniary benefits of farming and the affection for the profession of farming (Gorton et al., 2008, Howley et al., 2015): high levels of competitiveness and the relative price stability in the Thai cane sector due to the existence of the Thai cane and Sugar Act. For these reasons, farmers may be willing to accept a reduction in their welfare from farming, including the non-pecuniary benefits, even though the economic conditions worsen because they could offset some of the benefit lost from reduced profits.

At a wider level, an examination of farm size and specialization in cane farming were also performed to discern whether there were any differences in response to the reform scenarios along these dimensions. This information could be very useful for policymakers to help inform appropriate policy formulation and more targeted delivery of policy strategies to reflect the

diversity within Thai cane farming system. In consideration of farm size, surprisingly, medium-scaled farmers are likely to be the group most effected by libertarian scenario, i.e. over half of all farmers in this group expressed the intention to cease cane production. It may be that this group is large enough to require hired farm workers and the use of machinery but lack of the economies of scale of the largest farms. Therefore, these farmers are likely to suffer more than others in terms of increasing in production costs under this extreme scenario. As expected, smallest farmers are more likely to quit cane farming under the ‘government proposal’ and ‘protectionism’ scenarios. Kimhi and Bollman (1999) indicated that farm size would positively contribute to farm survival since larger farmers are more likely to provide the farm household with a reasonable and sustainable income. Therefore, the opportunity costs of discontinuing farming in general are higher for larger farms. In contrast, small-sized farmers tend to face many constraints such as more acute land constraints, access to inputs, extension which can affect their profitability. Agarwal (2013) suggested that these constraints will ease as farm size increases. One unanticipated finding was that while the largest farms are most likely to stay in cane production under any scenario, a considerable production volume loss from this group does occur. This inconsistency is due to the fact that any farmer in this class intending to quit, or downsize, cane production will do so over a much larger area than the other size groups.

The effect of degree of specialization in cane farming was also examined. As expected, share of farmers who devoted more than 75% of their farm to cane productive were more than double than those who less specialised in cane production due to dominance of monocropping of sugarcane in Thai communities (Attavanich et al., 2019). Through the lens of intensification of cane farming and cane farming specialization, the most interesting finding was that the more specialised and intensive the farmers in cane production, the more likely they are to remain in cane production under any policy reform scenario compared to more diversified farmers under any scenario. This relationship may be related to higher scale economies that may arise from higher specialization in tasks which may allow for more intensive use of specialised equipment and structures, leading to higher resource-use efficiencies and so greater resilience against loss of revenue (MacDonald et al., 2013). For example, Holmes and Lee (2012) observed that, higher levels of commodity-specific knowledge could contribute a significant reduction on production costs. Timmer (1997) also suggested that strong “learning-by-doing” effects contribute significant economies of scale and greater efficiency to such specialization. Our finding is in agreement with that of Möllers and Fritsch (2010) who found that higher the share of main crop production devoted to one crop, particularly maize, (i.e., a small share of vineyards, orchards etc.) the lower the exit rate in Croatian farms. However, Timmer (1997) noted that significant price instability either generate in domestic market or transmitted from international market

would lead a substantial income distribution consequence particularly on those who depend heavily on a single crop for their economic base. These could centennially lead contradictory results to our finding. However, price instability and market vulnerability issues may not be relevant to the case of Thai cane sector because such market fluctuations have historically been low. Despite potential drop in cane price under any policy reforms, cane industry would still be more strongly protected and more competitive than any other cash crops due to the effects of the Cane and Sugar Act, which ensures both market availability and fixed income through contract farming and revenue-sharing systems. It is also critical to note that no farmers, under any scenario, intended to expand cane production except a very few farmers who devoted more than 75% of arable land to cane where the number of expansionists were slightly higher under the ‘government proposal’ and ‘protectionism’ scenarios than the libertarian scenario. This occurrence could become visible if output of these specialised farms is so sufficiently negatively correlated with the price that their net revenue could be stabilized by lower prices (Timmer, 1997).

4.7 Conclusions, policy recommendations and limitations

This work has shown that if a catastrophic loss of cane production is to be avoided under any of these reform scenarios, the libertarian scenario in particular, government will need to provide more information to farmers, thereby raising awareness, about how farms can offset price cuts and the removal of certain government supports via indirect and sustainable long-term benefits i.e., products from research and development program and infrastructure services they might receive from the reforms. Effort should also be directed at increasing the level of support and encouragement offered through farmer support groups, including family and friends, other neighbouring farmer, sugar millers and government itself. Even though farmers who have strong belief in their own capability (skills and resources) to continue in cane production, the survey results suggest that they continue to believe that they need lots of government support, including access to cheap finance to become more efficient and remain profitable. Therefore, increasing levels of awareness and engagement with support available to farmers through providing technical training and advisory services, as well as facilitating farmer access to financial resources would be critical to encourage farmers to remain in cane farming where policies bring significant cuts in producer revenues

The results from the descriptive analysis also provided further detail about future planning actions that the most farmers intended to do if they intend to exit cane farming. The two actions most commonly found were, i.e. either switch to alternative crop production or transferring the

farm to their successor. There was very little interest in finding alternative off-farm employment, or selling or renting their farm out. Therefore, if government wishes to uphold cane production volumes, they might consider policy measures to encourage older farmers to hand farms on to successors, and, in parallel, providing education and training on adaptation strategies and encouraging the development of mechanization to decrease the physical burden of farming and reduce costs.

Apart from identifying these common significant determinants of intention to continue cane farming, the analysis reveals some distinguishing features of farmers' intentions under different scenarios. Critically, our results offer vital evidence for policy makers to determine the future policy target and provide hints about where the focus of their support should be if they wish to follow one of these scenarios.

Based on findings from the policy consultation chapter, the government's goal seems to be to encourage as many farmers as possible to stay in cane production under any policy regime. Therefore, under any scenario that heavily reduces prices and state support, such as the Libertarian scenario, even though this seems unlikely, the low-cost loans program must be protected as this is an essential restraining factor to slow down the structure change in Thai cane sector especially when vast majority of farmers are still under privileged, have less money, have low levels of technology adoption. For these farmers this financial instrument is a key source of their investment and working capital. The existence of this measure could be key in helping farmers cope with future challenges arising from market liberalisation. Without this mechanism a large number of farmers, regardless of any personal and structural differences, are unlikely to survive, resulting in abandoning farming altogether.

The farmers most dissatisfied with the Government Proposal reforms scenario are the most vulnerable, i.e. the less educated, high-cost farmers and operating the smallest farms, often in remote areas and with a relatively high share of rented farmland. Also, even though female farmers tended to stay in cane farming more than men under this scenario, it is probable that women may be challenged by the reforms as much as men and the reason they report a higher intention to remain in cane production is that they are trapped in this system due to lack of viable livelihood alternatives and cannot readily find jobs elsewhere. To prevent these vulnerable farmers from exiting, support will be necessary to help them overcome production constraints and increase farm productivities, so that they can continue in cane farming as a viable, satisfying, profession, or alternatively, discontinue on their own terms rather than out of distress.

In the case of least extreme scenario, many of the personal and structural variables which discriminate between farmer groups, in terms of their effect on intention to continue in cane production, under the 'libertarian' and 'government proposal' scenarios no longer do so. Farmers' intentions to continue under the protectionism scenario are more affected by operational and functional reasoning, related to cost and profitability considerations. Farmers with higher labour costs, lower productivity, resulting in lower margins from cane farming are more likely to disengage in cane farming operation than others. Farmers who fully adopted green harvesting, particularly through manual methods (hand cutting) and, surprisingly, farmers who had visited other farms as part of learning communication tended to belong in this exit group. For these farmers, labour shortages and inability to invest in a mechanical harvester are key issues that are seemingly not offset by receiving topped up payment from delivering fresh cane.

Manual cane harvesting is becoming prevalent due to government enforced regulations that penalize burning. Hence, these farms tended to be less-cost effective especially small-sized farms. For these, predominantly small, farms technological development is needed and should be promoted for a suitable and affordable prototype of harvester which could be used in small plantation under financial and farm size constraint conditions. Government, or sugar millers, should encourage to harvester investment, through subsidising or providing harvesting machineries to farmers under supply contracts. Encouraging group farming among small-sized farms would reduce land constraints and allow more efficiency in the use of harvesters.

The study shows that there exists a type of farmer that would struggle under any of these policy scenarios but, by virtue of higher levels of education and a more proactive attitude to information seeking, could be encouraged to remain in cane production with the right support. These farmers have visited other farms in the past five years (they are knowledge seekers) and tend to operate small and medium sized farms and obtain lower yields than other cohorts. This group, who would still hold assumption that cane farming is a worthwhile activity under the reform scenarios, often seek updates from community and will modify and enhance local knowledge, but may be constrained by some personal, or structural factors, including location, which are causing lower productivity and profitability. These desired outcomes could be achieved through government supports including (1) government investment for irrigation system construction along with development of low-cost drought resistant cultivation technologies and promoting comprehensive measures that could solve the drought issue i.e., deep tillage and planting furrow preparation, (2) cane breeding, germplasm innovation and new variety propagation i.e. producing high sugar, drought and disease resistant cane cultivars.

Another key policy-relevant message arising from this study is the important impact of any policy reforms on farmers' production plans. Clearly, confronted with these policy regimes farmers are making binary choices about future cane production strategy i.e., to continue with the same production pattern, or exit altogether in immediate years following the application of policy forms. Rarely do farmers propose a decrease or increase in the scale of production. The obvious implication of this is that significant cuts in support and reductions in cane price, would generate substantial losses in cane supply. The analysis shows that even though all policy scenarios would be a prominent force of change across the sector as a whole, their impact is uneven. For instance, the results of the survey suggested that the larger the farms are, the more likely they are to stay in production when government supports are somewhat retained and reduction in cane price is smaller, specifically under the 'government proposal' and 'protectionism' scenarios. Hence, it might be hypothesised that these farms have some dynamic entrepreneurship and the capability to survive in the market under given conditions.

However, the results show that by moving from the 'protectionism' and 'government proposal' scenario to the most extreme scenario of support removal and price cut, while large-scaled farms still tended to stay in cane production, the most the medium-sized farms are more likely to be the most effected group instead of the smallest farms under this circumstance. It is possible that production costs of these medium-sized farms are likely to exceed the revenue generate from cane farming, since this group is large enough to require hired labour but lack of the economies of scale of the largest farms. Thus, it is likely that the entrepreneurship and the capability to survive of medium scaled farm disappear as a result of step change in the impacts of moving to the most extreme scenario. For the smallest farms, even though the exit rate is still relatively high, they tend to be better at adaptation and faced lower costs since they may not require hired labour use in their farm operation.

By means of specialization, less specialized and less intensive farmers seem to be the most affected group under any scenario. An implication for this is that if government wish to uphold cane production volumes under any scenario, it needs to maintain the number of active cane farmers. This will involve develop target support frameworks for affected groups i.e., smaller-sized and less specialised. In the end, these tend to be the farmers who must cope with structural deficits, and therefore they would require adequate understanding of structural changes to explore alternative strategy and recognize opportunities both within and outside agricultural market. This could be done by encouraging farmers to adopt an entrepreneurial way of thinking as well as building social acceptance that cane farmer are entrepreneurs. In this respect, the cane farming community has to be aware of the direction of future market and technology changes

including open community's discussion on issues such as new farming strategies and economically viable and efficient solutions.

In respect of strategic support toward the most vulnerable group, developing policies that encourage efficiency and productivity improvement, promoting the sustainable intensification/specialization of cane farming, in particular to those with favourable agronomic and climatic factors. This should be directed at maximizing the productivity capability of owned resources by specializing in cane farming enterprise to maximize profitability. For vulnerable farms that are not located in regions well-suited for cane cultivation, if the government goal is to prevent cane farmer from abandoning agriculture which has always been ultimate objective of many countries where their economic fate depends on agricultural sector, the key role of government is to ensure that produced incomes for those employed in agricultural sector are comparable to opportunities in non-farm sectors. Therefore, rural structuring programs should be drawn up, including promoting diversification of alternative cultivation. This solution can decrease the risk of monoculture in Thai cane sector, as well preventing decreasing income-earning opportunities from cane cultivating developing into exits from agriculture altogether. More generally, smallholder-focused policies that aim to enhance the rural livelihood of small-scaled farms through providing access to land and economic resources and enhancing risk management should also be in consideration.

However, it is unavoidable that some farmers, particularly the least efficient ones would still have to exit cane farming if they cannot adapt themselves to cope with the situations, these farmers require strong policies for the development of economic opportunities outside the cane sector, or even outside of agriculture, such as switching into alternative crop, or renting out part of farmland would be essential for these farm and they may need to be accompanied by a specific transitional program such as the Exit Grant Scheme in New Zealand (Rae et al., 2004).

All of the policy scenarios, regardless of whether they are on the libertarian-protectionism scale, would negatively affect most Thai cane farmers and would negatively impact the sector to a greater or lesser extent through varying degree of price cut and removal of producer supports. The goal of the state, via the Thai cane and sugar policy is straightforward, i.e. to foster a healthy industry as far as is practical. Even though the policy reforms would result in fewer cane-producing farms than at present, it is very probable that a shift of policy toward freer market would increase the overall efficiency and competitiveness of cane sector, since farmers whose existence depended in the past on direct supports and not market conditions, would adapt themselves to the new situation and become more market oriented. The dramatic loss of farms from the sector projected in this study can be tempered through public-sponsored programs

which provide more reassurance to farmers that they can offset the removal of direct government supports with indirect supports in the longer term, in the form of government services, infrastructure, research and development, training and input supports, as well as access to low-cost loans. Moreover, a middle path could lie in policies that support affected farmers transition strategies, where further reassurance can be offered that there will be a transition period during which direct support will be only gradually withdrawn. This will allow existing farmer to have extra time to improve their productivity and diversify their livelihood before any policy reforms are fully implemented and could create more satisfied farmer citizens.

In conclusion, this study reinforces the view that Thai cane farmers and their farms are diverse, and that this diversity needs to be acknowledged in policy formulation. Adopting a typology approach to do so can be a very useful accompaniment since farm typologies including farm size and farm specialisation could be helpful in predicting impact of future policy changes on future farm strategy at farm level. Moreover, knowing the drivers and constraints of farmers' intention to continue in cane farming in different system and the deeper motivation of farmers should allow better predictions of farmers' response to policy changes and target next policy initiatives effectively. In concluding, it should be emphasized that the evolution of cane prices in domestic market is far and away the most important factor determining farmers' intention about future farming patterns in the light of new policy regimes.

Chapter 5

Competitiveness of Thai sugar millers and their responses to policy reform scenarios

5.1 Introduction

From the previous chapter, Thai cane farmer responses to three policy reform scenarios were investigated. From this we know what the impact of the policy scenarios would be on the number of active cane farmers and the volume of cane produced. The next logical step is to assess the likely impact of the scenarios, both directly and indirectly, i.e. via the response of farmers, on sugar manufacturing business. Therefore, this chapter will present a survey of the likely responses of millers to the policy reform scenarios, plus the response of farmers.

The presentation of this chapter is in six main parts. First, section 5.2 describes the survey methodology. Next, data analyses (Section 5.3) are described. Section 5.4 and Section 5.5 presents the results and discussion. The results are presented in three sections. Section 5.4.1 describes socio-economic profiles of investigated sugar mills. This includes descriptive statistics on sugar production and productivity, revenue structure and market characteristics. Section 5.4.2 presents an assessment of the competitiveness of investigated millers which was analysed to provide a broader understanding of the impact of competitiveness on the attitude of millers toward each scenario. Section 5.4.3 reveals millers' attitudes and likely business responses to the scenarios. Section 5.4.4 describes and compares millers' expectations for future policy regime, the kind of mixture of policy elements that they believe are essential for the Thai sugar sector to remain competitive. Finally, this chapter ends with section 5.5 and 5.6, which are the discussion of main findings and conclusions.

5.2 Methodology

Data collection was undertaken by face-to-face interview, using a structured questionnaire. The questionnaire was built upon the knowledge gained from the literature review, semi-structured in-depth interview with policy makers and academics and results of the farm survey presented in the previous chapters. Millers were presented with the same hypothetical policy scenarios, established in chapter 3, that were presented to cane farmer but with the addition of some key data on the likely responses of cane farmers to these same scenarios.

5.2.1 Population, target population and sampling methods

The target population of this research are sugar millers in Thailand. Currently, there are 57 sugar refineries. In determining the size of the sample that needed to be drawn to be representative of these 57 refineries, Yamane's (1967) simplified formula for estimating sample sizes from small populations was selected (Eq.17).

$$n = \frac{N}{1+N(e)^2} \quad \text{Eq. 17}$$

Where n is sample size, N is the population size, and e is the level of precision required. Therefore, as shown in Eq. 18, For a population of 57, with a $\pm 10\%$ level of precision (e) and confidence level of 95%, a minimum sample of 36 refineries is required.

$$36.3 = \frac{57}{1+57(0.10)^2} \quad \text{Eq. 18}$$

The total sample drawn in this case was 38 sugar factories, representing about 67% of the population. To capture the structure of Thai sugar industry, i.e. its size distribution, a stratified random sampling approach was adopted within each region. In other words, the number of refineries in different size classes was used to determine the number of refineries that had to be sampled in each size category. The minimum quotas for each region were set to at least 50% of the total population within each size class in each region, as shown in Table 5.1. Figure 5.1 shows all provinces where sugar factories are located and where data were collected across four regions that cane is cultivated in Thailand.

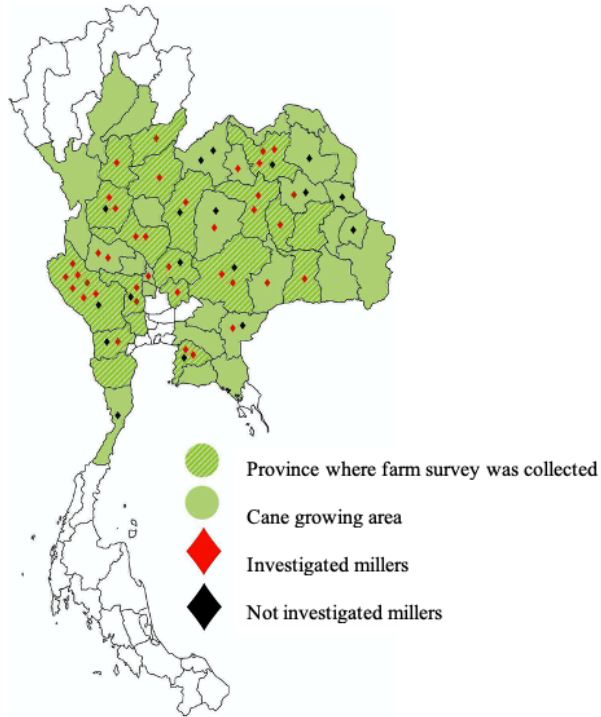


Figure 5.1 Location where investigated sugar mill factories are situated

Table 5.1 presents the comparison between statistic information of Thai sugar millers from the latest national census report provided by the OCSB and the stratifications of respondents from investigated factories for this study.

Table 5.1 Number of Thai sugar millers surveyed in this study and the national population distribution from national census

Regional distribution	Population	Percentage (population)	Sample	Percentage (sample)	Sampling percentage by region
Northeast region	22	38.6%	13	34.2%	59.1%
Central region	20	35.1%	14	36.8%	70.0%
North region	10	17.5%	8	21.1%	80.0%
East region	5	8.8%	3	7.9%	60.0%
Total	57	100%	38	100%	

Source: OCSB (2020) and main miller survey 2020

5.2.2 Survey instrument- scenario-based questionnaire survey

In this study, the instrument for data collection was a questionnaire. This questionnaire method was selected because it has reduction in biasing error, greater anonymity (Nachmias and Nachmias, 2005) and allow researcher to collect data systematically and can be economical way of collecting accumulating quantitative data (Patten, 2016).

The questionnaire was developed as a scenario-based form based on the constructs identified in the conceptual framework. A scenario-based questionnaire is a form of questionnaire that explores respondents' decision rules based on their responses to a series of scenarios. In contrary to the prevalent use of standard questionnaire survey in human behavioural studies, the use of the scenario-based questionnaire is still limited. However, Atzmüller and Steiner (2010) suggested that this method is believed to be powerful tool and have high internal and external validity in investigating respondents' judgements, beliefs and attitudes. Moreover, the use of scenario-based questionnaire has been accepted practice for behavioural studies, particularly in cases where behaviours are hard to observe because they are associated with conditions that only rarely occur (Jafarkarimi et al., 2016).

There are two main sections in the questionnaire: Section A) socioeconomic characteristics and Section B) refiners' responses toward scenario-specific policy. The section A was organised into 12 parts eliciting: 1) company general information; 2) products produced and business diversification; 3) revenue structure; 4) production and production process structure; 5) sugar distribution and marketing structure; 6) contract farming; 7) human resource; 8) financial structure and turnover; 9) research and development (R&D); 10) production value and cost reduction; 11) government support and regulatory policy and 12) market environments.

Section B, where the policy scenarios were applied, consisted of 5 parts. Part 1 obtained views and preferences for policy in general, Parts 2-4 focused on the impact of scenarios on the business and millers' likely responses to this. At the start of Part 2, the settings for the parameters associated with one of the scenarios was provided to the respondent, including changes in cane supply resulting from farmer response to the scenario. Respondents were then asked to indicate their likely business responses to the scenario. Part 5 looked at the respondent's preferences for policy design, expressed in terms of the same policy parameters used to characterise the three case study policy scenarios.

Most questions were presented in closed format, taking the form of either, five-point Likert rating scales (i.e., very unlikely (1)-very likely (5) and very dissatisfied (1)- very satisfied (5)) or semantic differential scales (i.e., bad-good, invaluable-valuable and harmful-beneficial).

Although the vast majority of survey questions were closed, some open questions were also included, to follow-up to on answers to closed questions, to collect more in-depth information.

To increase the validity and reliability of the survey and accuracy of data, the data sources collected by this questionnaire consist of both primary and secondary data. First, to reduce the

data provision burden on respondents, most parts of Section A (socioeconomic characteristics) of the questionnaire were pre-filled by the data collection team using the official data held on the millers. These secondary data were obtained from relevant industry and official statistics reports and documents provided by the Office of Cane and Sugar Board. Data that were extracted from official documents are those related to production and marketing where companies may be unable to provide their accurate records. However, respondents were asked to confirm the pre-filled data and allowed to make a revision if necessary.

Second, primary data was collected for the rest of the sections in the survey by using the well-structured questionnaire, pre-tested for validity and reliability. Primary data refers data which is collected for the first time and therefore is original in character (Kothari, 2004). Primary data was collected on the company's personnel profile, human, business sophistication, financial capability, opinion on government role in the Thai sugar industry and millers' views toward alternative policy scenarios.

5.2.3 Questionnaire translation and pilot-testing

The questionnaire translation procedure and validation were done in the same way as the farm survey, i.e., using forward and backward translation to ensure the equivalence of meaning between the original and the language of administration.

A sample size of 3 participants was used in the pilot testing, this being nearly 10% of the sample for the actual study. Baker (1994) suggested that in pilot study, the number of a pilot sample size should be 10% of effective sample size for actual study. Pretesting the questionnaire was done to determine whether any of the questions were ambiguously worded and to ensure that the respondents are able to supply the information requested. Thus, comments and suggestions made by respondents during pretesting were used to improve the questionnaire. Some revision of the questionnaire was required as deficiencies in questionnaire were revealed. The revised questionnaire was subsequently pre-tested on another similar group to confirm its validity and reliability.

5.2.4 Survey administration and collection procedure

An in-person, self-administered survey was chosen as mode of survey administration. The miller survey was carried out during September to November 2020. In order to increase the response rate, the assistance of the Director of Thai Sugar Miller Corporation Limited (TSMC) was

secured to distribute questionnaires at an assembly of the TSMC. Due to very complex questionnaire instruction and design, the researcher discussed the details contained in questionnaire with the Director and staff of the TSMC before the administration of the survey. The questionnaires were handed out at the meeting.

Researcher also participated in this meeting through the video conferencing where both research and the Director explained questions and statements in questionnaire to all respondents where everyone who participated in the meeting read and went through question by question together. This step was done in order to reduce respondent error and to ensure that respondents shared the same understanding. Due to the long length and complexity of questionnaire, respondents were allowed to take the questionnaire home or workplace and given a one-month period to complete the survey before returning the completed survey by email.

5.2.5 Measurements and variables in the study

The questionnaire design in this study was developed from the extant literature and informed by the findings of the phase one interviews. The operationalization of the variables including the objective and compositions of the questionnaire survey are presented in Table 5.2. A copy of the full questionnaire can be found in Appendix C

Table 5.2 The list of variables used in the analysis of millers ‘competitiveness’ and also analysis of responses to scenarios

Objective	Indicator	Variable description	Question type	Format	Source (Adapted version)	Statistical analysis used	Data source
1. Exploring competitiveness of millers and how competitiveness impacts responses to the scenarios	Socio-economic: Costs and Profitability	Percentage change in profitability; Percentage of raw sugar produced.	Open-ended	Interval	The author; Imbambi (2018)	One-Way ANOVA	Primary and Secondary
	Socio-economic: Productivity	Extraction rate of sugar and molasses; Percentage of crushing productivity; Sugar production volume	Open-ended	Interval	Khushk et al. (2011); Arjchariyaartong (2007); Solomon (2011)	One-Way ANOVA	Secondary
	Socio-economic: Material capability	Cane volume supplied; Percentage of fresh cane; CCS level	Open-ended	Interval	Khushk et al. (2011); Arjchariyaartong (2007)	One-Way ANOVA	Secondary
	Socio-economic: Competitive advantage	Sugar distribution; Market share; Sales and Profit	Open-ended	Interval	Arjchariyaartong (2007); Singh and Kumar (2020); Imbambi (2018)	One-Way ANOVA	Secondary
	Socio-economic: Diversification	Research and Development; Range of cane related business; Proportion of revenue from sugar business	Multiple choice Open-ended	Nominal Interval	Singh and Kumar (2020); Muteshi and Bolo (2017)	Chi-square test and One-Way ANOVA	Primary
	Socio-economic: Financial capability	Source of financial capital; Business legal	Multiple choice	Nominal	Singh and Kumar (2020); The author	Chi-square test	Primary
2. The impact of scenarios and likely miller responses to these impacts	Scenario-based	Satisfaction score toward each scenario; Impact on business; Expected turnover; Millers likely business responses to each scenario; Likelihood of specific actions undertaken in response to each scenario	5-point Likert-scale	Ordinal	The author	Descriptive Friedman’s ANOVA Test	Primary
3. Millers’ preference for sugar policy measures and their favourable policy scenario	Scenario-based	Preference for quota system; Preference for revenue-sharing system; Preference for domestic pricing; Preference in terms of support to farmers	Multiple choice	Nominal	Pre-interviews; The author	Descriptive and One-Way ANOVA	Primary

5.2.6 Data quality checking

The dataset entered into the questionnaire which was used for analysis was examined and checked by researcher to ensure the data was reasonably useable and to ensure that there were no missed questions. In terms of completeness, every single record was checked, and the stored data was 100% complete. In other words, there was no missing values or missing data records that were used in the analysis.

Random survey answers, which did not provide meaningful responses were checked. The issue of ‘straight-lining’, more technically called non-differentiation in rating, is one of the types of problem that was checked. Straight-lining answers¹¹ typically occur with longer surveys, where survey fatigue kicks in, and which may be serious threat to data quality. Using this technique, consecutive questions from the same survey section are grouped and, the standard deviations (SD) of this set of questions for each respondent are calculated. The respondents would be suspected as straight liners if the SD was equal to zero (Barge and Gehlbach, 2012, Leiner, 2019). In this study, there were 11 SDs calculated per respondent and no scores of zero SD were detected, suggesting no straight-lining issue in the sample.

5.2.7 Descriptive statistics

Millers were classified into 3 size groups based on the average cane crushing capacity of their factories in tonnes per day, namely, small, medium and large. Large-scaled sugar factories have an average crushing capacity of more than 20,000 tonnes per day, medium-scaled factories 10,000-20,000 tonnes and small factories less than 10,000 tonnes per days. This classification is consistent with other past studies of the sugar sectors in the region. For example, Khushk et al. (2011) used level of crushing capacity to classify sugar mills into small and large mills to analyse sugar industry competitiveness in Pakistan. Likewise, Arjchariyaartong (2007) adopted the same technique to analysis the competitiveness of the sugar industry in Thailand.

There were 19 attributes representing the socio-economic features of Thai sugar millers used in this study. The descriptive statistics was presented in the similar manner with farmer survey

¹¹ Straight-lining answers are from respondents who frequently choose the same answer for consecutive questions, particularly the questions with the same scale such as five-point Likert scale of agreement. These are assumed to be unintended or random answers.

(Chapter 4) where two inferential statistical tests of the significance of observed differences between sub-groups within the sample were employed: 1) One-Way ANOVA and 2) Fisher's exact tests.

One-Way ANOVA test was used to assess the sub-group differences for the continuous variables. The Tukey's honestly significant difference test was also used to assess all pairwise comparison between miller groups in this study.

To test for subgroup differences in terms of categorical variables, Fisher's exact test was used. This method was selected because it is more accurate and valid than the chi-square test of independence when the expected values are small, especially when more than 20% of cells have less than 5 observations (Kim, 2017a). After that, the Bonferroni correction was applied where probability (p) values are adjusted due to the increase in risk of Type I error¹² rate in hypothesis testing when making multiple pairwise comparisons (Armstrong, 2014, McDonald, 2009).

5.3 Data analysis

5.3.1 Competitiveness Profile Matrix (CPM)- An application of equal aggregation weights

Prior to investigating the responses of different segments of sugar millers to future policy scenarios and their expectations for the scenarios, it is crucial to classify them into groups based on level of competitiveness. In this study this was carried out using cluster analysis, based on the index scores for each important competitiveness indicator. The main advantage of this approach is the aggregation of multiple aspects of the competitiveness concept into one composite index score, capturing a more holistic competitive concept.

According to Zimmermann and Zeddies (2002), competitiveness in the sugar industry can be drawn from the analysis of current economic and political production conditions, as reflected in various indicators at different spatial levels, including the firm and sub-sectors within the boarder sugar sector. These indicators often include a firm's productivity and national policies, regulations and subsidies. The report written by Wijnands et al. (2015) for The OECD Food and Agricultural Paper also emphasizes that the degree of self-sufficiency, comparisons of market

¹² In statistics, a Type I error, also known as a "false positive", is a type of fault that happens during the hypothesis testing process when a null hypothesis is mistakenly rejected as the result of a test procedure, although it is accurate and should not be rejected.

shares and price are relevant competitiveness indicators for sectors like the agricultural or food industry. However, despite being widely used, in the current study product price and market share metrics were excluded from the indicator because these indicators are restricted by regulations and not determined by the firm. This conveys no distinction between millers, rendering these metrics non-discriminatory in the context of the Thai sugar industry. Moreover, as mentioned in the literature review, the primary sources of agribusinesses' competitiveness (Harrison and Kennedy, 1997), are product differentiation, input quality, productivity and quality enhancing attributes and production economies. Consequently, these were among a total of 13 critical factors selected to capture competitiveness in this case. These metrics were classified into three major indexes of competitiveness, covering differences in productivity, cane supply, and research and development and business diversification.

The performance and competitiveness analysis of Thai sugar millers built upon the Competitiveness Profile Matrix (CPM) approach (Zimmerer et al., 2008). Zimmerer et al. (2008) defined CPM as an analytical tool that helps in assessing a company's relative competitive position against its rivals using a set of critical success factors (CSFs) for that industry. In this study, we extended the CPM approach by establishing three sets of CSFs reflecting three different performances evaluation criteria including productivity index, input index and business structure and diversification index. Each one of these main criteria is made up of a set of CSFs. The relevant CSFs were grouped together in this way to represent its performance criterion. For example, input index criteria which refers performance in acquisition of large volume and/or high-quality cane, comprised three CSFs including amount of cane supplied to factory, percentage of green harvested cane over entire supply and level of CCS

Equal weighting for each criteria was selected to simplify the analysis because predetermined weights derived by informed judgements of external experts or members of the public were not collected and so there are no explicit statistical or empirical grounds for varying the weights in relation to the context of Thai sugar sector. Assigning equal weights to each criterion is a simple and popular aggregation procedure adopted in the development of composite indicators (Bandura, 2008, OECD, 2008) where each criterion is assumed to be equally important within the evaluation process (Bowen and Moesen, 2011). According to Greco et al. (2019), an equal weighing scheme could be applied hierarchically when composite criterion categories include a number of indicators such as CSFs, as is the case here. However, if the individual CSFs are grouped into a higher order (i.e., composite indices in this study) and the weighting is distributed equally index-wise, then the CSFs do not necessarily have equal weights (OECD, 2008), because

there are different numbers of them in each composite index. The distribution of weights and their hierarchical application used in this study is also shown in Figure 5.2.

of the creation of the Competitiveness Matrix involves six important steps. First is assigning equal weights to all three composite indices where these weights must sum to 1.00 (or 100 percent). In this case, the weight for each of the three composite indices is approximately 0.3333 (or 33.33 percent). Each index comprises several individual CSFs. Second is to attach an equal within-index weights to each individual CSF, where these within-index weight scores must then sum to the index weight score. In other words, all within-index weights must also sum to 1.00 (or 100 percent) across all the composite indices. For example, the Input index comprises three CSFs. Therefore, the weight score of each CSF in this composite index is 0.1111 (or 11.11%) which must be then aggregated within the index as weight sum equal to 0.3333 (or 33.33%). Third is to score each company on the basis of each CSF. The rating scale used has seven points, from 1 (poor/industry laggard) to 7 (top performance/industry leader). Fourth, for each CSF, multiply the company rating score by the CSF weight. Fifth, the average weighted CSF score within each index is then multiplied by the weight for each index, to get the weighted index score. Finally, to calculate the overall company competitiveness score, the average weighted score of each of the three composite indices is simply added together capturing the competitiveness ranking of each company. The composite indices and listed CSFs used for company's competitiveness ranking in this study is shown in Figure 5.2.

The robustness checks following the construction of this index was performed through sensitivity analysis, a traditional quality assurance technique that displays how sensitive the rankings are to variations in the weights used i.e., how much change in the index there is with change in one of more of its components (Saisana et al., 2005). The index being constructed are considered as fairly robust if there is no significant change in rankings when varying the weights, meaning that the constructed metrics used are fairly stable, thus is sensible to be applied in Competitiveness Matrix.

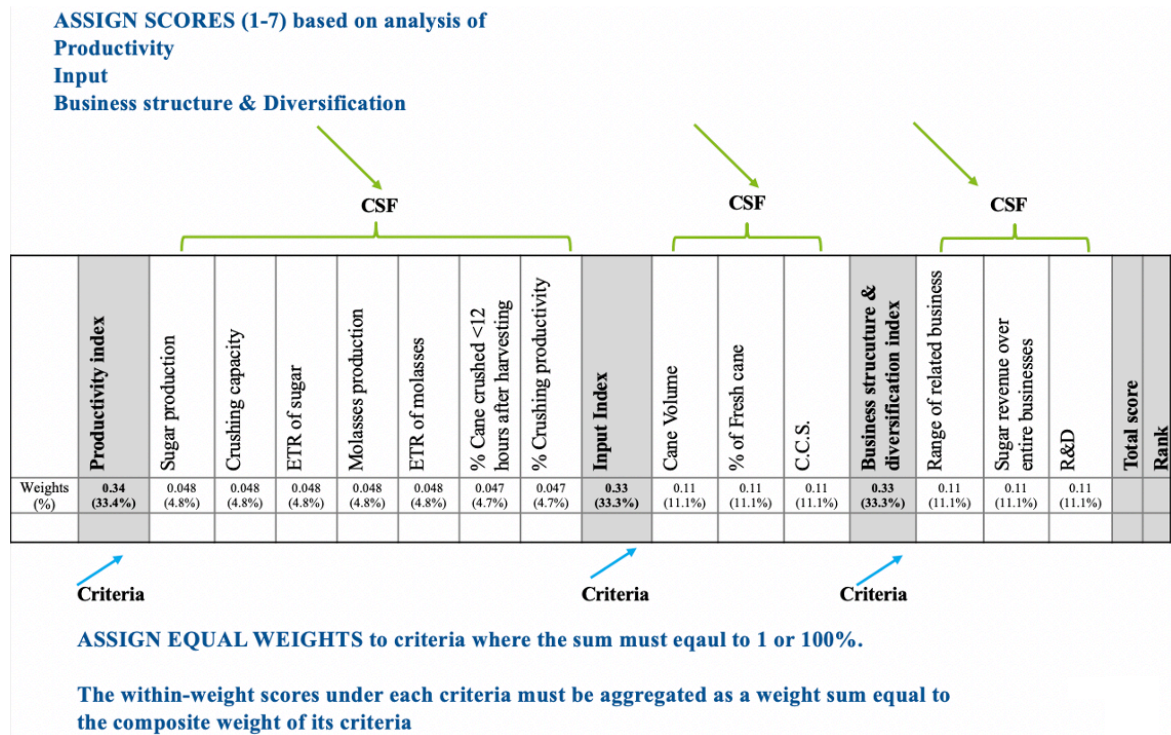


Figure 5.2 criteria and listed critical success factors and weights used in competitiveness index analysis

5.3.2 Describing data – frequency distributions and supplement tests

Because the emphasis of this chapter is on the account of way and how miller sector likely to response to different policies rather than on the statistical analysis, thus the frequency distribution and cross-tabulation were used for the most part of data analysis to describe and compared data between the scenarios. However, several statistical tests were performed, and the statistical outcomes were provided as supplementary materials to confirm the key findings. For example, the Friedman test, a non-parametric alternative to One-Way ANOVA with repeated measures, was used to test differences between three scenarios measured by related respondent group where the dependent variable being measure is ordinal such as in Likert scale format. If the result from Friedman test was statistically significant, then the Wilcoxon signed-rank tests were run separately on different combinations of related groups to examine where the differences occur (McCrum-Gardner, 2008, Sheldon et al., 1996, Zimmerman and Zumbo, 1993).

5.4 Results

5.4.1 Description of investigated sugar mills

In total of 38 completed and valid questionnaire were collected. Analysed sugar mills were classified into 3 size groups based on the average cane crushing capacity in tonnes per day. 13 (34.21%) are small scaled-factories with average crushing capacity less than 10,000 tonnes per day, 14 (36.84%) are medium scaled-size mill with average crushing capacity of 10,000-20,000 tonnes per day and 11(28.95%) are large-scaled factories with capacity rate more than 20,000 tonnes per day. The description of investigated sugar mills is divided into four main parts: (1) socio-economic profile; (2) production and productivity characteristics; (3) raw material characteristic and (4) revenue structure and market characteristics.

5.4.1.1 Socio-economic profile of sugar mills in the sample

Table 5.3 reports the summary statistics for socio-economic characteristics of sugar mills including: regional location, business legal status, company research and development (R&D) spending, sources of financial/capital investment and number of business diversification. The results show that there were no statistically significant differences in type of business legal status ($P = 0.107$, Fisher's Exact test), source of financial capital ($P = 0.426$, Fishers' Exact test) and number of business diversification options adopted ($P = 0.744$, Fishers' Exact test). The study found that 32 (84%) investigated factories are registered as Limited Companies, while the rest are registered as Public Limited Company. Of 38 millers, 13(34.2%) millers use commercial loans as their only source of financial capital and 15 (39.5%) have two financial capital sources, i.e. commercial loan and investment made by shareholders. Moreover, 6 (15.8%) millers reported using either their own capital or bonds in the business in addition to commercial loans and investments made by shareholders. No millers ran only a sugar refinery, with all millers also engaged in associated commercial activities, i.e. 13 (34.2%) millers also operated a biomass powerplant, while 18 millers (47.4%) run another non-sugar and biomass powerplant businesses, with the most common diversification business being fertiliser manufacture (13 of 18 millers).

Table 5.3 Socio-economic profile of the sample of millers

Socio-economic characteristics	Small-scaled production capacity*	Medium-scaled production capacity**	Large-scaled production capacity***	Total (n=38)	Significance of differences ²
	(n=13) Counts (Expected value)	(n=14) Counts (Expected value)	(n=11) Counts (Expected value)	Counts (%)	
Research and Development					P = 0.029
No R&D plan	4 (2.4)	2 (2.6)	1 (2.0)	7 (18.4)	
Has a plan to establish R&D	9 (6.8)	7 (7.4)	4 (5.8)	20 (52.6)	
Already has R&D	0 (3.8) ^{a,b}	5 (4.1) ^a	6 (3.2) ^b	11 (28.9)	
Business legal status					P = 0.107
Company Limited	13 (10.9)	10 (11.8)	9 (9.3)	32 (84.2)	
Public Limited	0 (2.1)	4 (2.2)	2 (1.7)	6 (15.8)	
Region					P = 0.021
Central	9 (4.8) ^{a,b}	3 (5.2) ^a	2 (4.1) ^b	14 (36.8)	
Northeast	1(4.4) ^{a,b}	7 (4.8) ^a	5 (3.8) ^b	13 (34.2)	
North	1 (2.7)	4 (2.9)	3 (2.3)	8 (21.1)	
East	2 (1.0)	0 (1.1)	1 (0.9)	3 (7.9)	
Source of financial/investment capital					P = 0.426
Commercial bank only	3 (4.4)	5 (4.8)	5 (3.8)	13 (34.2)	
Commercial bank and shareholders	6 (5.1)	6 (5.5)	3 (4.3)	15 (39.5)	
Commercial bank, shareholders, and others	4 (2.1)	1(2.2)	1 (1.7)	6 (15.8)	
Others (i.e., bond, commercial bank and bond)	0 (1.4)	2 (1.5)	2 (1.2)	4 (10.5)	
Business diversification					P = 0.744
2 businesses ¹	5 (4.4)	6 (4.8)	2 (3.8)	13 (34.2)	
3 businesses	6 (6.2)	6 (6.6)	6 (5.2)	18 (47.4)	
More than 3 businesses	2 (2.4)	2 (2.6)	3 (2.0)	7 (18.4)	

Notes: Each common superscript letter denotes a subset of categories whose means differ significantly from each other at the 0.05 level from generated from Bonferroni Correction test

¹ Sugar and biomass powerplant businesses

² Fishers' Exact test

* Average crushing capacity per day less than 10,000 metric tons, ** 10,000-20,000 metric tons, *** more than 20,000 metric tons

The surveyed sugar mills are located in four main regions across Thailand. 14 (36.8%) from the central region, 13 (34.2%) from the north-east region, 8 (21.1%) from the north region, and 3 (7.9%) from the east region. The results show that there was statistically significant difference in regional location on the scale of the factories, with more of the smaller factories in the Central Region and larger factories in the Northeast than would be expected (P =0.021, Fishers' Exact test). A significant difference was also found in presence of Research and Development activities (P =0.029, Fishers' Exact test) between size groups, with medium and large-scaled factories largely operating R&D activities, while many small scaled had none.

5.4.1.2 Production and productivity characteristics

In terms of productivity metrics, there were no statistically significant differences between size groups in the length of interval between gravest and crushing ($P = 0.807$, Fishers' exact test), or the crushing and extraction rate of molasses (ETR) ($P = 0.174$, Fishers' Exact test) as determined by one-way ANOVA. As shown in Table 5.4, on average, about 77 % of cane are crushed within 12 hours after being harvested and the average of extraction rate of molasses is about 46.01Kg per tonne of cane.

Table 5.4 Production and productivity characteristics of investigated millers

Productivity characteristics	Small-scaled production capacity*	Medium-scaled production capacity**	Large-scaled production capacity***	Total (n=38)	Significance of differences ³
	(n=13) Mean (SD)	(n=14) Mean (SD)	(n=11) Mean (SD)	Mean (SD)	
% of cane crushed <12 hours after harvesting ¹	78.5 (13.445)	76.1 (8.362)	75.9 (10.681)	76.8 (10.744)	$P = 0.807$
% of factory capacity utilization (4-year average) ²	62.7 ^a (8.063)	70.5 ^a (7.854)	67.6 (6.052)	67.0 (7.995)	$P = 0.034$
Extraction rate of sugar (ETR)	100.3 ^{a, b} (6.426)	110.3 ^a (8.182)	111.7 ^b (7.660)	107.3 (8.907)	$P = 0.001$
Extraction rate of molasses (ETR)	47.92 (4.946)	45.25 (4.551)	44.73 (3.714)	46.01 (4.574)	$P = 0.174$
Sugar production (mt/season)	61,793.1 ^{a, b} (22,534.063)	141,485.1 ^{a, c} (41,966.840)	270,127.2 ^{b, c} (35,061.699)	151,460.56 (90,359.403)	$P = 0.000$

Notes: Each common superscript letter denotes a subset of categories whose means differ significantly from each other at the 0.05 level from generated from Turkey Post Hoc tests

¹ Percentage of cane that have time lag between harvesting and crushing less than 12 being crushed

² Over maximum capacity utilization with regard to the availability of cane

³ Fishers' Exact test

* Average crushing capacity per day less than 10,000 metric tons, ** 10,000-20,000 metric tons, *** more than 20,000 metric tons

On the other hand, statistically significant differences were found in terms of the percentage of 4-year average factory capacity utilization ($P = 0.034$, Fishers' Exact test), extraction rate of sugar ($P = 0.001$, Fishers' Exact test) and volume of sugar produced ($P = 0.000$, Fishers' Exact test). A Tukey post hoc test revealed that percentage of average factory utilization was statistically significantly higher for medium-scaled factory (70.5 ± 7.85 percent, $P = 0.027$) compared to the small-scaled group (62.7 ± 8.06 percent). Moreover, the extraction rate of sugar was statistically significant higher for the medium- and large-scaled production capacity

factories (110.3 ± 8.18 Kg/tonne of cane, $P = 0.004$) compared to the small-scaled group (111.7 ± 7.66 Kg/tonne of cane, $P = 0.002$). However, there was no significant difference between medium and large scaled factories. Lastly, as expected, there were statistically significant differences in volume of sugar produced between all groups.

5.4.1.3 Raw material (cane supply) characteristics

As expected, the factories with higher rate of cane crushing capacity per day tended to buy in greater volumes of cane. Table 5.5 shows that there were significant differences between size groups volume of cane bought in ($P = 0.000$, Fishers' Exact test) and level of CCS ($P = 0.011$, Fishers' Exact test) as determined by one-way ANOVA. This relationship between factory scales and volume of cane brought in is replicated in some other countries such as, India (Singh and Kumar, 2020), Brazil (Belik et al., 2017) and Kenya (Mati and Thomas, 2019). The significant difference in level of Commercial Cane Sugar (CCS) between size groups, we found that the CCS level was significantly higher for both medium (12.8 ± 0.921 CCS point, $P = 0.013$) and large (12.7 ± 0.818 CCS point, $P = 0.044$) scaled factories compared to small-scaled factories.

Table 5.5 Volume of cane supplied to factory and their quality

Raw material characteristics	Small-scaled production capacity* (n=13)	Medium-scaled production capacity** (n=14)	Large-scaled production capacity*** (n=11)	Total (n=38)	Significance of differences ³
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	
Cane volume bought in (metric tons)	610,462.2 ^{a, b} (215,053.564)	1,269,685.2 ^{a, c} (312,011.850)	2,457,574.1 ^{b, c} (324,423.800)	1,388,024.1 (797,161.379)	$P = 0.000$
Prop of fresh cane ¹	50.6 (21.913)	50.3 (14.967)	50.3 (17.421)	50.4 (17.791)	$P = 0.998$
CCS level ² (%CCS)	11.9 ^{a, b} (0.644)	12.8 ^a (0.921)	12.7 ^b (0.818)	12.5 (0.892)	$P = 0.011$

Notes: Each common superscript letter denotes a subset of categories whose means differ significantly from each other at the 0.05 level from generated from Turkey Post Hoc tests

¹ Proportion of fresh cane being delivered over entire cane

² A % Commercial Cane Sugar (Sugar content of cane)

³ Fishers' Exact test

* Average crushing capacity per day less than 10,000 metric tons, ** 10,000-20,000 metric tons, *** more than 20,000 metric tons

In general, sugar mill received 50:50 percent between fresh and burnt cane delivered from farmers. No significant difference between size groups in the proportion of the cane supply that is fresh compared to burnt.

5.4.1.4 Revenue structure and market characteristics

On average, the sugar output of Thai sugar mills was about 66% raw sugar and 80% of millers' business revenue came from sugar production. Compared to the 2018/19 production season, millers' sugar productivity and profitability in 2019/2020 production season decreased by 38.5% and 49.6% on average. Table 5.6 demonstrates no statistically significant difference between size groups in terms of: the proportion of volume of raw sugar produced ($P = 0.250$, Fishers' Exact test); the proportion of business revenue generated from sugar product sales ($P = 0.108$, Fishers' Exact test); and the percentage change in terms of sugar productivity ($P = 0.644$, Fishers' Exact test) and profitability ($P = 0.928$, Fishers' Exact test) compared to 2018/19 production season.

Table 5.6 Revenue structure and market characteristics

Revenue structure and market characteristics	Small-scaled production capacity* (n=13)	Medium-scaled production capacity** (n=14)	Large-scaled production capacity*** (n=11)	Total (n=38)	Significance of differences ³
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	
Proportion of raw sugar production ¹	58.03 (30.473)	68.72 (14.579)	73.10 (20.079)	66.33 (22.909)	$P = 0.250$
Sales distribution: Domestic market	17,374.0 ^{a, b} (6,385.041)	39,541.7 ^{a, c} (11,728.742)	76,818.7 ^{b, c} (11,968.320)	42,748.75 (25,989.999)	$P = 0.000$
Sales distribution: Exports	44,419.1 ^{a, b} (16,155.731)	101,943.4 ^{a, c} (30,238.099)	193,308.5 ^{b, c} (24,198.831)	108,711.81 (64,509.478)	$P = 0.000$
% Change in productivity (Compared to 2018/19)	-37.6 (14.947)	-41.9 (8.850)	-35.2 (27.909)	-38.5 (17.844)	$P = 0.644$
% Change in profitability (Compared to 2018/19)	-48.1 (19.742)	-50.4 (17.372)	-50.5 (14.570)	-49.6 (17.060)	$P = 0.928$
Proportion of revenue from sugar ²	82.3 (11.108)	82.5 (6.124)	75.5 (9.070)	80.4 (9.255)	$P = 0.108$

Notes: Each common superscript letter denotes a subset of categories whose means differ significantly from each other at the 0.05 level from generated from Turkey Post Hoc tests

¹ Raw sugar as a proportion of all sugar

² Revenue as a proportion of total business revenue

³ Fishers' Exact test

* Average crushing capacity per day less than 10,000 metric tons, ** 10,000-20,000 metric tons, *** more than 20,000 metric tons

However, the statistically significant differences between size groups were found for volume of sales distributed for both domestic market ($P = 0.000$, Fishers' Exact test) and for exports ($P = 0.000$, Fishers' Exact test) as expected due to government control on sugar marketing, where approximately 28% of sugar produced from any miller must be allocated for domestic consumption. A Turkey post hoc test revealed that the sugar mills with greater crushing capacity

tended to supply a larger volume of sugar to both national and international markets, as all pairwise comparisons were < 0.05 .

5.4.2 Competitiveness and position of Thai sugar millers

To examine competitiveness of surveyed millers, three productivity-related indices and various corresponding indicators were created (for a list of these indices, see Table 5.7). A ranking score was used to position each miller on each indicator. The summary of each competitiveness index, corresponding indicators and their assigned weights were explained in Section 5.3.1 and their descriptive results are presented in Section 5.4.1. The full details of the results from the analysis of competitiveness indexing including listed indicators, assigned scores for each indicator, competitiveness scores and ranking can be found in Appendix I.

For illustrative purposes, competitiveness clusters were designed based on their competitiveness ranking obtained from the analysis of competitive index. This clustering was created on the account of the presence of multiple competitiveness-type metrics used in this study. The advantage of this method is that it facilitates researcher to create competitiveness ranks based on all of competitiveness-type metrics for more holistic view. In this research, Thai sugar millers were classified into five competitive clusters, namely; (1) highly competitive group, (2) competitive group, (3) average competitive group with higher productivity and feedstock supply stability, (4) average competitive group with lower productivity and feedstock supply stability, and (5) least competitive group. Table 5.7 reports the respective cluster statistics and descriptions. The clusters are displayed as radar chart showing their mean values on each of the competitiveness index variables in Figure 5.3. The rationale behind the classification system is to check if the likely responses to policy scenarios of investigated millers differ based competitive position, they play within the system of Thai sugar sector.

Table 5.7 Respective cluster statistics and descriptions

Major determinants	Average scores				
	Cluster 1	Cluster2	Cluster 3	Cluster 4	Cluster 5
Productivity index	4.94	4.89	4.34	3.24	3.00
Input index	4.87	4.93	4.50	2.76	1.67
Business structure and sophistication factor index	5.40	4.00	2.50	2.22	1.00
No. of millers included	5	5	8	17	3
Cluster description	Highly competitive group	Competitive group	Average competitive group (higher productivity and feedstock supply stability)	Average competitive group (lower productivity and feedstock supply stability)	Least competitive group

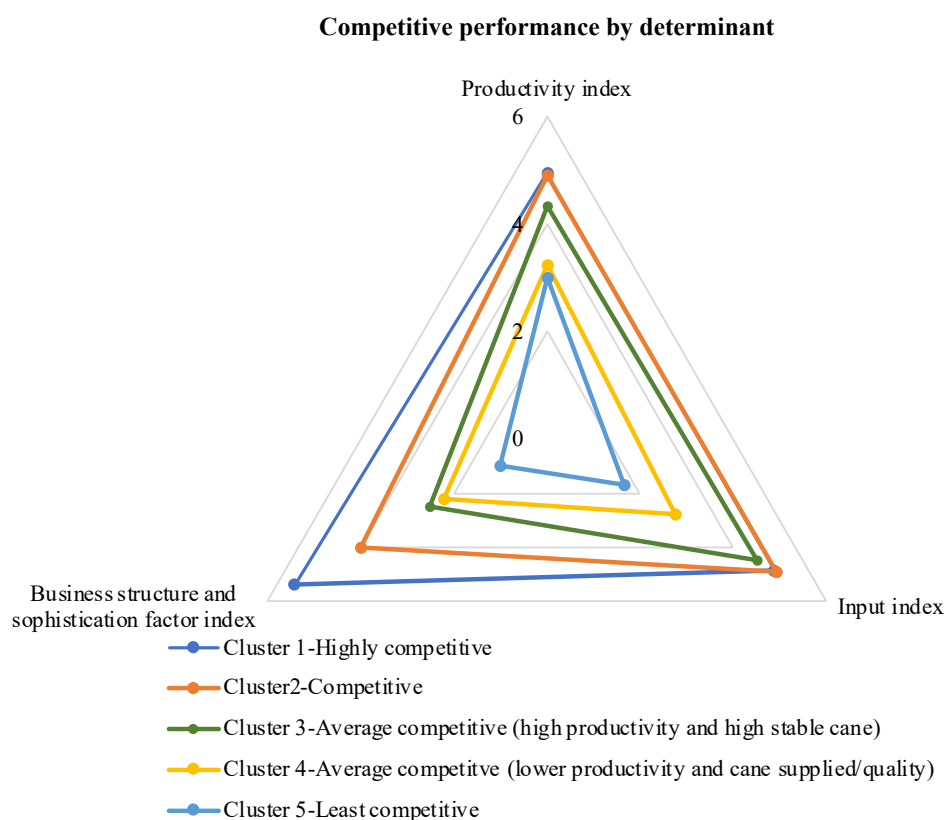


Figure 5.3 Miller's competitive performance by determinants

Cluster 1 (n=5), considered as a “very” competitiveness cluster, is characterised by overall highest levels of productivity, cane supply and their quality, business diversification and research and development performance. Perhaps the most striking results while observing the properties of investigated millers achieving the very highest competitiveness ranks is that four of these mills constitute one sugar producer group who explicitly outperform in terms of R&D investment and business diversification. Cluster 2, competitive group, is similar to Cluster 1 with regard to productivity and characteristics of feedstock because these differences are not statistically significantly different at the 5% level. However, they differ significantly in business diversification and R&D spending where Cluster 2 obtains less range of business diversification and spending slightly less in R&D ($t(8) = 2.357, P = 0.046$). Cluster 3 and Cluster 4 are considered as average competitive group with no statistically significant difference in terms of R&D spending and business diversification, but they differ significantly in levels of productivity ($t(23) = 3.629, P = 0.001$) and characteristics of cane supply ($t(23) = 4.879, P = 0.000$). The results from Table 5.7 show that Cluster 3 obtains higher productivity level and larger and better supplies of cane than Cluster 4, in general. Finally, Cluster 5 seems to be the one which is overall least competitive, with the lowest mean scores on all three measures, in general. Comparison of Clusters 4 and 5 using one-way ANOVA and post-hoc tests show no significant difference in productivity and R&D and business diversification index but a difference in input index ($t(19) = 2.664, P = 0.015$). Cluster 5 also significantly underperformed all other clusters in all categories ($P_s < 0.05$). These results provide support for hypothesis H11 is *that there are significant differences in the degree of competitiveness among Thai sugar millers in respect of productivity, input, and business structure and level of business differentiation dimensions*.

5.4.3 Millers’ attitudes and business likely responses to the scenarios

The objective of this section is to provide a narrative of the way the sugar miller sector is likely to be impacted by, and respond to, the different policy scenarios. Because providing an interesting narrative is the central focus of this section, the frequency of attitudes and expectations for the three scenarios was also explored. Results of statistical analysis are also presented as a supplement to the descriptive evidence to confirm the significance of any observed differences.

5.4.3.1 The impact of scenarios on level of satisfaction

In terms of differences in the evaluation of the three scenarios ('protectionism', 'government proposal' and 'libertarian') by the same individuals, the Friedman test (a non-parametric alternative to one-way ANOVA with repeated measures) was used as the dependent variable being measured is ordinal. To examine where the differences actually occur, a post hoc tests was performed by running separate Wilcoxon-signed-rank tests comparing different scenarios, using a Bonferroni adjustment for multiple comparisons. The summary of findings in this study is presented as follows.

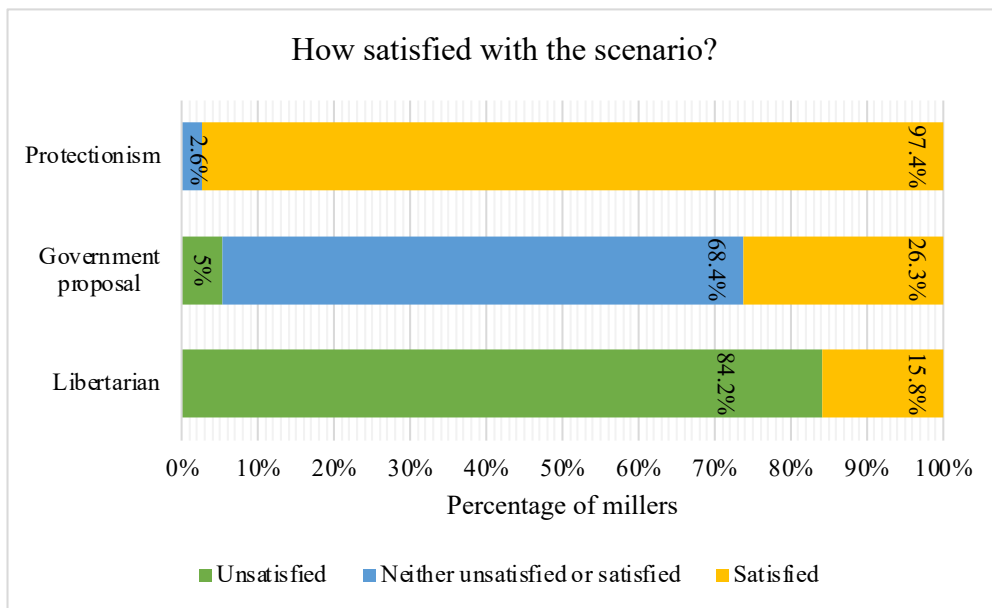


Figure 5.4 Millers' satisfaction toward scenarios

The differences in level of millers' satisfaction toward different scenarios and potential impact on their sugar business if the scenarios are presumably implemented are illustrated in Figure 5.4 and Figure 5.5, respectively. Overall, no respondents expressed dissatisfaction with 'protectionism' scenario, while the majority were dissatisfied with 'libertarian' scenario. Nearly 75% of sample were neutral when speaking about their satisfaction for the 'government proposal' scenario. The statistically significance difference in level of satisfaction was verified ($\chi^2(2) = 57.190$, $P = 0.000$), demonstrating statistically significant reduction in satisfaction between the libertarian vs government proposal scenario ($Z = -4.512$, $P = 0.000$), libertarian vs protectionism scenario ($Z = -5.578$, $P = 0.000$) and government proposal scenario vs protectionist ($Z = -5.038$, $P = 0.000$).

A total of 32 millers (84.2%) were unsatisfied with 'libertarian' scenario and 33 millers (86.9%) believed that this scenario would cause negative impact to their sugar business. However, 6

(15.8%) millers were satisfied with ‘libertarian’. Of the 6 respondents who satisfied with libertarian scenario, only 4 millers (10.5%) believed that this scenario would produce positive impact to their business while one believed there would be no difference in terms of impact on the business.

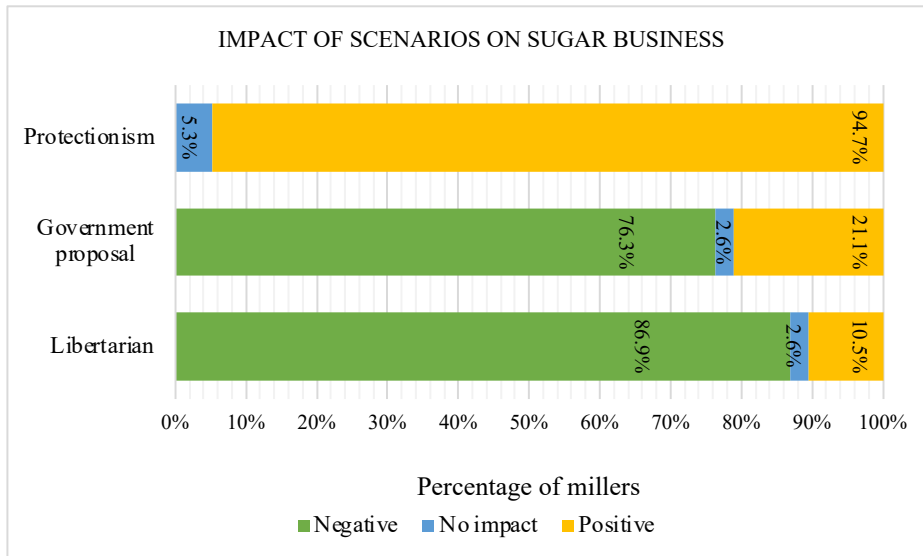


Figure 5.5 Possible impact on sugar business under three scenarios

The majority of millers (68.4%) were neutral in relation to the ‘government proposal scenario’ with only 2 respondents (5.3%) expressing dissatisfaction. However, 76.3% of respondents believed that this scenario would still cause negative impact to their business.

In contrast, none of the millers surveyed were dissatisfied with the ‘protectionism’ scenario, as none of these respondents believed that this scenario would cause negative impact to their business. Only one or two respondents were neutral about satisfaction and the impact for protectionism scenario.

5.4.3.2 The likely impact of scenarios on sugar business position

Figure 5.6 compares the likely impact of scenarios on three dimensions, representing sugar business position; (1) millers’ ability to gain greater market share, (2) ability to compete with other rivals and (3) the survival of their sugar business.

Generally speaking, what stands out in Figure 5.6 is that the ‘protectionist’ scenario is perceived as the least likely to damage sugar business position, followed by the ‘government proposal’ scenario. Not a single person expressed the view that their sugar business would be unlikely to survive and that they would be unlikely to compete with the rivals and unable to obtain more

market share under the ‘protectionist scenario. Among three scenarios, the neutral responses were most frequently given to the ‘government proposal’ for all three dimensions. Particularly, it is evident that more than half of respondents (57.9%) were either unsure, could not decide, or felt they lacked sufficient information to form an opinion regarding their business survival under the ‘government proposal’ scenario. Nonetheless, a minority of respondents did express the view that they would be unlikely to survive and to compete with rivals under this scenario.

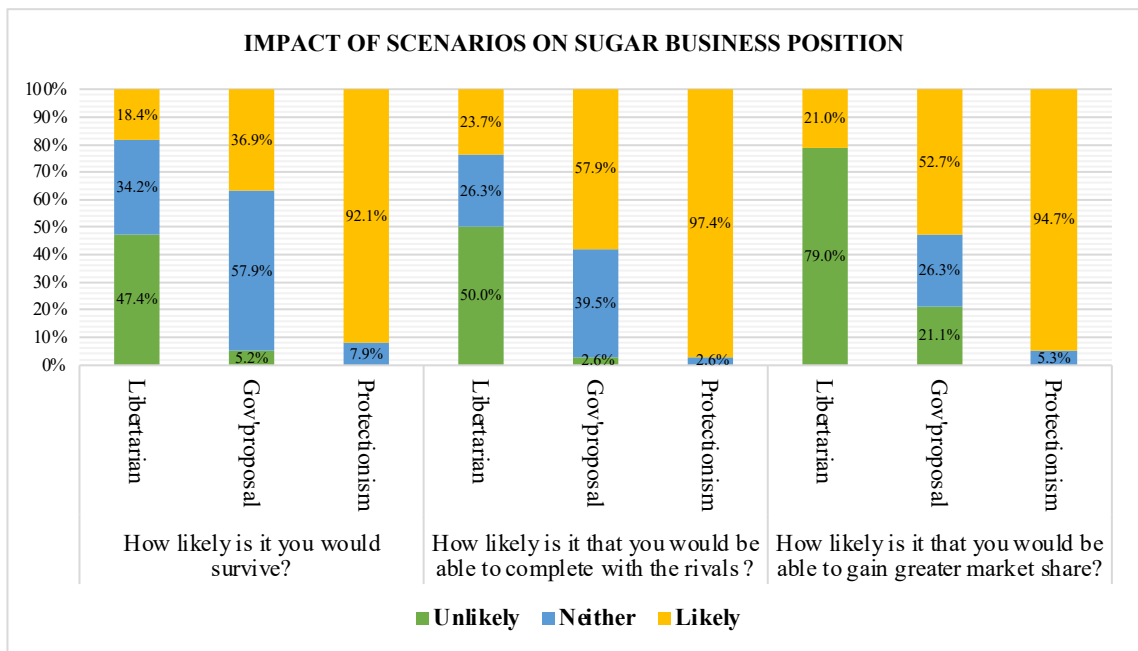


Figure 5.6 Likely impact of scenarios on sugar business position

On the other hand, the ‘libertarian’ scenario was viewed as likely to be highly detrimental by more than half of investigated millers, with only 18.4% of the sample indicating that they would likely survive. In the same way, only around 20% of respondents expressed the view that they would be able to compete with leading rivals and gain greater market share.

The observed differences between the three scenarios on the three dimensions were found to be significant using Wilcoxon-signed-rank tests with Bonferroni correction¹³. The tests revealed a statistically significant reduction in likelihood of business survival, ability to compete with leading rivals, and ability to obtain greater market share under the libertarian vs government proposal scenario ($P < 0.017$), libertarian vs protectionism scenario ($P < 0.017$) and government

¹³ The critical value (alpha) for multiple comparison by Bonferroni correction is found by dividing the critical P level of significance or alpha, usually 0.05 by the number of tests or all possible pairs. In this case, there were only 3 possible pair, so each pairwise P value would have to be less than $0.05/3$ or 0.0017 , to be significant.

proposal scenario vs protectionist ($P < 0.017$). Therefore, the Hypothesis H12 i.e. *there are significant differences between the impact of three scenarios on three business position dimensions (i.e. likelihood of business survival, ability to compete with leading rivals, and ability to obtain greater market share)* was accepted.

5.4.3.3 Impact of scenarios on business profitability

The estimated impact of the scenarios on millers' revenue is demonstrated in Figure 5.7. Overall, the findings revealed that there are significant differences between the impact of scenarios on millers' sugar business profitability. As was foreseeable, implementing the 'protectionism' scenario would not cause any negative impact on business profitability. More than three-fourths of observed millers (76.3%) reported that their business would financially perform very well. The worst effect in respect of business profitability from the protectionist scenario would be driving the profitability of about 10.5% of millers to break-even point.

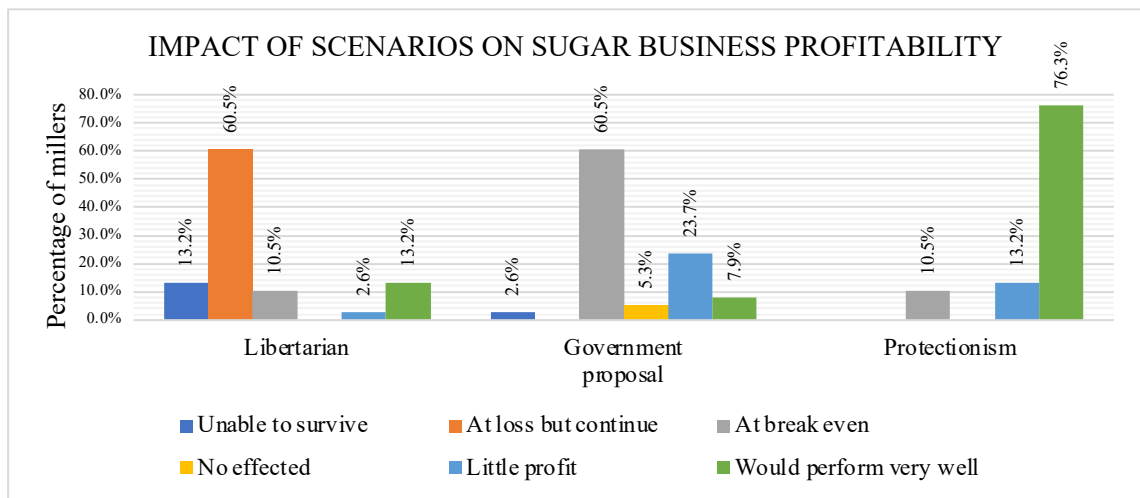


Figure 5.7 Impact of scenarios on sugar business profitability

One of the most striking results to emerge from the data is that under the government proposal scenario 60.5% of those surveyed (23 respondents) indicated that their profitability would be no better than breakeven point, while just under one-third (31.6%) perceived that their business would be profitable. Nonetheless, only one miller (2.6%) felt that the company could not survive under this scenario.

Importantly, the results reveal a marked effect of the 'libertarian' scenario on millers' expected business profitability, with almost three-fourths of investigated millers (28 respondents) believing that the scenario would negatively affect their profitability. Perhaps the most remarkable result is that under the 'libertarian' scenario, even though they would be losing money, 60.5% (23 millers) of sample stressed that they would remain in business. Just 6 millers (15.8%) believed that they would be profitable, under this scenario.

5.4.3.4 Expected profit the next five years

The previous section looks at the impact of scenarios on business revenue and profitability in general. This section will explore the impact of scenarios on the business' expected turnover within a more specific time frame.

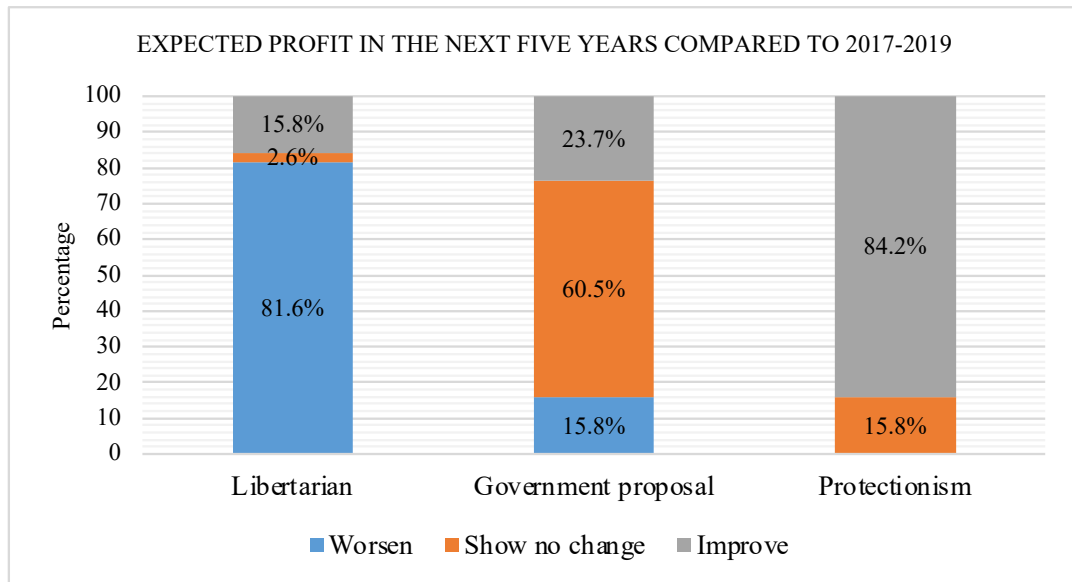


Figure 5.8 Expected profit in the next five years compared to 2017-2019

As can be seen from Figure 5.8 (above), 81.6% of respondents stressed that their expected profit in the next five year would be lower than MY2017-19 under the 'libertarian' scenario, followed by the 'government proposal' scenario (15.8%) while none of these samples believed that they would generate less profit than in 17-19 under the protectionist scenario. To explore the root causes of these changes, millers who stated that their business would generate less profit under each scenario were asked, using a series of binary choice questions, whether they agreed that given items are the reason for the change.

As seen in Figure 5.9, it is prominent that the main causes of expected reductions in business profitability would be external factors such as market environment and marketing factors, whereas internal business factors were less important. Of the 11 reasons given, all respondents who indicated their expected profit would be lower under the 'libertarian' and 'government proposal' scenarios agreed that a decrease in both export and domestic sales, a reduction in volume of cane supplied to processing factories, and loss of domestic market share would likely be the biggest constraining factors. Another predominant external constraining factor under the 'libertarian' scenario was 'less government intervention' while 'a decrease in cane price' was also constraining under the 'government proposal' scenario.

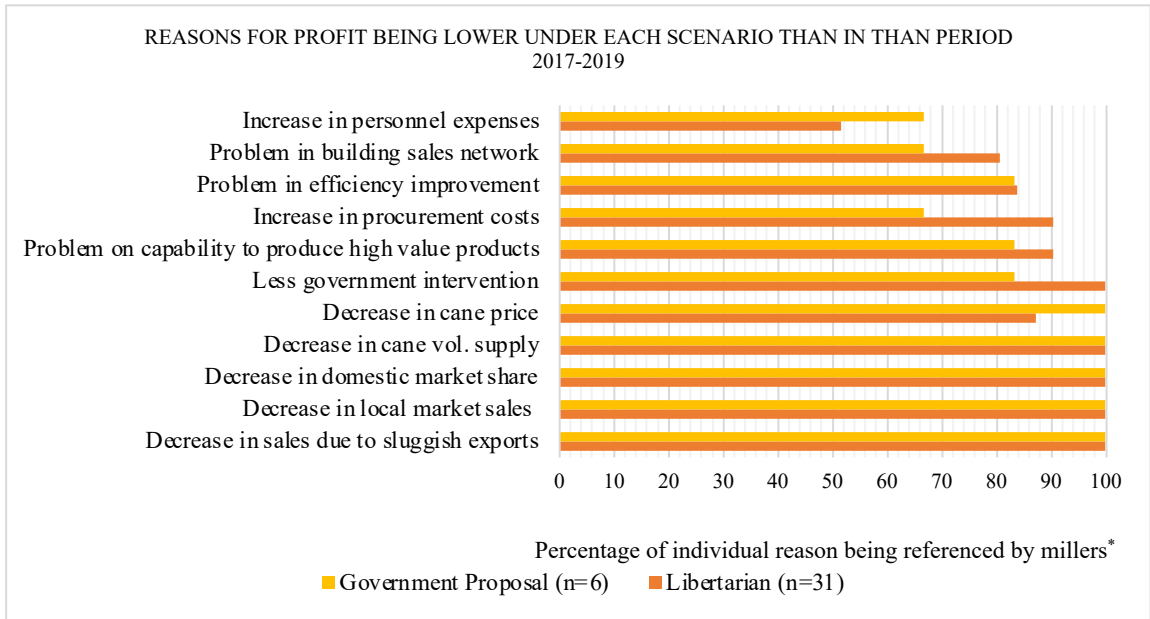


Figure 5.9 Reasons for profit being lower under each scenario than in the period 2017-2019

Millers who indicated their expected profit in the next five years would be higher compared to MY2017-2019 were asked to indicate the reasons for this.

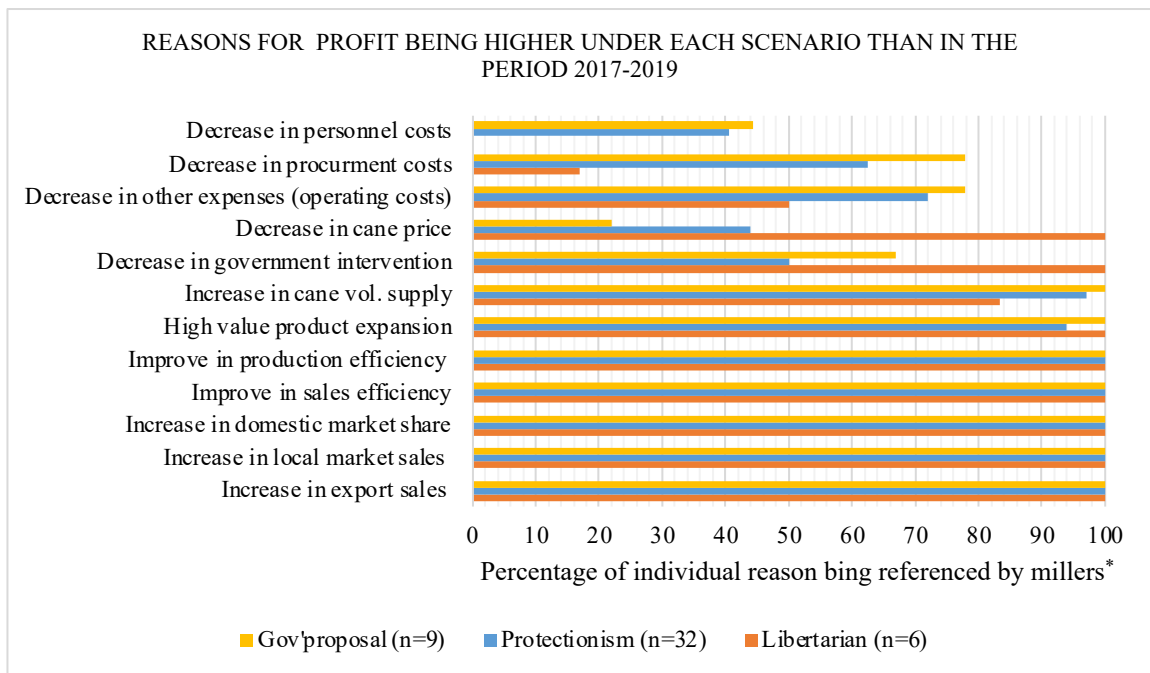


Figure 5.10 Reasons for profit being higher under each scenario than in the period 2017-2019

The data presented in Figure 5.9 can be compared with the data in Figure 5.10 which shows the equivalent importance of market environment factors but in the reverse direction. Under any scenario, increase in both exports and domestic sales and increase in internal market share were found to be the most impactful factors for increasing profitability in the next five years compared to MY2017/19. In addition to external factors, internal factors representing company's performance which are considered as the most enhancing factors under any scenario are improvement in production and sales efficiency, as well as expansion into higher value markets. While reductions in costs were found to be positive influencing factors, these were of low significance. For example, of the 12 options, on average, reductions in labour costs were seen as the least important enhancing factor, only half of respondents identified this factor, followed by decrease in procurement costs and decrease in other expenses such as operating costs, respectively, under any scenario.

What is striking about data in Figure 5.10 is that in addition to the factors identified above a decrease in government intervention and the cane price were also believed to be facilitating factors, but only under the 'libertarian' scenario.

5.4.3.5 Millers' likely business responses to scenarios

This section explores millers' likely business responses to each scenario, including an assessment of the likelihood of specific actions undertaken in response to each scenario.

Figure 5.11 and Table 5.8 below illustrate the breakdown of millers' likely business responses to each policy scenario. Overall, it is apparent that 100% of investigated millers would remain in sugar business under the protectionist scenario. This figure drops slightly to 90% and 97% under the 'libertarian' and 'government proposal' scenarios respectively. Therefore, it can be suggested that the hypothesis H15 is that *the three scenarios will not cause significant sugar refining sector restructuring, in terms of causing the closure of milling factories was supported*. From the Figure 5.11, it can be seen that by far the most satisfactory scenario is protectionism with a mean satisfaction score of five. Under this scenario, nearly 80% of investigated millers reported that they would increase throughout while the rest indicated they would maintain status quo.

Because the mean score of satisfaction for the 'government proposal' scenario was just above average (3.24), therefore it is realistic that the majority of participants (87%) would maintain their sugar production at existing levels.

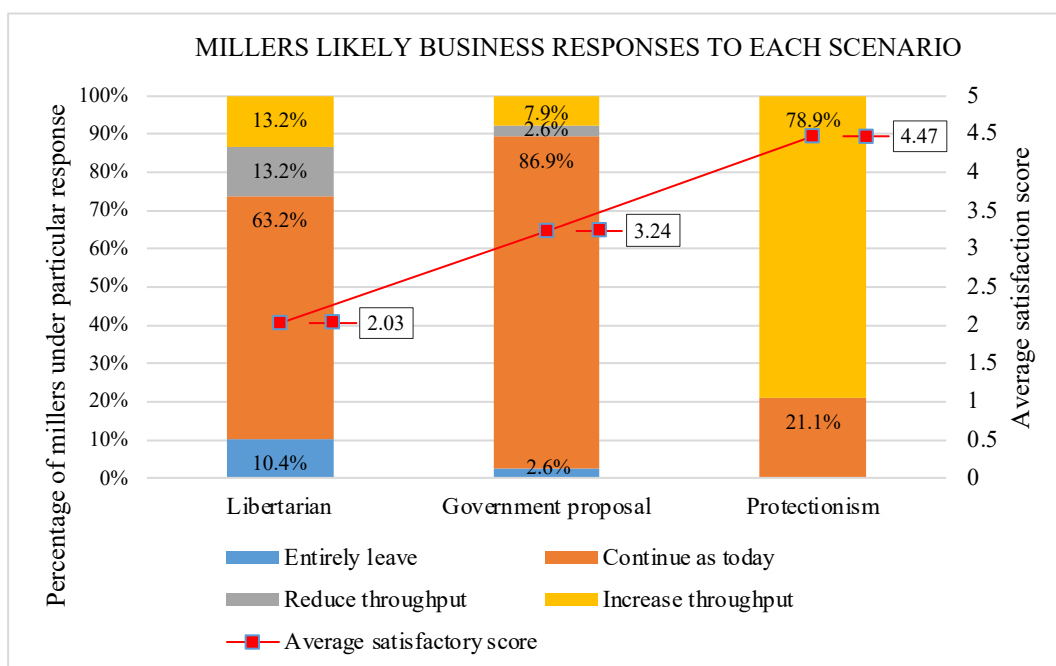


Figure 5.11 Millers' likely business responses to each scenario

Table 5.8 change on number of millers and production

Change in sugar production and number of millers	Libertarian scenario	Government proposal scenario	Protectionism scenario
% Vol. loss (Quit)	6.80%	1.91%	0.00%
% Vol. loss (Reduce)	6.30%	1.00%	0.00%
% Vol. increase (Increase)	8.60%	1.44%	22.98%
Net change in cane vol.	-4.50%	-1.47%	22.98%
% of millers (Quit)	10.40%	2.60%	0.00%
% of millers (Reduce)	13.20%	2.60%	0.00%
% of millers (Expand)	13.20%	7.90%	78.90%
% of millers (Remain in business)	89.60%	97.40%	100%

Note: Compared to 2019/20 when miller survey was collected

The single most striking observation to emerge from the data comparison was the intriguing connection between millers 'likely business responses and their level of satisfaction with the 'libertarian' scenario. Although the average satisfaction score for the 'libertarian' scenario was only 2.03, almost two-thirds of participants (63.2%) reported that they would maintain the status quo regarding the production capacity and five participants (13.2%) even felt that would expand

throughput and only 13.2% of those surveyed suggested that they would downsize sugar production.

In addition to addressing their likely business responses, millers were also asked to provide an estimate of the associated change in the level of their sugar production. These estimates are presented in Table 5.8. It is apparent from this table that under the 'libertarian' scenario, the volume of sugar produced would decline slightly (-4.5%) compared to the production in MY2019/20. As vast majority of millers indicated that they would maintain the scale of sugar production at the existing level, under the 'government proposal' scenario is expected to lead to a smaller decline in sugar production compared to the libertarian reform (-1.47%). Under the Protectionism scenario the majority of millers are expected to increase the sugar production, and implementation would result in dramatic rise in production volume compared to MY2019/20 (23%). These results provide support for hypothesis H13 that *there are differences in millers' likely business responses between the protectionism' and other scenarios.*

Figure 5.12 and Figure 5.13 show the likelihood of specific actions being undertaken by millers in response to the scenarios. On average, about 50% of participants reported they would postpone the new investment, downsizing the existing sugar business, reduce staff levels and cut manufacturing hours under if the libertarian were to be implemented. Under the government proposal scenario about 10% of participants on average commented that they would undertake those four specific actions illustrated. Superior results are seen for the protectionist as no investigated millers intended to cancel or postpone new investment they have planned or downsize their existing business. Hardly any participants indicated that they would reduce staff levels and manufacturing hours under protectionism scenario.

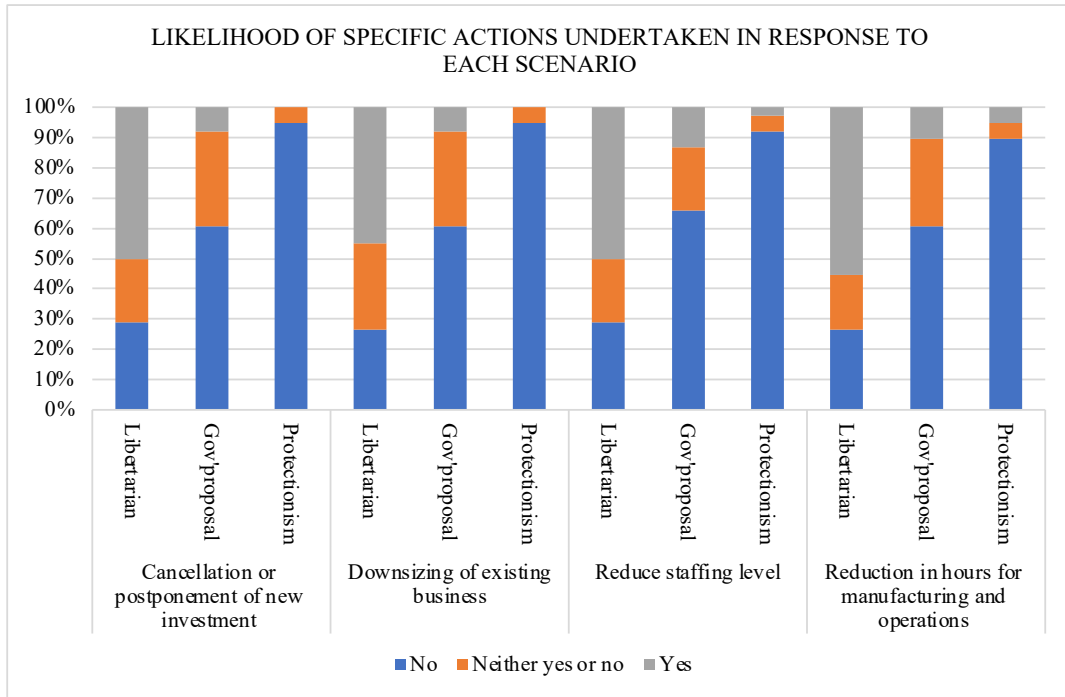


Figure 5.12 Likelihood of specific actions undertaken in response to each scenario

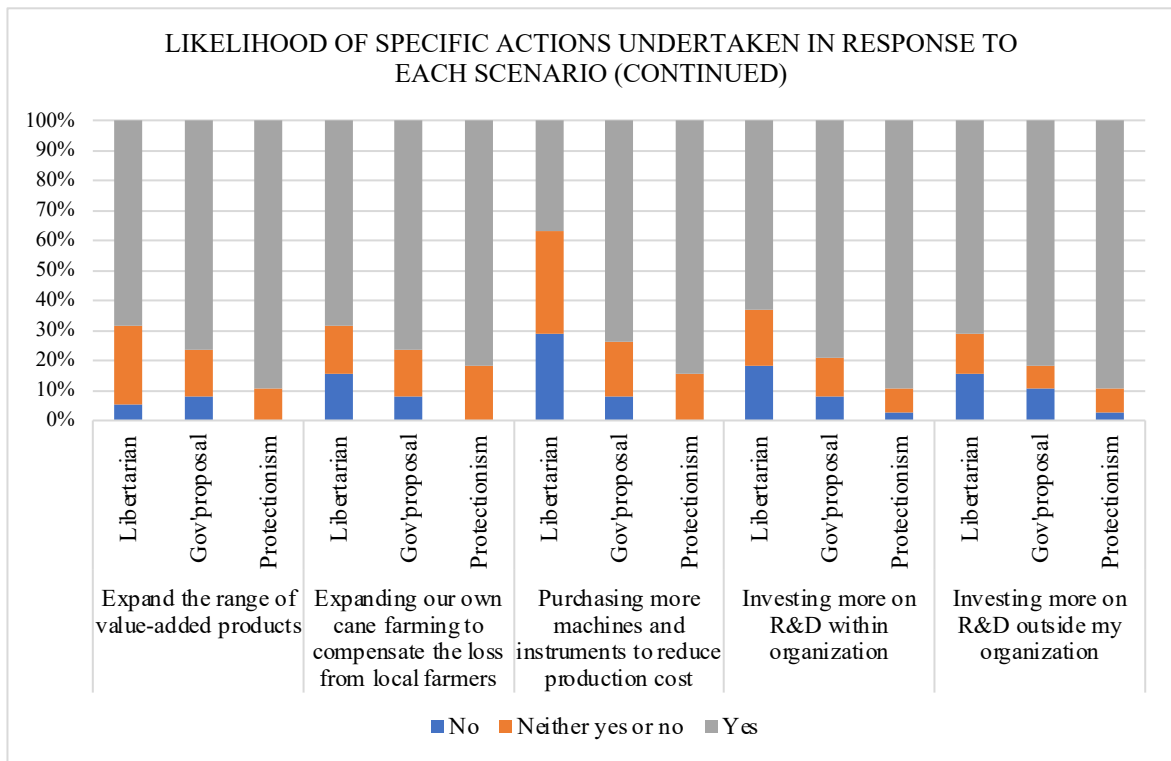


Figure 15.13 Likelihood of specific actions undertaken in response to each scenario (continued)

Aside from the fact that the more pressurized the scenario, the more actions millers would take to compensate including postponing new investment, downsizing the existing business, and cutting both staff levels and manufacturing hours, it is also apparent the more pressures the millers feel, the less likely they would undertake business development actions. In other words, the less pressurized the scenario, the more likely millers will develop and increase the investment to their business. To illustrate, the data in Figure 5.13 shows that, no participant opposed to value-added business expansion, investing on factory-owned farms to compensate loss from local farmers and new machinery investment while only one participant said that the company would not investing more in R&D under the protectionism scenario.

The significant differences in all actions undertaken between all scenarios were confirmed by the Friedman test. The results from Wilcoxon-signed-rank tests with Bonferroni adjustment also strengthened our frequency distribution results, demonstrating statistically significant increase in likelihood of postponing new investment, downsizing exist business, cutting staff levels and manufacturing hours and statistically significant reduction in likelihood of investing more resource, capitals, and R&D on libertarian vs government proposal scenario ($p < 0.017$), libertarian vs protectionism scenario ($p < 0.017$) and government proposal scenario vs protectionist ($p < 0.017$).

5.4.4 Millers' preferences for policy options and mixture of policy elements

This section constructs an appropriate future policy scenario that favours sugar miller interests, based on millers' expressed preferences for four main policy elements of Thai sugar industry: (1) domestic sugar price mechanism; (2) revenue-sharing system; (3) domestic sugar distribution mechanism; and (4) cane producer supports.

As shown in Figure 5.14, the majority of millers (28 participants or 73.7%) expressed a preference for the protectionism scenario, well ahead of the next most preferred, the libertarian (6 participants) and the least preferred, the government proposal (4 participants), respectively. Hence, the hypothesis H16 was supported. There are two striking observations to emerge from the data comparisons in this study. First, as summarised in previous sections, although the 'government proposal scenario' seems to be the more business friendly option, i.e. it would cause much less harm to business positions and company's profitability than the libertarian scenario, the 'libertarian' scenario was chosen in preference to the 'government proposal' scenario when millers were asked to choose the scenario they prefer to be implemented. Second, closer inspection of the results shows that, of six participants who expressed support of the 'libertarian' scenario, four of these participants were the highly competitive millers who operate under the most competitive sugar producer group. The other two participants were found to be in the competitive group. Therefore, the hypothesis H14 i.e. *Millers who achieve the very highest competitiveness scores were most likely to support the 'libertarian' scenario than those with lower competitiveness was supported.*

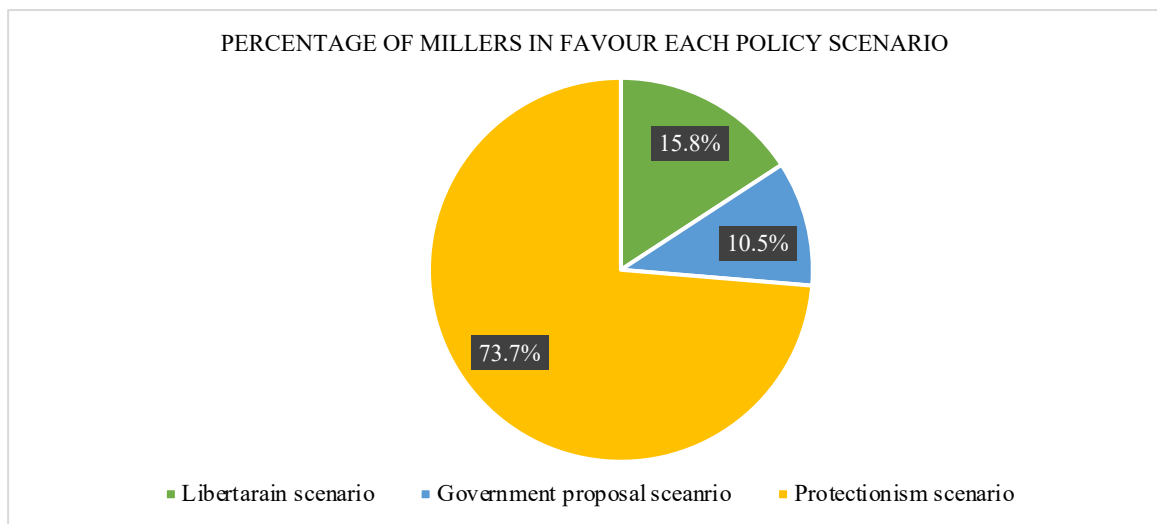


Figure 5.14 Percentage of millers in favour each scenario

Figures 5.15 to 5.18, present a breakdown of the four main policy instruments that define each scenario and millers' preferences for these. First, when asked which domestic sugar price policy

option they prefer, over half (58%) indicated that price fixing through a price collusion mechanism would be the best alternative for their sugar business, while a fully liberalised domestic pricing, where millers are freely allowed to sell sugar in the local market at any price they desire was the least favourable choice with only 6 proponents (15.8%).

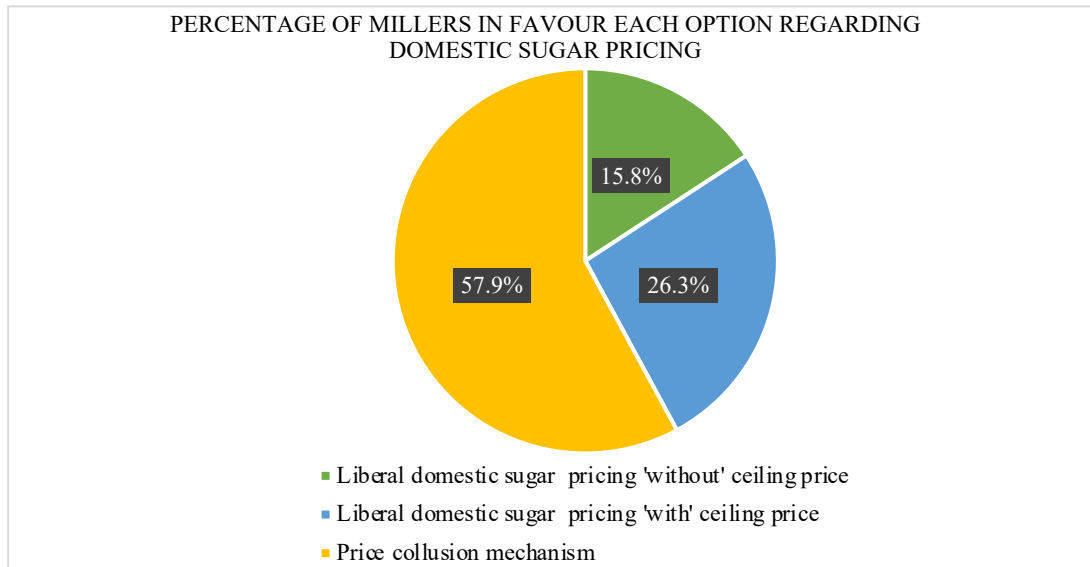


Figure 5.15 Percentage of millers in favour each option regarding domestic sugar pricing

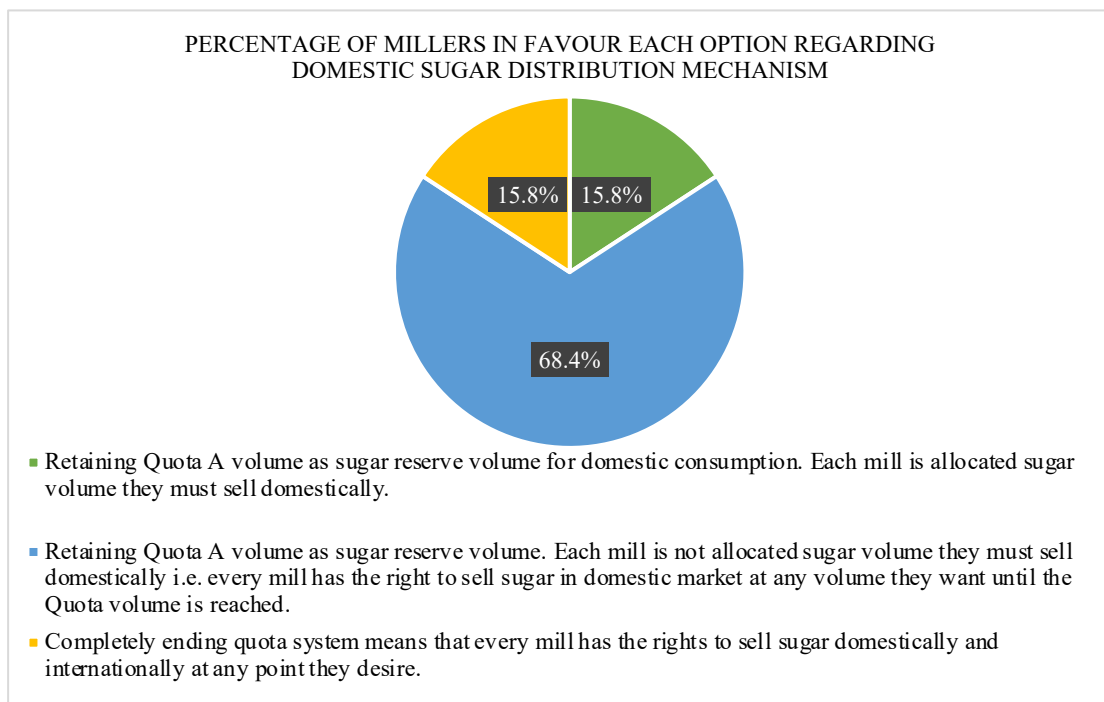


Figure 5.16 Percentage of millers in favour each option regarding domestic sugar distribution mechanism

Millers were asked to choose the domestic sugar distribution mechanism that would be best for their business. Just above two-thirds of participants (68.4%) agreed that a quota volume for domestic consumption (Quota A) must be retained as a sugar reserve to ensure internal requirements are met, but there must be no restrictive regulation on domestic sales volume allocation as it has been done in the past, which implies that millers should be allowed to sell any volumes they want, or not sell, once the volumes required to meet the national reserve has been met. The data in Figure 5.16 also shows only limited support for the other two options, as six respondents (15.8%) preferred the status quo, i.e. a domestic distribution mechanism, whereas only six respondents (15.8%) preferred a full elimination of quota system.

In terms of revenue-sharing between farmers and sugar millers, as seen in Figure 5.17, it is evident that majority of participants (79%) agreed that the current revenue-sharing system ought to be retained. This means that revenue from sugar and molasses is shared at 70:30 proportion. Where cane is used as feedstock for other cane-related industries, such as the bio-industry, it must be sold in the open market without being taken into the account sugar and molasses revenue-sharing mechanism. It is also worth noting that hardly any of those who took part in the survey (7.9%) agreed with the idea of re-adjusting the proportionate revenue distribution ratios by taking all cane-related products into account for re-calculating farmers' proportion, despite a decrease in farmers' proportion.

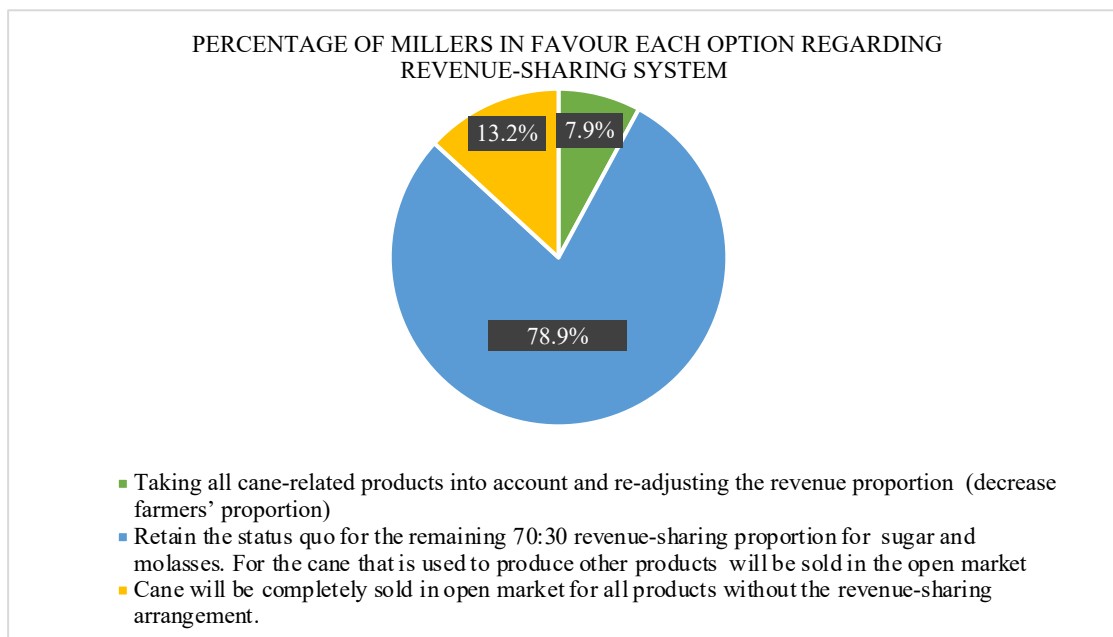


Figure 5.17 Percentage of millers in favour each option regarding revenue-sharing system

Investigated millers were also asked what would be the best general policy direction for both cane growing and sugar production. The data in Figure 5.18 reveals that hardly any of participants (2.6%) preferred the policy approach that promoted supporting only efficient farmers and millers to remain in the industry while encouraging less efficient ones to leave the industry. This result confirms our finding from Chapter 3. Figure 5.18 shows that about half of participants (53%) agreed that for the industry to move forward sustainably, while efficient producers should be put encouraged, some support policies should be maintained during the period of transition towards a more liberalized regime, to allow for adjustments and the arrival of the more sustainable and long-term benefits resulting from structural enhancements. On the other hand, about 45% of those surveyed preferred a policy approach that encourages all existing producers to remain in business under regardless of their condition.

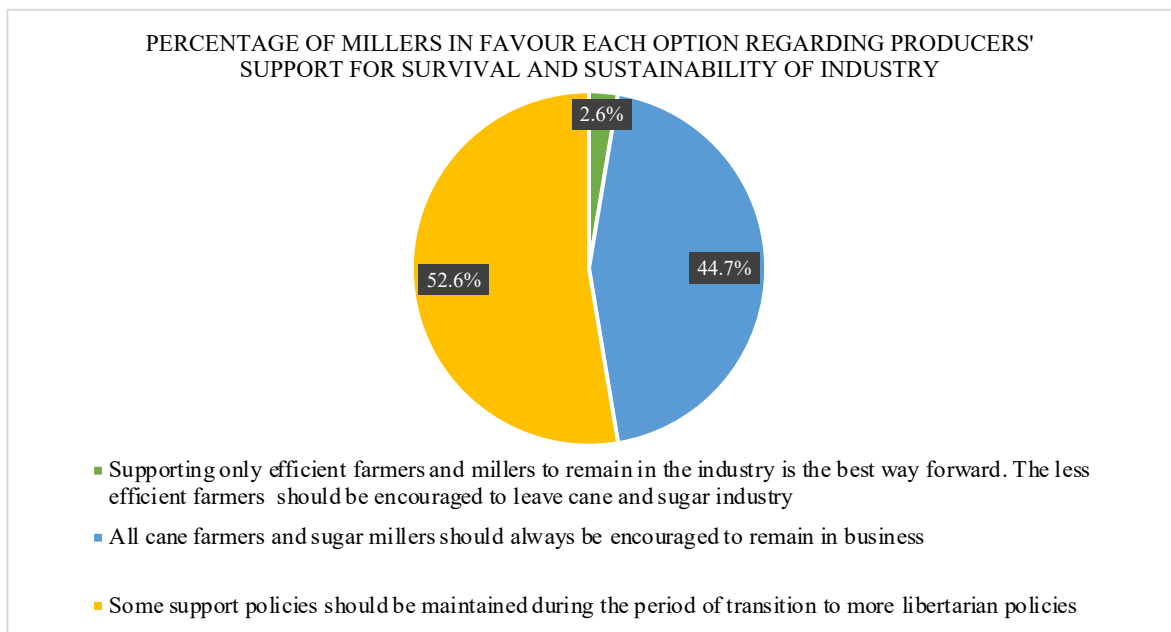


Figure 5.18 Percentage of millers in favour each option regarding producer support

In the final part of results in this chapter, further statistical tests were performed to determine whether there are significant differences in millers' preferences for policy elements between supporters of the three different policy scenarios (see Table 5.9).

The results reveal that there was no statistically significant difference in millers' preference for revenue-sharing system between three groups ($P= 0.100$, Fisher's Exact test). In respect to domestic sugar distribution, there were statistically significant differences between the preferences of those who were supportive of the 'libertarian' and the 'government proposal' scenario and between supporters of the 'libertarian' and 'protectionism' scenarios. Even though

most millers agreed with maintaining the sugar reserve mechanism to protect domestic consumption, millers who were in support of the ‘libertarian’ scenario were more likely than supporters of the other scenarios, to be in favour of the idea of regulating the volume distributed by each miller, but less likely to support a scheme that would put no control over volume distribution

Table 5.9 Differences in miller preferences for policy elements between three proponent groups

Policy measures and their options	Libertarian proponent (n=6)	Gov’ proposal proponent (n=4)	Protectionism Proponent (n=28)	Total (n=38)
	Counts (Expected value)	Counts (Expected value)	Counts (Expected value)	Counts (%)
Domestic sugar distribution mechanism (Fisher’s Exact = 16.697, $p = 0.001$)				
No restriction (Millers are allowed to manage their own selling distribution)	0 (0.9)	0 (0.6)	6 (4.4)	6 (15.8%)
Sugar reserve without controlling over allocation of distribution volume	1 (4.1) ^{a, b}	4 (2.7) ^a	21 (19.2) ^b	26 (68.4%)
Sugar reserve with controlling over allocation of distribution volume	5 (0.9) ^{a, b}	0 (0.6) ^a	1 (4.4) ^b	6 (15.8%)
Domestic sugar pricing (Fisher’s Exact = 16.716, $p = 0.000$)				
Full price float without price ceiling	2 (0.9)	0 (0.6)	4 (4.4)	6 (15.8%)
Price float with price ceiling	4 (1.6) ^a	3 (1.1) ^b	3 (7.4) ^{a, b}	10 (26.3%)
Price fixing through price collusion	0 (3.5) ^a	1 (2.3) ^b	21 (16.2) ^{a, b}	22 (57.9%)
Revenue-sharing (Fisher’s Exact = 6.384, $p = 0.100$)				
Readjusting revenue-sharing proportion	0 (0.5)	0 (0.3)	3 (2.2)	3 (7.9%)
Maintain status quo	3 (4.7)	4 (3.2)	23 (22.1)	30 (78.9%)
Farmers receive open market prices	3 (0.8)	0 (0.5)	2 (3.7)	5 (13.2%)
Cane producer supports (Fisher’s Exact = 10.508, $p = 0.012$)				
Policy support only efficient producers while encourage less efficient ones to exit	1 (0.2) ^a	0 (0.1)	0 (0.7) ^a	1 (2.6%)
Policy helps every producer to remain in business under any circumstance	0 (2.7) ^a	1 (1.8)	16 (12.5) ^a	17 (44.7%)
Gradually withdraw producer supports while maintain some policies during period of transition	5 (3.2)	3 (2.1)	12 (14.7)	20 (52.6%)

Notes: Each common superscript letter denotes a subset of categories whose means differ significantly from each other at the 0.05 level from generated from Bonferroni Correction test

Statistically significant differences, in terms of preference for domestic pricing, were found between those who support the protectionist and government proposal scenario and protectionist and libertarian scenario. As seen in Table 5.9, proponents of protectionism were more likely,

than supporters of other scenarios, to prefer a price fixing scheme, involving price collusion and less likely in favour a free-floating price with price ceiling mechanism.

Finally, a statistically significant difference in millers' preference regarding direction of overall producer supports was found between those who were supportive of the 'libertarian' and 'protectionism' scenarios. Proponents of protectionist were much more in favour of types of policy that would help all producers to remain in business regardless of circumstances and were more likely to oppose the type of policy that encouraged only efficient producers to stay in business.

5.5 Discussion

5.5.1 The determination of competitiveness of Thai sugar millers

The analysis of miller competitiveness reveals some interesting results. First, although it becomes evident that millers in the highly competitive group outperformed the other groups in all three dimensions, it was found that the predominance in terms of level of business differentiation and, in particular, their development in R&D and business diversification is the outstanding factor distinguishing them from other groups. In line with several studies, it also happened to be the indicator that contributed most to the competitiveness of Thai sugar sector, as some studies have emphasized the importance of business diversification as a tool of company's optimal performance and competitive advantage (Barney, 1991, Dirisu et al., 2013). A factory obtains above-normal performance when it creates greater-than-expected economic value from its superior resource and subsequently achieves a competitive edge over its rivals (Barney, 1991, Barney, 2014). A number of studies in sugar producing countries such as Mexico (Vargas-Hernández et al., 2018), Kenya (Muteshi and Bolo, 2017, Wilfred et al., 2014) and South Africa (Johnson et al., 2007) confirm that adding value to sugar mill by-products is a key determining factor and has a positive effect on sugar firm on improving productivity and competitiveness edge over the rivals.

In addition to business diversification, another important finding was that highly competitive millers had the highest levels of private investment in in-house R&D as well as collaborations with other non-industry related individuals or organisation such as government and universities. Only a very few firms from the 'competitive' and 'average competitive' groups reported having internal R&D programmes, while the vast majority made no internal R&D investment at all. These findings are consistent with that of Sukyai et al. (2016) that only the Mitrphol (miller) Group has established its own research center (in 1997) while Arjchariyaartong (2007) pointed

out, in his work on competitiveness of the Thai sugar industry, that lack of even meager research and development is still a major problem of many Thai sugar millers. A possible explanation for the widespread lack of internal R&D infrastructure is the rules and regulations established under present Cane and Sugar Act of 1984 that restrict these developments, while NaRanong (2000) emphasized that the current structure of Thai sugar policy has not created an environment that is attractive for investment in research and development. In accord with current results, previous studies have proved that a company's research and development capability is one of the major positive factors contributing to competitiveness (Galović and Bezić, 2019, Garzon Delvaux et al., 2018, Ndlangamandla et al., 2016, Simelane, 2021). That is, the greater the ability, from own or external resources, to integrate R&D strategy within project execution, the stronger the competitive position.

We also found that the availability of cane from their catchment areas and its quality are also found to be other significant constraining factors of the least competitive and many of the moderately competitive firms. It is interesting to note that these millers tended to obtain lower quality cane, that is, a higher proportion is burnt over green harvested cane and so the cane yielded lower CCS levels, which are important determinants of sugar yield. It has been suggested by Harrison and Kennedy (1997) that, in addition to research and development, high quality inputs are among the sources affecting product quality. The quality of cane as a raw material for sugar production is more crucial factor determining the competitiveness of a company than other raw materials are for other food processing industries because its accounts for 85-95% of over sugar business costs, while costs for other raw materials for producing products such as dairy, poultry and fructose are approximately 52%, 69% and 50% respectively. For this reason, if the quality of sugarcane is better, the actual sugar yield will be higher, (Somsen, 2004). According to Arjchariyaartong (2007), the product yield is central company's competitiveness advantage because company can achieve higher sales volume without having to increase the physical volume of cane processed. The higher in CCS level obtained by competitive firms than the others are likely to be related to the influence of locational factors such as rainfall and temperature within the region in which the factory is located. From the results, more than half of the top ten most competitive firms were located in either the northeast or east region where the cane cycle is often longer than other regions. This is due to the adoption of late rainy season planting because of drought condition in these regions, particularly in the Northeastern.

In summary, this analysis provides information that can be utilized in the development of sugar miller strategies for increasing competitiveness, i.e. that directing resources to developing R&

D capacity, business diversification and increasing cane quality are key routes to improving competitiveness.

An implication of this is that, to achieve improvements in competitiveness, the combined efforts of government and sugar mills are needed. There are several prospective ways in which this could be achieved. First, the research and development efforts must be spearheaded to meet its raw material requirements as millers' competitiveness would raise by improving quality of cane. Although, Clearly, company's internal R&D department or centered should be established in consideration of its own characteristics to provide internal support for R&D implementation for products development and process innovation, some developments such as plant breeding is beyond the capabilities of R&D departments of individual milling businesses. From corporate perspective, therefore, this research must be undertaken by universities or government-funded agencies. Either way, government investment for development in R&D is unquestionably needed. In addition, to increase cane quality, collaboration between farmers and millers will be necessary in such areas as encouraging use of technology to increase cane productivity and reduce sugar losses during sugar refining process, and mechanical harvesting services provided by millers in order to reduce local constraints on mechanical harvesting. Other areas of R & D, such as improving the manufacturing process to increase sugar productivity and cane breeding programmes to create new cane varieties that are suitable for growing in each particular cultivation will require long-term investment by government, with the research work carried out in universities and research institutes.

Second, to optimise operating conditions and diminish economic challenge from volatile sugar prices in both world and domestic markets, sugar millers should diversify their existing activities to supply other products in addition to refined sugar, to spread risk. These products, which could be produced using existing cane inputs and factory and equipment, could include fertiliser, paper, ethanol and fuel blending. Moreover, both government and the sugar sector must acknowledge the need for the industry to be updated to be on a par with countries that have already introduced policies and measures to better leverage their cane and refinery resources. Hence, government must focus on development and implementation of an industry strategy related to the direct use of sugar syrup in more valued-added activities.

5.5.2 Millers' attitude and likely business responses to scenarios

A number of studies have examined the impacts of sugar policy reform on the sugar industry through the comparison of sets of reform scenarios reflecting a range of points on the

liberalisation-protectionism spectrum and found that the different scenarios had different impacts on the sugar industry (Devadoss and Kropf, 1996, Elobeid and Beghin, 2006, Noble, 2012, OECD, 2007). In our survey, we found that none of the investigated millers perceived that the ‘protectionism’ scenario would cause negative impact to their business position and revenue. By contrast, the majority believed that the ‘libertarian’ scenario would induce detrimental impact in the next five years, not just in one area, but every aspect of their sugar business, including: inability to increase market share and compete with leading domestic rivals, putting their business revenue in the red and making their business loss-making.

Millers’ negative attitude toward the ‘libertarian’ scenario has its roots in expectations of both direct and indirect negative consequences. First, the direct impacts would arise from the policy reforms themselves, which will generate an instant shock to the firm in terms of decline in sugar business profitability, heightened competitive environment for local millers and enforced business structural change. Second, indirect impacts would be experienced through a significant decrease in the number of active cane farmers and consequent reductions in the volume of cane supplied (as measured by the farmer survey in this current study). These results corroborate the findings of Mulwa et al. (2009) who found that the implementation of a liberalisation policy regime had a negative effect on sugar millers in Kenya through their sudden exposure to a highly competitive environment and disruption of firms’ cane supply resource allocation.

The most interesting insight provided by this survey, with respect to the main research question, is how sugar millers are likely to response to the different reform scenarios. One unanticipated finding is that although the libertarian policy implementation is very likely to harm millers’ business, particularly their profitability, even these millers who expected to be operating at a loss would still remain and operate their sugar business just like they do today without making any change to their present production capacity. Only a small number reported that they would reduce throughput, or close down the least profitable factories. Based on an analysis of narrative responses provided by respondents, it seems possible that these results are due to: (i) the need to service existing bank debt, (ii) the need to look after their workforce. An explanation of why most firms intended to stay in business even if they are making loss can be found in economic theory where this result could be attributed to the principle of firm’s shutting down found in the works of many authors (e.g. Boyes and Melvin, 2001, Pindyck and Rubinfeld, 2001, Samuelson and Marks, 2003). These authors have demonstrated that firms may consider that operating at loss is better than shutting down, as long as the firm is generating sufficient revenues to pay all variables costs plus partially covering fixed costs such as bank loans because these must be paid regardless of whether a firm is operating. Another possible explanation for this is that sugar

millers would still generate additional profits from other sources from revenue streams through cogeneration using by-products. These could be used to cross-subsidise the sugar business. Even though vast majority of millers would keep their sugar business running under the ‘libertarian’ scenario, clearly at least half of millers would have to cancel or delay any new business investment, reduce operating hours for manufacturing and staff as a way to minimise loss in the business.

Another important finding is that a few millers viewed the ‘libertarian’ scenario as likely to bring prosperity to their sugar business. As expected, it was the millers achieving the very highest competitiveness rank scores that were most likely to support the ‘libertarian’ scenario, believing they can take market share from rivals and can be more profitable. In consequence, the likely response of these highly competitive millers to the scenario is to increase sugar throughput. These results seem to be consistent with those of Zamroni (2006) who suggested that, for the case of Thai agricultural sector, only strong and competitive firms will survive and gain benefit from any liberalisation process, whereas non-competitive businesses are likely to be worse-off and would ultimately collapse.

Closer inspection of the results reveals that implementing the ‘government proposal’ scenario is likely to have no effect on the expected profit of more than half of millers in the next five years compared to MY2017-19. However, this would mean that almost three-quarters of millers would lie at break-even point in terms of their sugar refining enterprise (excluding diversification activities), under this scenario and only about a quarter would be profitable, albeit at a small margin. This result highlights the fact that margins for sugar in the milling industry at present are thin. There has been a significant increase in the fixed costs of many sugar millers in recent years, in particular due to extensive capacity expansion, which has raised the average cost of producing sugar (NaRanong, 2000). However, this would be compounded by a drop in selling price and decrease in cane supply volume under the government’s proposal scenario. Surprisingly, despite the high likelihood of having to operate at little better than break-even, these millers intended not to make any adjustment to their sugar throughput. Indeed, few millers suggest that they would affect such a change. This inconsistency may be due to that fact that even though refining of sugar alone under the ‘government proposal’ scenario is not profitable, millers are kept in business from additional revenue streams which are generated downstream through the valorisation of by-products and excess materials alongside sugar refining. NaRanong (2000) has pointed out that aspects of the current organisational structure of the Thai sugar sector, such as the sugar distribution system, has not created an environment that would support productivity improvement. Moreover, a report by Braude and Montmasson-Clair (2019) found

that revenue from the other streams cushion sugar producers from the vagaries of the sugar market. Braude and Montmasson-Clair (2019) found that the traditional sugar business model, i.e. reliance on sugar sales, has been widely replaced by a multi-stream model through co-generated electricity, biofuels and other bio-refinery products. In Thailand, many millers hold the view that value in diversification can offset the impact of lower world sugar prices and manage costs (Pinijparakarn, 2016).

As anticipated, under the ‘protectionism’ scenario, with margins only minimally impacted existing millers are very unlikely to cease their operation or exit the industry. More than 75% of millers believed that their business could operate very well under this scenario, with many indicating they would increase the scale of production. It is important to notice that millers were more likely to develop and spend more on R & D and other investments, including for diversification, to achieve performance improvement than under other scenarios. Therefore, it seems possible that the protectionism scenario would also encourage sector restructuring, leading to the emergence of new industries from the utilization of cane and sugar produce than other scenarios.

As discussed above, although the ‘libertarian’ scenario is likely to result in the most significant negative impact, in terms of the on number of negatively affected millers, the results show that in the short run even this scenario would cause no significant sector restructuring, in terms of causing the closure of milling factories. This finding contradicts the findings of previous studies of the impacts of policy liberalisation (Bureau et al., 2006, Noble, 2012) in the EU which have noted that the 2006 reform of the EU sugar industry, undertaken to fulfil its international treaty obligations, caused an inevitable reduction in number of sugar companies and factories. The relatively minor number of firms likely to exit the sugar industry in Thailand through regime liberalisation compared to the EU can perhaps be attributed to the absence, in Thai policy reforms, of structural fund payments to encourage closure of less efficient refineries, plus diversification aid to encourage the development of alternatives in regions significantly impacted by sector restructuring.

Mirroring the very modest decline the number of millers, sugar production also falls to a very small extent compared to production in MY2019/2020 under the ‘libertarian’ and ‘government proposal’ scenarios, respectively. This finding is broadly consistent with the projections of OECD (2007) that under a hypothetical full liberalisation and domestic policy elimination scenario (i.e. the participation in NAFTA scenario), domestic prices in Thailand would drop, reducing the size of cane harvest, leading to a small decrease (2.4%) in sugar production. The overall level of net change in sugar production under the liberalisation scenario in this study was

found to be -4.5% and -1.47% under the government proposal scenario. These values are considerably smaller than those protected by Talukder (2013) who estimated that sugar production in Thailand would decline by 30% if domestic price control were to be abolished. Talukder also argued that the net change would be even greater if import restrictions were to be lifted along with removal of domestic subsidy. In some respects, the findings from Talukder (2013), OECD (2007) and this study contrast previous studies, which have suggested positive impacts of liberalisation and elimination of domestic production subsidy, to achieve full WTO compliance, on sugar production in Thailand (Elobeid and Beghin, 2006, Itharattana, 1999). This discrepancy in estimates of net impacts across studies could have a number of causes, i.e. differences in model specification and reference point, policy specifications in the models, and the parameter estimates being used (FAO, 2004, Gohin and Bureau, 2006). However, the findings from this study suggest that implementing the protectionist policy is likely to result in an increase in sugar production compared to the MY2019/2020. Clearly, this is likely to be related to the likelihood that the scale of sugar production by majority of millers increases due to an expected recovery in domestic cane production.

5.5.3 Millers' expectations for the policy scenarios

In addition to accounting for the way and which millers are likely to respond to the hypothetical reform scenarios, this part of the study also asks the question: what mixture of policy instruments would millers themselves choose to ensure that they remained competitive in the global sugar market?

To answer this question, millers were asked to manipulate four policy instruments to achieve settings that, in their view, best suited their needs. These individual instruments were: (i) domestic sugar distribution, (ii) domestic sugar pricing, (iii) revenue-sharing system and (iv) producer supports. Based on miller feedback, the current study found that the most preferable settings for these policy instruments are:

- to maintain the sugar reserve for domestic consumption, but without controlling the volume allocated for each mill
- fixing the domestic sugar produce through a price collusion mechanism
- maintain the current 70:30 revenue-sharing from domestic sales of sugar and molasses, while other new products produced from diversification are sold in an open market

- maintain most producer supports, but slowly phase these out over a further transition period towards a freer market.

According to these data, we can infer that, for the short term, protectionism policies that allow a “soft landing” for the sugar sector seem to be the most political acceptable approach to the majority of millers. The possible explanation for this is that millers are concerned to allow more time to become more efficient, allowing them to compete in freer market in the future. Simultaneously, they are much less in favour of a completely uncontrolled policy approach on sugar production and domestic market that allows more competition between all players in sugar industry.

These findings have important implications for policy makers. It is apparent that impromptu and rushed ‘libertarian’ policy implementation would harm the Thai sugar sector. The results of the libertarian scenario analysis suggest that if the government wishes to prevent domestic sugar market from becoming oligopolistic, the ‘libertarian’ scenario should not be implemented abruptly as the smallest and least efficient refineries would not survive such an abrupt transition. Evidence to support this conclusion comes from a study of the Vietnamese sugar industry by Van Vua and Hob (2020), who suggest that protectionist policies were needed in the short term to create provide time for sugar millers to adjust their technology, improve quality and output and build competitiveness. They also conclude that this type of policy should not last too long and the level of protectionism should not be too high, since this would not improve the autonomy and competitiveness of sugar millers.

In general, the present study suggests that for the Thai sugar sector to remain competitive in the longer term, the protectionism scenario might need to be promoted in the short run to prevent unlevel of playing field, even though doing so does continue, for time, the distortion of the domestic market and prevents free market competition between sugar millers. This is because smaller and less efficient millers could not survive from the through the type of policy that exposes to full market forces and intense competition from larger and more efficient millers. If this issue were to occur, it could lead to a loss of sugar refining capacity in some regions, subsequently effecting the availability of the market for some cane farmers in those regions.

In terms of the ‘government proposal’ scenario, the results of this study show that this policy would be unlikely to impact millers badly, i.e. compared to the ‘libertarian’ scenario. The question is “should this scenario be promoted?”. This scenario broadly reflects the reform package proposed by the Thai government. However, the findings reveal unanticipated outcomes which policy has shortcomings, i.e. it is very likely to so erode terms of trade that the majority

of firms would be driven to break-even point. To achieve the desired aims this policy package would have to be strengthened with other market management policies to ensure that firms are able to operate more profitably, at least, after a short time. These first cannot operate with zero profit for long as this will impact their ability to stay in business.

A recommendation from this study is that the policy protections in place in the Thai sugar sector should be withdrawal gradually in order to allow sugar millers to adjust steadily to new changing policy environments. To conform to the new environment, millers themselves should re-adjust their input mix and management system that to improve their technical and scale efficiency levels and optimize the use of milling capacity. Diversification through value-adding activities using by-products, as well as establishing in-house research and development capacity are extremely necessary, particularly for less competitive firms to reduce production costs, increase sale prices, and so increase profitability. Above all, government policy measures must be able to effectively assist and enable the sugar sector to improve competitiveness and viability, for example, removing the government restriction on permitted end uses of sugar syrup in order to facilitate the diversification into bio-fuel and other industrial products, to ensure its survival while local and international market access improvements are being developed. If the introduction of the libertarian scenario can be done in these stages, so that competitiveness imbalances can be corrected, the damage done to the sugar refiners would be less extensive.

5.6 Conclusions

To sum up, the magnitude of the impact on sugar millers' business and millers' likely business responses differs across reform scenarios, However, the likelihood of refinery business exits the industry within the next five years is similarly small across the scenarios. Moreover, we found that millers' attitudes to, and expectations for, future policy options are largely dependent on their existing level of competitiveness, with the most competitive being most favourable towards the end of protectionism. This study has provided promising evidence that overall, the 'protectionism' scenario is an appropriate policy approach, in the short term, for Thai sugar sector from the sugar processors' angle, because it ensures a level of playing field for existing millers in the industry. However, this should not preclude the removal of market protections over the longer-term to maintain/improve the competitive position of the Thai sugar sector and develop the sector's sustainability. This may be partly explained by the fact that protectionism may be effective in the short run to bolster domestic sugar production and sugar business, however, if such a policy is implemented for too long, it may inhibit sugar millers from making changes to become more efficient and improve level of competitiveness. Therefore, if

government choose to maintain market protections, it is extremely essential that they must make it very clear to the sugar industry how long the short-term protected environment will last and what a future liberalised regime will resemble. Hence, future studies should evaluate long-term policy options and perhaps extended study by modelling the implementation of multiple policies and the transition between them.

Chapter 6

General Discussion and Conclusion

6.1 General discussion

At present, the Thai sugar sector is at a key juncture when policy reform is being forced upon the sector, after a long period of stability created by protectionist policies. Policy makers, therefore, recognize the need to liberalise policy. However, there is uncertainty over how much exposure to market forces the sector can take before significant damage is done. Hence, the purpose of this study is to provide evidence to inform this decision, through assessing the impact of a range of policy options reflecting different levels of market liberalisation.

To achieve this overall objective, three policy scenarios named the ‘libertarian’, ‘government proposal’ and ‘protectionism’ were created in conjunction with a panel of sugar sector expert stakeholders. These detailed scenarios reflected a range of market and economic philosophies, but which are also compliant with the WTO rules. The scenarios were parameterized using a suite of different policy instruments (or variables), the settings for which varied across the scenarios. The first, and unexpected, observation to arise, at the stage of policy scenario construction, was that a majority of stakeholders were very reluctant to vary the settings of some policy instruments away of protectionism under any scenario on the grounds that to do so would cause unacceptable damage to the sugar sector. These policy instruments were: access to ‘soft’ loans, revenue-sharing arrangements, and domestic sugar reserve policies. Those policy instruments that were allowed to vary across scenarios, and which therefore defined them were: farm income and cane price support policies, and domestic sugar pricing. In consequence, the set of three possible future policy scenarios designed from policy consultation accommodated three principles: coherence with alternative economic philosophies, compliance with WTO rules, and avoidance of wholly unacceptable economic and social cost. These scenarios were used as the future contexts in determining producer sector responses. However, it should be noted, therefore, that these policy scenarios do not represent extremes, but rather much more realistic and plausible reform scenarios. This fact should be borne in mind when comparing the results to other studies that might have generated much more radical impacts on the sectors to which they have been applied.

In respect of the impacts of these scenarios on the sugar producer sector, taken together, the research results have shown a good deal of consistency concerning the impacts between farmers

and sugar millers. Overall, this thesis strengthens the idea that any type of policy reforms, regardless of where they are on the libertarian-protectionism scale, would negatively impact the sugar producing sector, but their impact is variable dependent on the degree of price cutting and extent of removal of producer supports. Obviously, therefore, compared to other scenarios, the ‘libertarian’ policy scenario, with its deep price cuts will cause greatest negative impact to both farming and sugar processing businesses and therefore, would be highly detrimental to the Thai sugar industry. The implication of this outcome is the expectation that implementing full market libertarianism, even to the extent reflected in this study, would result in an extreme catastrophic loss of cane production within five years. These results are consistent with those of Talukder (2013) and OECD (2007), indicating that if domestic subsidy which had long been in place, is abolished along with import controls, internal prices in Thailand would fall to the extent of significantly depressing the volume of cane produced and in turn sugar production.

The research shows that, for both farmers and refiners alike, the “libertarian” scenario seems to be the most harmful and the “protectionism” scenario would be the least damaging in terms of production volume.

a) Farmer responses

For the cane farming sector, the results show that falls in the volume of cane produced under the different scenarios closely mirrored by falls in the number active farmers. This strongly suggests that Thai cane farmers are making a binary choice about future cane production in the face of policy changes, i.e., either to preserve the *status quo* of cane production scale, or quit cane production altogether, but rarely vary their scale of production.

Although the finding reveals that most cane farmers under any scenario will maintain the status quo, the number of farmers anticipated maintaining the status quo drops significantly as price cuts deepen, especially under the libertarian. Therefore, it can be assumed that this effect is related to ‘price dependence’ which implies that farmers who intended to continue with the same production size must be able to remain profitable under the new price regime. Nevertheless, there may be other factors causing strong tendency to maintain the status quo, including status quo bias. According to the findings of Attavanich et al. (2019) who, when investigating behavioural biases known to affect Thai farmers, found that about 60% exhibit some degree of status quo bias. Farmers with such a behaviour usually perceive the disadvantages of changing to be larger than potential gains or improvements from change (Kahneman et al., 1991). Thus,

they tend to accept the current circumstance and to stay in farming as they are and are not motivated to change.

At wider level, this research has also shown that the larger, more specialised cane farmers are less likely to quit cane farming under any scenario. This finding may be related to the greater economies of scale that arises from higher specialization in tasks (MacDonald et al., 2013). Quite simply these farmers remain profitable at lower prices than their smaller, less specialized peers. An implication of this is the possibility that greater level of specialization in cane farming allows for more intensive use of specialised equipment and structures, leading to higher resource-use efficiencies, and in turn greater resilience against loss of revenue. However, there are limits to the resilience of even these larger, more specialized farmers and this limit appears to be breached under the libertarian scenario. Under this scenario the effects of the extreme cane price cut are compounded by effects of loss of other supports, such that the greater ability to absorb shocks and continue cane farming operation in the face farm income loss from being more specialised become invisible.

When the losses become most extreme, the farm type most adversely affected seems to be not the smallest, but medium-scaled farmers. This is likely due to relative higher production costs in this group, due to their need to hire in farm labour and the need to use machinery, yet without the economies of scale of the largest farms.

The results from regression analysis identified the main drivers of intention to remain in cane production under the three scenarios. This revealed that across the three scenarios psychological drivers have a consistent effect, but the influence of demographic and socio-economic drivers varies. The results provide empirical evidence that despite capturing a range of levels on the libertarian-protectionism dimension, there is very low variation between farmers in terms of their attitude towards the scenarios, with most farmers holding negative views toward all scenarios, as reflected in the Outcome Attitudes dimension of the TPB conceptual model – this partly explains its low discriminant power, i.e., it does not vary across scenarios. There is also low variation between scenarios for the subjective norms and perceived behavioural control dimensions. To illustrate, for example, if peers all had negative views of all scenarios, then they would all be disapproving of the respondents remaining in cane production under all scenarios and so the variable would have low discriminant power. As far as PBC is concerned, the technical ability to undertake the action (i.e. remain in cane production) should be universally high among respondents because they are already successfully producing cane and this level should not vary between the scenarios because the technical requirements should remain unchanged unless the impact of lower profits on ease of production is factored in, e.g. making it

harder to buy seed and fertiliser etc. However, despite this low variation, all TPB dimensions are found to be statistically significant determinants of intention. Therefore, in the case of this study, the TPB variables, for example, attitudes cannot be discounted simply because it was not found to be a significant driver of intention. This is likely due to the fact that all farmers viewed all of the scenarios negatively because all scenarios led to losses. Negative attitudes therefore act as a constant force driving farmers away from cane production, but whether they actually do so will depend on other factors such as socio-economic factors of the farm business and farmer characteristics and farms break-even point.

Moreover, the regression analyses seem to reinforce the idea that the main determinants of farmer' intention to continue in cane production are concrete socio-economic factors of the farm business and farmer characteristics, due to there being differences in the significance of these drivers across scenarios. An implication of this is the possibility that new/different factors become more prominent in determining intention, as the scale of income and support losses increases and that there is a difference in the "threshold price point" at which each factor comes into play. For example, access to off-farm income, engaging with farm advisor and past behaviour, i.e., continuous farming of cane over the past five years are found to be significant drivers under the libertarian scenario, but are not significant drivers under the other scenarios.

b) Miller responses

Although the impacts of scenarios on both producer segments largely shadow one another, their effects were found to be of a smaller magnitude in the miller sector. The primary cause of this difference is the lag in the responses of the millers relative to the farmers, i.e. the millers were surveyed a full year after the farmers, so that some sector adjustments to the government reform proposals had already been made. For example, in MY 2019/20 cane supply from producers was 130.97 million tonnes but was only 74.89 million tonnes in MY2020/21. The miller survey results, therefore need to be interpreted with caution because, in addition to reacting to the three scenarios, miller responses were also influenced by some structural changes in the producer sector that had already been built in, i.e. the millers baseline was not as 'pre-reform' as the baseline for the farmers.

The study showed that the way the miller sector is likely to undertake business responses to the scenarios is fundamentally different to farmers despite output effects appearing to follow the same path. The most obvious finding to emerge from the analysis is that the scenarios are most unlikely to result in loss of millers from the sector.

First, it is somewhat surprising that although the vast majority of millers believe that the ‘libertarian’ scenario would be highly detrimental to their sugar business, i.e., it would result in them experiencing a loss of profit, and they would be unable to compete with leading rivals, most millers are likely to continue in sugar production, and the majority would make no adjustment to throughput. Only a very small minority of millers expressed an intention to either reduce sugar throughput, or exit the industry. These unanticipated findings may be partly explained by strong barriers to exiting the industry such as high levels of sunk capital (high gearing) and high costs of servicing existing borrowing, high costs of divestment and investment in specialist equipment. A number of studies (Karakaya, 2000, Phillips and Mason, 1997) also find that high fixed costs are associated with high costs of disinvestment and that this increased the likelihood of continuing with the status quo, i.e. in this case remaining in sugar production. Regarding the likelihood of high sunk costs, Blanchard et al. (2012) found that, in France, the sugar industry has the largest sunk costs of any sector in the food industry. Authors of Microeconomics publications (Boyes and Melvin, 2001, Pindyck and Rubinfeld, 2001, Samuelson and Marks, 2003) emphasize that rather than shutting down, firms are better-off operating at a loss, at least in the short-run, even if they make zero profits, if a firm can still cover all its variable costs including generating enough income to pay labour and capital costs and their ordinary opportunity costs. Thai sugar millers identify two key reasons for intent to continue operating business while operating at a loss: (i) the need to service the existing bank debt (sunk cost) and (ii) responsibility to look after their workforce. The conclusion to draw from this is that, in the short-term at least, if millers’ profits are more than or equal to their variable costs, they are more likely than not to accept the opportunity costs of staying in business, so that they can continue to pay down their fixed costs including bank loans which must be paid in any case.

Second, the strongest resistance to business structural change was found under the ‘government proposal’ scenario. According to the analysis, millers’ reluctance to introduce structural change is related to the break-even point of their sugar enterprise, i.e. if the sugar enterprise remains at or near breakeven, structural change is likely to be resisted. This tendency to pursue the status quo would be reinforced by:

- The study finding that an expectation that business profit would remain unchanged after the policy change (or compared to a couple years before)
- The uncertainty and ambiguity associated with change, such as fear of losing sunk costs

- An expectation that they can be kept afloat from other cane-related revenue streams generated from diversification.

In general, theoretically, it is possible in the short run, that sugar millers could keep their sugar business enterprise operating at, or below, break-even point, without making any business change, if the average revenue is still above the average variable costs. However, failure to make adjustment in response to long term change in market environments may affect a firm's long-term competitiveness and erode its ability to survive. In this respect, it is possible that, in the long-run, if sugar millers are unable to raise overall revenue to cover total costs, the losses will continue increasing and could reach the shutdown point.

In respect of the observed strong unwillingness to introduce productivity improvements under both the 'libertarian' and 'government proposal' scenarios and the relatively small intention towards downsizing throughput, cane and sugar production would decline only slightly (i.e., -1.5% under the government proposal and -4.5% under libertarian scenarios) compared to MY 2020/21 supply baseline. These findings highlight the need for extra government efforts to overcome resistance to change and encourage successful management of strategic and operational change to minimize loss (i.e., costs) in the face of adverse policy impacts and for long-term survival.

Third, compared to the other scenarios, the protectionism approach is likely to result in most positive business responses. Through this least extreme policy environment, a majority of millers indicated their intent to increase their scale of sugar production while no one would undertake downsizing of production or exit the industry. However, since the miller survey was conducted a year after the producer survey, when structural changes in the producer sector (i.e., shock in cane volume) have already begun to take place, this finding needs to be treated with caution. It is possible to hypothesise that millers have already responded and taken into account the shock in cane volume that they have already experienced. Hence, it could conceivably be hypothesised that if the protectionism scenario is to be implemented, the impact on millers would be less harsh compared to the producer supply baseline, therefore, based on the finding, most millers would in fact increase their throughput compared to production in millers baseline year.

A closer inspection of the impact of inherent competitiveness on the attitudes of millers towards the scenarios reveals that, as expected, it is the millers achieving the very highest competitiveness rank scores that were most likely to support the 'libertarian' scenario. These millers believed that they could expand the scale of production and take market share from less competitive rivals. It seems possible that this result is due their perception that some competitors

will go out of business in the face of lower prices, allowing the more competitive millers to mop up their former suppliers due to the removal of allocation protections between millers.

This finding may help stakeholders to understand the importance of improving productivity performance through activities such as improving quality of cane supply, through building and embedding stronger mutually beneficial relationships with contracted farmers, and most importantly being open to possible diversification options and paying great attention to those research and development priorities which are most prospective enhancing the future viability of sugar millers.

Finally, taking the standpoint of all policy stakeholders together, there were strong feelings on both sides of the protectionism-libertarianism debate, with most producers and policy makers on the one hand arguing that protectionism should be pursued as far as possible as producers need more time to adapt and increase self-reliance and productivity, while on the other hand, the most competitive sugar millers and the non-governmental miller organisation agents argue for a free market now. This, they contend would allow for more competition between operators in the industry, thereby discouraging the least efficient production, reducing the complexity caused by strong government intervention, increasing business agility and bring the industry into compliance with international law.

6.2 Practical policy implications and recommendations for policy makers and sugar producers

WTO enforcement has been the key external driver forcing the Thai government to initiate policy reform to bring the sector into line with international commitments. These and other international pressures, are inexorably driving the Thai sugar system toward a freer market and trading environment.

One thing is certain: whatever policy approach the Thai government ultimately chooses, it must remain within the limits of WTO's rules and commitments. The question raised by this study is, what can the Thai government do to support its sugar production sector within these constraints?

The findings of this study have several important implications for future policy practice. First, based on this analysis of a sequence of possible policy reform scenarios¹⁴ that the Thai

¹⁴ Considering in turn: full liberalisation in the first scenario, then a middle-of-the-road policy approach, in which certain domestic production subsidies are removed, but retaining as much support as is permissible under the current WTO's rule. A third scenario, a minor reform relative to the former reforms, represents the

government could seek, the findings of this study have important implications that no policy arrangement approach is ever perfect, because there are always trade-offs.

In general, the Thai sugar sector is composed of a large number of highly immobile small farmers, with little financial and market power. These producers in turn sell to many sugar refining companies of varying size and levels of efficiency. Therefore, if the Thai public is disposed towards protecting the viability of, and maintaining a level playing field for, all these farmers and sugar millers, then protectionism would seem the most desirable approach. Protectionism provides many obvious benefits, i.e., providing a highly stable market environment, including supply and trade; greater farm income; a level playing field among millers; securing sugar availability for domestic consumption at an affordable and stable price; and a range of social benefits, including ensuring local employment and protection of living standards of cane and sugar producers. On the other hand, persistent protectionism may does not incentivize producers and refiners to reduce costs and innovate and is likely to prolong the least efficient businesses. As a result, undertaking a protectionism approach may hamper increased efficiency and greater competitiveness in the industry.

Full liberalisation, in the sense of a greatly reduced government control, through a rapid dismantling of domestic supports, could only make cane and sugar businesses more market oriented and allow more competition between all producers in industry driving remaining producers towards greater efficiency at unprecedented speed. Such a policy change would, in the short run, be very difficult for many vulnerable farms. Less efficient millers who were unable to cut costs would see margins eroded in the face of falling prices. Under an extreme price cut the majority of the industry population would be impacted in this way. In consequence, there is a possibility that forcing these producers and millers out of production may be the most likely long-term outcome, unless their level of sustainability can be improved, through raising self-reliance and productivity.

If the Thai government goal is to protect national food security, protect rural employment, avoid catastrophic financial losses and structural damage on the producer side, and prevent the domestic sugar market from becoming oligopolistic, then the abrupt introduction of the 'libertarian' scenario must be avoided, at least in the near term. However, if liberalisation is not pursued other desirable outcomes cannot be achieved, such as: the development of a more robust

highest range of extreme policy, including maintaining all the current internal market producer supports, that are permissible under WTO commitments.

industry, discouragement the least efficient, lowest yielding production and increasing efficiency amongst the remaining producers, as well as bringing the industry in line with the WTO commitments.

However, based on the results of this study the researcher believes that the most severe adverse impacts of market liberalisation could be minimised, if not avoided entirely, by choosing to keep the variable tariffs (i.e., TRQs scheme and quota reductions), as these remain permissible under terms of the WTO agreement. In addition, providing a compensation scheme to those who are hurt by liberalisation along with reform may help easing the extent of the damage, and perhaps lead to a win-win outcome (i.e. allow the welfare of stakeholder groups to be protected while driving a more market-focused, efficient and resilient industry).

The findings of this investigation also offer vital evidence for policy makers to determine the future policy target and provide hints about where the focus of their support should be if they wish to follow one of these scenarios. For instance, if the government wishes to undertake the protectionist policy approach, efforts should be directed at improving farm operational and functional conditions such as facilitating the adoption of green cane harvesting and other successful farm visits for less efficient farm groups to receive suggestions for farm improvement, because farmers' intentions to continue under the protectionism scenario are more affected by farm operational reasoning, related to cost and profitability considerations, rather than farm operator and structural characteristics per se.

However, if the government wishes to move toward a freer and unfettered market by adopting the government proposal scenario, to mitigate the catastrophic impacts arising from large price cuts and abandonment of certain supports, there is need to direct interventions at the personal and farm characteristics of farmers that this study has identified as increasing the likelihood of farmers leaving the sector. For instance, under the 'government proposal' scenario, the group intending to leave the sector tend to be vulnerable farmers i.e., higher-cost farmers and operating the smallest farms, often in remote areas and with a relatively high share of rented farmland and those who have more responsibility to households' expenses. Therefore, policy interventions that help overcoming cost and production constraints of these farms such as facilitating joint operations where some specific tasks such as cane transportation to mill, irrigation, harvesting where land and labour are pooled and paid in according to the amount of capital and labour provided would be helpful in this case. Reforming land tenure and financing of credit land purchases made available through either the banking system or other specialized agencies could be indirect policy interventions. However, legal advice must also be required to facilitate land acquisition.

Under the most extreme libertarian scenario, farmers who are likely to abandon cane farming are proactive, with alternative sources of income, who deem that ending the soft loan scheme would be bad for farm operations. Alternatively, persistent farmers who expressed their intention to remain in cane farming in the face of adverse policy changes, tend to be those with higher occupational immobility. In this case, where the cane price paid to farmers is heavily cut, it may be difficult to prevent many farms from leaving cane farming. However, this risk could be minimised indirectly if the government would modify the Cane and Sugar act, 1984, to end the restriction on cane syrup being only used for sugar production, i.e. to allow diversification through creating other commercial product lines using cane syrup. If this action can be taken, there would be more demand for cane, resulting in higher in cane prices. Moreover, to help immobile farmers, who resist giving up cane farming, support could be provided to improve their efficiency, through training and the creation of off-farm employment opportunities within their community.

Another important implication for future practice is that, although a range of future policy options is available, from strong protectionism within the WTO permissible boundary to extreme libertarianism, above all, whatever policy philosophy is chosen certain key policy instruments have to be retained as they are deemed by policymakers as being the strength of Thai sugar regime. In addition, the policy consultation also reveals that several social, economic, and environmental challenges require equal attention regardless of scenarios to revive the ailing Thai sugar sector in the face of ongoing policy changes and subsequently to ensure sustainable long-term development.

At the farm level, the challenges are conflict between farmers and millers, fairness of distribution of industry revenue from joint productions, capability and self-reliance of cane farmers and farm productivity, mechanization, and movement toward going green. For the sugar processing sector, the challenge is improving productivity and the opportunity is sugar business diversification, whereas food security for domestic consumption is priority for local consumers. To overcome these challenges, achieve improvement and maximize impact, firstly, improving stakeholder engagement and building a strong collaborative platform is needed across the supply chain, through government mediation. The relationship between cane farmers and millers is “obligatory-symbiotic” meaning that both parties depend on each other for business survival. However, cane farmers tend to be marginalized in terms of getting a fair share of benefits among other players. Hence, the continuation of the revenue-sharing system is essential to prevent the demise of many farmers and ultimately the collapse of large sections of the industry.

To strengthen the financial health of the sector and build long-term stability in the face of volatile global sugar markets and potential loss from internal policy reform, diversification of revenue streams, through value adding products from cane and its downstream industries, are needed. To achieve this, millers must leverage their available resources and do this more sustainably. Government can help by modification of law and conveying strategies for utilization of cane in value-adding productions alongside getting farmers and millers to the negotiating table to arrive at the best future revenue sharing solution with proper and fair incentives for both parties are urgent matters to push such a development forward.

As far as is known, miller business shutdown, or exit, is very unlikely to occur, in the short term, under any type of policy environment. In the face of declining cane supply, this finding suggests that under-utilization of available refining capacity would be a problem which would have a direct bearing on the sugar mills' efficiency and their competitiveness. The evidence from this study reveals that underutilization of production capacity will be a critical issue for Thai sugar millers and the major cause of this would be a shortfall in supply, rather than technical problems (i.e., breakdown and production stoppage). In order to prevent this under-utilization problem, cane farmers need to be kept farming cane. To achieve this goal, both the government and sugar millers should devote more effort and resources to promoting the viability of cane farmers. This means targeting both cane production quantity and quality, as well as production efficiency, to reduce farm production costs. Achieving these improvements will require a different approach. However, the farm economic viability issue must be resolved first. Thus, at the farm level, policy priorities should be given toward empowering cane farmers and making their farming competitive, efficient, and resilient in adverse environments. The soft loan policy should be retained to ensure that farmers have the necessary cash to acquire operating inputs such as seed and fertiliser and perhaps to increase their ability to invest in mechanization, crop management (training) and small irrigation systems.

Effort should be directed at knowledge transfer through social learning from cane farmers' social networks, where promoting more private learning should also be considered, as farmers tend to learn from others within their social network that are more like them, rather than from the leading or best farmers. The study also reveals that most farmers do not have access to independent scientific-based advice, hence, technical assistance and advisory services should be made available at household and village levels to build the technical knowledge and skills necessary to improve quality and production on farm. Basic financial and risk management knowledge for farming should also be provided alongside the technical assistance so farmers can prepare

themselves for adverse market conditions (low cane prices) for example by cutting unnecessary expenses and saving for periods of income shortfall.

These indirect supports are essential, as they facilitate farmers in continuously improve their productivity and input use efficiency. To further facilitate farm productivity improvements, indirect supports should also focus on agricultural research and development, including in the areas of improving in-field access to water and infrastructure, developing high sugar and drought and pathogen resistant cane varieties, and developing farm machineries and technologies that are affordable, adaptable, and appropriate for small farm mechanization activities. These could be coupled with collaborative and productivity improvement programs such as farm mechanization, adoption of green revolution practices, and provision of easy-to-access and reasonably price inputs to stimulate farm development. Socio-economic safeguards may also be needed to mitigate unintended negative impacts of policy reform.

This link between indirect supports and productivity improvements can be illustrated by the familiar Chinese proverb:

“Give a Man a Fish, and You Feed Him for a Day. Teach a Man to Fish, and You Feed Him for a Lifetime”

In addition to the general support strategies previously discussed, some strategic supports should be targeted at specific groups whose particular socio-economic structure may lead to increased uncertainty about their future cane farming. Based on empirical finding of this study, these farmer groups tend to be those who did not practice green harvesting and are likely to be more adversely impacted by price cuts due to higher income needs to support their farm households. We also found that high-cost small and medium scaled farmers, often in remote areas and less specialised in cane production whose operations tend to contend with diseconomies of scale are the most affected-groups under any scenario. Therefore, policy maker should consider how to make these farmers more efficient so that they remain in cane farming. Reasonable approaches to supporting such farmers could be: 1) promoting labor-saving technologies which could be used with small field sizes; 2) promoting either farm activities co-operationalisation and machinery ring or joint farming between cane farm enterprises which would make mechanization accessible, including cane harvester, for small-scaled farms; 3) setting temporary cane purchase centres operated by sugar mills at village-level to reduce transportation cost and rate of post-harvest deterioration and facilitate quick transportation of cane to the factory; and 4) providing communities with funds for creating off-farm work opportunities to ease the burden on cane farming and enable farm household to stabilize household income. However, these

solutions would require stakeholder engagement and collaboration, not to mention the requirements for a lot of government expenditure.

From the miller side, improvements are possible in sugar production efficiency, cost competitiveness and more consistent revenue generation through investments in a range of diversification through adding value to cane and by-products and R&D efforts. However, high investment costs and long timelines involved in achieving returns on R&D and diversification investments seem to be key barriers. Several state supports could be provided to overcome these barriers. For instance, incentive schemes to encourage investments in equipment may enhance production yield and optimise production times. There is also a need for additional investment funds and public and private collaborative investment for research and development where there is market failure to deliver this research. Government should draw lessons from Brazil's earlier successful experience in biorefinery policy and its sugarcane-ethanol model. If Thailand could implement the Brazilian sugarcane-ethanol model successfully, it could be powerful tool for stabilizing domestic sugar prices and increase farm income and perhaps reduce Thailand's dependence on foreign crude oil.

Besides the producer sector, national policy must also pay attention to the question of security of domestic consumption. In this context, government must be concerned about sufficient availability for domestic consumption at acceptable prices. Thus, there is a definite need for reserving an amount of the sugar produced, equal to domestic consumption volume, for domestic security purpose.

6.3 Limitations and further research

There are some limitations in this research which might restrict the generalizability of the results to the Thai context. First, due to time constraints and the scale of work faced by the researcher, it was not possible to carry out both the farm and miller surveys in the same year. Because the miller survey was collected in the year following the farmer survey, the millers will have experienced more of the sector responses to the government reform proposals than the farmers had. These within-year sector responses included a marked fall in cane volume produced. The level of supply of cane from farmers forms part of the scenario landscape that they were asked to react to. This means that millers were estimating the scale of changes in their own activity in comparison to an already depressed baseline. The net effect of this would be that millers have likely under-estimated the scale of the impacts that the reforms would have on them compared to the pre-reform position.

Second, although there was a sufficiently large farm sample size for quantitative data analysis, the researcher was unable to achieve meet full regional stratification requirements, i.e., the sample under-represents producers in the North and Northeast regions. This imbalance may affect the prediction of the impacts of the scenarios on the number of active farmers and the volume of cane produced in these regions, to the extent that the farms surveyed in these regions was un-representative. Any error here will also be replicated in the miller survey, as miller data were used to represent part of scenarios in miller survey. Also, the farm sample was divided into 3 sub-group of approximately 150 farms and different scenarios presented to each sub-group. For this reason, the sample sizes of each scenario for performing scenario-specific regression are relatively reduced and this may affect the power of the results.

Third, there are also sample size issues in relation to the miller survey. Because the sugar miller population is 57, the minimum recommended sample size (5% margin of error and 95% confidence level) is 50 mills. The researcher managed to collect data from only 37 mills which accounted for 10% margin of error and 95% confidence level. Since the miller study is based on a less than ideal sample size the emphasis of the analysis of the miller survey has been on building a narrative of how the sector would respond to the scenarios, rather than on quantitative analysis. However, tests for statistical significance of differences between some sub-groups of millers and between the different scenarios were carried to provide supplementary explanatory evidence.

Fourth, a theoretical limitation is that the study of farm responses only looked at intention to undertake a behaviour, whilst the full TPB model is a two-stage approach capturing, first, intention to undertake a behaviour and then the actual behaviour itself. However, it was not possible to capture actual behaviour because: 1) some of the scenarios will never be implemented (they are hypothetical); and 2) the time-scale over which implementation of policy will be implemented is too long to be captured in this study. However, a follow-up study could be undertaken where actual response to a policy scenario is recorded and compared to intention. However, this would only be possible if one of the actual policy scenarios considered in this study were implemented. Increasing variation from the policy provisions used in these scenarios increasingly invalidates such a comparison.

Fifth, our study is based hypothetical policy scenarios that could be implemented based within WTO's policy frame. This implies that this analysis is suitable to describe the nature of trends in farm and sugar processor reaction to policies with these economic respective philosophies. The results should not be taken as predictive in detail. Also, because the study did not attempt to capture overseas trade or consumer responses, the results should not be viewed as capturing

the cane and sugar market as a whole. Last, even though efforts were made to incorporate as many factors affecting cane and sugar producer responses as possible (in terms of policy and market signals), there may be more factors that could be significant. Therefore, future research should consider other important factors affecting cane and sugar supply, such as the price of inputs market demand and technological change in the medium term. Performing cost-benefit analysis of both producer segments would provide different layers of detail. Although important factors influencing producers' likely business responses to a range of possible future regimes were identified in this study, further investigation of how each factor exerts its influence and what underpins these factors should be carried out in greater depth. Qualitative interviews or observations of real-world situations may shed more light on into motivation i.e., what really drives their motive behind the likely responses of both cane producers and millers to a suite of alternative policy regimes.

6.4 Concluding remarks

The current chapter draws results from the three empirical studies (reported in Chapters 3-5), and through synthesis attempts to understanding what could happen in the Thai sugar sector under three possible reform scenarios, in the absence of reactive policy corrections. The principal implication arising from this study is the possibility that any type of reform of the policy regime is going to drive dramatic change for most Thai cane and sugar producers, on account of their long-standing reliance on a highly regulated and protected policy regime. That being said, the degree of impact will be uneven. This analysis will be of value to the Thai government, in forewarning them of possible of negative unintended outcomes. As policy makers should already know where they want the industry to go, this chapter hopes to assist all those involved in policy formulation in recognizing what are the degree of libertarianism and policies needed to achieve to get them there and what additional support measures would be necessary to prevent negative unforeseen outcomes.

At the same time, farmers and millers can also use the results from this research to help manage their business strategy if they know which policy is going to be undertaken.

While some farmers and milling business will gain under all the scenarios considered here, there are likely to be others that lose out. To a substantial extent, the negative consequences seem to be quite severe under the libertarian scenario since it would be associated with drastic income and employment losses. Moreover, there is high chance that these negative effects would not be offset by the positive effects of driving inefficient out of production, as this group represents the

vast majority of all producers. The loss of this many producers would see Thailand fall from its current position as a major leading player in world sugar market. The consensus appears to be that, if implemented, full liberalisation of this sort would drive a severe downward adjustment in the number of sugar producers and also the volume of cane produced. The effect of this on the social structure of rural areas would be very significant. Such a policy would not sell well with voters, especially the 430,000 voting cane farming households in Thailand. Given the strength of the case against full liberalisation of Thai sugar industry, undoubtedly, it seems evident that the high protectionism approach is more likely to be implemented because, as part of interventionism, government actions are influenced by public opinion and protecting a favoured or politically influential industry like sugar sector from collapse is their responsibility.

Although the prospect of extreme sugar market liberalisation is not high in the short term, it should be noted that high and continued protectionism, in long run, never helps any country. Indeed, it is recognized that long-term protectionism is damaging to the economy, acting, as it does, as one of the biggest obstacles to achieving efficiency and producer improvements. Viewed in this light, the researcher believes that it is essential that the Thai sugar industry should be moved further toward what economists refer to as the efficiency frontier and this must mean, over time, increasing market libertarianism but one of the lessons from this analysis is that libertarianism must not be implemented in an extreme 'all at once' way. However, even implemented gradually liberalisation entails many negatives over the short and medium terms, such as a shock to production volumes, revenue loss, rising farm unemployment, and even the closure of some factories. While these negative outcomes cannot be fully eliminated, they can be mitigated if they are managed by appropriate government policies where policies that may have benefits over the longer term are also needed to be considered. This could be achieved effectively if government made strong efforts on developing policy liberalisation at an appropriate pace, where a soft landing for producers is possible. In this sense, good macroeconomic stabilization policies must be set, such as enhancing welfare supports. Even more important complementary policies such as a compensation scheme to those who hurt by this policy movement are also needed. The most important task for government is to ensure that safety nets are put in place and that the industry's macro-economic environment is sound. To facilitate the transition, government must make sure that both soft and hard infrastructures are improved in a prompt manner and industry-related institutions such as The Office of Cane and Sugar Fund (OCSF) evolve with the encouragement of government policy. Lastly, to prevent any further dispute in the future, government must remember that their role within the industry is not to decide or direct but rather to create better policy environment and ensuring a system of support providing related assistance during both anticipated and unanticipated shocks.

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Appendix A: In-depth Interview – Questions (English version)

PARTICIPANT INFORMATION SHEET

Reference number:

Name of interviewer: Savita Tangwongkit

I am a PhD student in the School of Agricultural, Policy and Development at the University of Reading, UK. This interview forms part of my doctoral research programme.

The goal of my research project is to assess the likely impacts of a range of alternative policy regimes (scenarios) on the Thai sugar sector, in particular the responses of Thai sugar cane farmers and other sugar stakeholders in regard to WTO-enforced change in the Thai sugar regime.

In order to explore the impact of different scenarios on the Thai sugar sector, I first have to design these alternative scenarios. This is where I would like your help, and so I would like to invite you to participate in a video call in-depth interview which will take approximately 1 hour of your time. You have been selected as a possible interviewee because you have acknowledged expertise on the operation of the Thai sugar sector and an interest in the development of sugar sector policy. Your name was identified by other stakeholders in the sector.

Your responses to the interview will be kept confidential. I will store your name and email address so that I can contact you in 6 months' time to ask follow up questions. Your name and email address will be linked to your original responses by means of a coded spreadsheet held separately. This spreadsheet, which will contain your contact details will be password protected and the password known only to me and my supervisor. The spreadsheet will be kept on my password protected PC and will be destroyed at the end of my degree in September 2022. Your name and email address will not be published as part of my research. As all data will be presented in aggregate form, so that it will not be possible to identify any individuals from their responses

Participation is entirely voluntary and you are free to withdraw from the interview at any time and you do not have to specify a reason. The discussion will be audio or video recorded if you agree, and the anonymised transcripts of the audio/video recordings will be used only by myself for the purpose of this project. Once transcribed the original recording will be deleted. Your anonymity will not be compromised as only the reference number above will be used to identify the transcript.

If at any stage, you wish to receive further information about this research project please do not hesitate to contact s.tangwongkit@pgr.reading.ac.uk by September 2022. The findings will be written up into my thesis, parts of which may also be published in academic journals. This will not affect your anonymity.

By agreeing to this interview, you are acknowledging that you understand the terms and conditions of participation in this study and that you consent to these terms.

This research project has been reviewed according to the procedures specified by the University Research Ethics Committee and has been given a favourable ethical opinion for conduct.

Thank you very much for taking time to take part in this interview session!

Savita Tangwongkit (Postgraduate Research Student)

Interviewees

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Ground Rules

Before we start, I would like to remind you that there are no right or wrong answers in this discussion. We are interested in knowing what you think, so please feel free to be frank and to share your point of view. It is very important that we hear your opinion.

The intention of this interview is to use the information provide from you and other interviewees to design three alternative policy scenarios for Thai sugar industry. One of these scenarios (the Baseline scenario) will be the current proposals by the Thai Government for reform of the sugar regime (we would like your views on this), while the other two alternatives will be more protectionist, of libertarian than the Baseline.

Section A – Information About You

1. What is your role in the Thai sugar sector?

- Which organization do you work for?
- What is your position in this organisation?
- What are your responsibilities in this position?
- How long have you involved working in sugar industry field?
- Do you have any influence on, or responsibility for, managing or developing the Thai sugar regime? If yes, How?

B.-- Current (unreformed) Thai Sugar Regime

2. *Could you please give me your opinion about the current sugar regime before any changes (1984)?*

- What are the strengths and weaknesses of the current unreformed regime?
- What are your views on which are the most important supports for maintaining the viability of the Thai sugar sector?

3. *What are the main factors leading to the requirement to reform the current sugar regime?*

- What is your opinion about this situation?
- What do you see as the main reason Brazil challenged Thailand at the WTO regarding Thai sugar industry?
- Do you believe that the existing Thai sugar regime should be replaced or amended?
- What are the issues and regulations in Thai sugar policy regime regarding the subsidy issue do you think must be reformed? And how?
- Do you know about the government reformation plan?

4. *What are impacts of the current (Unreformed) Thai sugar regime to sugar producers both farmers and millers?*

- How would farmers and millers respond to this current policy?
- What are the benefits and weaknesses on farmers and millers on this unreformed policy regime?

5. *What is the likelihood of current (Unreformed) Thai sugar regime?*

- Very likely Likely Neither likely nor unlikely
 Unlikely Very Unlikely

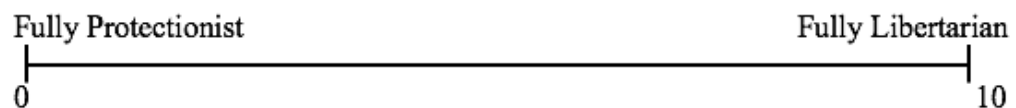
C.--Current government proposals for reforming the sugar regime

6. *Your views on current government reform proposals*

- Do you think it is possible to perform every activity in this policy package plan?

- Which one seem to be in most challenge to perform? and why?
- What are the strengths and weaknesses of the current government reform proposals?
- In your opinion, is there anything else that could be added (or should be dropped) from the restructuring plans to increase effectiveness, or reduce negative consequences? How would that work?

SCALE



7. *Where would you place the current unreformed Thai sugar regime on the scale above?*

8. *Where would you put the government policy reform package in this scale?*

9. *What would be the consequent impacts to sugar producers both farmers and millers within the next five years?*

- How would farmers and millers respond to this proposal policy reform?
- What are the benefits and weaknesses on farmers and millers on this government proposals for reforming the sugar regime?

10. *What is the likelihood of the government proposal plan for reforming the sugar regime?*

Very likely Likely Neither likely nor unlikely

Unlikely Very Unlikely

11. *How the current government reform proposal impacts within the next five years on following aspects compared to the unformed of Thai sugar regime?*

Impacts	Increase	Decease	Remain Unchanged
Exports			
Imports			
Sugarcane Production			

Sugar Production			
Farm Income			
Sugar Mill Income			
Sugarcane Price			
Sugar Price			
State Supports			

12. Despite the enforced-change in Thai sugar policy regime, what would you suggest as the survival options for policy-makers and stakeholders to maintain the competitiveness of Thai sugar sector, perhaps remain a major player in sugar market? What are the general approaches the Thai sugar industry could take under this proposal reform of Thai sugar regime?

Section D – Libertarian Policy Scenario Alternative

13. What would be the benefits and weaknesses, what would be the damaging or successful part of the policy in terms of specific policy measures? For libertarian policy scenario;

- What would it be if we removing tariffs? Base on TRQ purposed by WTO, what would it be if the Tariff quota (tons) for sugar increases up to totally free in 2025? ***Say the quota allows 140.40 tons to be imported until the end of 2019 and will increase to 192.19 tons from 2020-2024. In 2025, there will supposed to have no tariffs on sugar imported.***
- What would it be if we ending the price setting for sugar?
- What would it be if we are completely abolishing quotas?
- What would it be if we ending monetary supports including sugarcane price guarantee and government mandate on sugar pricing and cheap loans to farmers (low interest rate credit)?
- What would it be if we ending the fixed revenue-sharing system (70:30)?

14. If this policy scenario option is feasible and possible, where would you put this Libertarian policy scenario alternative in the scale above?

15. What would be the consequent impacts to sugar producers both farmers and millers within the next five years?

- How would farmers and millers respond to this libertarian policy?

- What are the benefits and weaknesses of this libertarian policy alternative on farmers and millers?

16. What is the likelihood of the libertarian policy alternative?

- Very likely Likely Neither likely nor unlikely
 Unlikely Very Unlikely

17. How would the libertarian policy scenario alternative impact within the next five years the following aspects compared to current situation?

Impacts	Increase	Decease	Remain Unchanged
Exports			
Imports			
Sugarcane Production			
Sugar Production			
Farm Income			
Sugar Mill Income			
Sugarcane Price			
Sugar Price			
State Supports			

18. Despite the enforced-change in Thai sugar policy regime, what would you suggest as the survival options for policy-makers and stakeholders to maintain the competitiveness of Thai sugar sector, perhaps remain a major player in sugar market? What are the general approaches the Thai sugar industry could take under this scenario?

E – Protectionist Policy Scenario Alternative

19. What would be the benefits and weaknesses, what would be the damaging or successful part of the policy in terms of specific policy measures? For example, for protectionism policy;

- What would it be if we remain the most protected measures allowed under WTO as much as possible?

- What would it be if we increase the level of domestic supports allowed under the Green Box such as government services programs and direct payments or other supports to producers that do not link to production decisions such as monetary supports and funding on research and training, infrastructure as well as decoupling payments while abolishing other supports that are prohibited? Which of these supports in Green Box is the most possible and easiest to encourage? Why?
- For example, how would it be if we abolishing the direct payments to producers in terms of guaranteed prices, low credit whereas increasing the monetary payments to producers in order to develop farm and environmental management specifically for improving and increasing sustainable and efficient sugarcane and sugar productivity?
- How far can the government go for expanding monetary payment on establishing research and development institution etc.?
- What would it be if we fully implement the amount of support at 10% of the production value (de minimus level)?
- What would it be if we remaining the fixed revenue sharing between farmers and millers (70:30)? *What would it be if we increase the revenue proportion for farmers? What would it be if we increase the revenue proportion for millers?*
- What would it be if we remaining the highest tariffs allowed under the market access condition as much as possible?
- What would it be if we only ending the mandated pricing in Quota A but still maintain the quantity required in both quota A and C in sugar quota-system?

20. *If this policy scenario option is feasible and possible, where would you put this Protectionism policy scenario alternative in the scale above?*

21. *What would be the consequent impacts to sugar producers both farmers and millers within the next five years?*

- How would farmers and millers respond to this protectionism policy?
- What are the benefits and weaknesses of this protectionism policy alternative on farmers and millers?

22. *What is the likelihood of protectionism policy alternative?*

- | | | |
|--------------------------------------|--|--|
| <input type="checkbox"/> Very likely | <input type="checkbox"/> Likely | <input type="checkbox"/> Neither likely nor unlikely |
| <input type="checkbox"/> Unlikely | <input type="checkbox"/> Very Unlikely | |

23. How the protectionism policy scenario alternative would impact within the next five years the following aspects compared to current situation?

Impacts	Increase	Decease	Remain Unchanged
Exports			
Imports			
Sugarcane Production			
Sugar Production			
Farm Income			
Sugar Mill Income			
Sugarcane Price			
Sugar Price			
State Supports			

24. Despite the enforced-change in Thai sugar policy regime, what would you suggest as the survival options for policy-makers and stakeholders to maintain the competitiveness of Thai sugar sector, perhaps remain a major player in sugar market? What are the general approaches the Thai sugar industry could take under this scenario?

F – Your Own Policy Alternative

25. If you were to start from a blank sheet, what would be your suggestion for a new policy support regime ?

- **If you are doing the changes, what do you do differently toward government is currently doing? What would you do with the following support instruments?**
 - a) Import Tariffs
 - b) Quota System
 - c) Price Support
 - d) Monetary payments such as cheap loan, minimum cane price etc.
 - e) Revenue-sharing system
 - f) Supports through exemption under the Agricultural Agreement under WTO such as green box, decoupled payments, *de minimis* etc?

26. Could you please give me the best of your alternative plans?

27. Where would you place your policy regime on the scale above?

28. About farmers and millers

- Are there any producer supports that should be retained or added?
- Do you believe we should consider retaining as many support policies as possible as long as it is in compliance with WTO rules, or should we try to abolish most supports as much as possible toward higher level of free trade? Why?

29. What would be in consequent impacts to sugar producers both of farmers and millers within the next five years?

- How would farmers and millers respond to this particular policy option?
- What would be the benefits and weaknesses on farmers and millers based on the alternative policy option you believe that suite the industry?

30. Would the new possible policy options affect Thai sugar industry as a whole? How?

31. What is the likelihood of you own policy alternative?

- Very likely Likely Neither likely nor unlikely
 Unlikely Very Unlikely

32. Despite the enforced-change in Thai sugar policy regime, what would you suggest as the survival options for policy-makers and stakeholders to maintain the competitiveness of Thai sugar sector, perhaps remain a major player in sugar market? What are the general approaches the Thai sugar industry could take under your own policy scenario?

33. How the Your Own policy alternative would impact within the next five years the following aspects compared to current situation?

Impacts	Increase	Decease	Remain Unchanged
Exports			
Imports			
Sugarcane Production			
Sugar Production			
Farm Income			

Sugar Mill Income			
Sugarcane Price			
Sugar Price			
State Supports			

34. In order to maintain competitiveness and protect domestic sugar market, do you personally believe that the libertarian policy moving toward free trade, or a protectionism policy which remain the most possible supports from the government, is the most suitable strategy for Thai industry? Which one should suit better?

Appendix B: Questionnaire – farm survey (English version)

PARTICIPANT INFORMATION SHEET

Reference number:

Name of survey collector: **Savita Tangwongkit**

I am PhD student in the School of Agricultural, Policy and Development at the University of Reading, UK. This farmer survey forms part of my doctoral research programme. The goal of my research project is to assess Thai sugarcane farmers' responses about continuing cane farming in order to find out what would they do in regard to a range of alternative cane and sugar policy scenarios.

In order to explore Thai cane farmers' responses, I first have to survey farmers' beliefs, attitudes, intentions, and behaviours. This is where I would like your help, and so I would like to invite you to participate in this survey by filling in this questionnaire. Completing the questionnaire should take approximately 40 minutes of your time.

You have been randomly selected as a possible participant in the survey. Your responses to the survey will be kept confidential. I will store your name and contact information so that I can contact you in 6 months' time to ask a few follow up questions. Your name and contact information will be linked to your original responses only by means of a coded spreadsheet held separately. This spreadsheet, which will contain your contact details, will be password protected and the password known only to myself and my supervisor. The spreadsheet will be destroyed at the end of my degree in September 2022. Your name and contact details will not be published as part of my research. The results of the survey will be published in aggregate form, so that it will not be possible to identify any individual responses.

Participation is entirely voluntary, and you are free to withdraw from the survey at any time up to the point of publication and you do not have to specify a reason. The data you supply will be used only by myself for the purpose of this research. Once translated to English the original questionnaire will be deleted. If at any stage, you wish to receive further information about this research project please do not hesitate to contact s.tangwongkit@pgr.reading.ac.uk by

September 2022. The findings will be written up into my thesis, parts of which may also be published in academic journals. This will not affect your anonymity.

By agreeing to this survey, you are acknowledging that you understand the terms and conditions of participation in this study and that you consent to these terms. This research project has been reviewed according to the procedures specified by the University Research Ethics Committee and has been given a favourable ethical opinion for conduct. Thank you very much for taking time to take part in this survey!

Regards,

..... (Signature)

Savita Tangwongkit

...../...../.....

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CANE FARMER QUESTIONNAIRE

Participant Number ••••• • Administrator Number ••
Date of Participant Visit •• •• •••• Scenario Number ••

FOR OFFICE USE ONLY

INSTRUCTIONS TO THE FARMER SURVEY (Administrators)

The questionnaire should be given to the selected participant. The participant must complete the questionnaire with the assistant team. It is important to be familiar with the content and format of the questionnaire before giving it to the study participants. At the first visit, please begin by telling the participant the following:

“Please answer all questions as accurately as possible; you will not be judged based on your responses. When completed, the form will be quickly reviewed to make sure you did not mistakenly skip questions. Your specific responses will not be reviewed. Please feel free to ask the assistant team if you need any of the questions explained to you”

The questionnaire is very simple and should take less than 40 minutes to complete. Before giving the participant the questionnaire, please fill out the header (s).

Note that the participant is usually asked to respond to questions with a tick “√” or provide short answers.

Please remember, there are 3 sections contained in the questionnaire. All participants will answer the same set of questions in section A and B. For the section C, there are 3 different sets of questionnaires regarding different policy scenario alternatives. The participants will be separated into 3 groups and will be asked to answer the questions in the set they are given. A scenario description sheet (about each of the three policy scenarios) will be attached to the front of section C. You will need to make sure the participant reads and understands the content of description before allowing them to start the section. Please explain the detail if they have any questions.

Collect the completed questionnaire. Before going on, review the questionnaire for omissions. If the participant missed any of the questions, point this out and encourage him/her to complete the omissions.

Name)

(Administrator

Signature)

(Administrator

Before we start I would like to remind you that there are no right or wrong answers to these questions. We are interested in knowing what you think, so please feel free to be frank and to share your point of view. It is very important that we hear your opinion.

SECTION A: SOCIODEMOGRAPHIC CHARACTERISTICS

ALL THE INFORMATION IN THIS STUDY WILL BE KEPT CONFIDENTIAL AND USED FOR RESEARCH ONLY

This section asks about the **SOCIODEMOGRAPHIC CHARACTERISTICS OF CANE FARMER** The participants must read and complete the questionnaire with the assistant team.

For each question:

- Please tick the box “√” for the answer that best describes you
 - Please write down short answers in the boxes provided where the question requires this
 - Answer all of the items
 - Never write “√” more than one on each scale
 - If you want to write any comments, feel free to do so using the space after each question
-

1. What is your gender?

Female Male

2. What is your age?

Under 20 45-54

20-24 55-64

25-34 65+

35-44

3. What is your position on farm?

- Owner
- Decision maker
- Manager
- Employee

4. What is the highest level of education that you achieved?

- No formal schooling completed
- Some high school (No diploma)
- High school (Diploma obtained)
- Vocational training
- Bachelor degree
- Higher degree (Masters)
- Higher degree (PhD) degree

5. Household size (please indicate in the box provided)

4.1 How many members in your household?

4.2 How many household members are aged under 16?

6. How many people (including family members and yourself) work on your farm

(Please indicate in the box)

	Number Full-time	Number Part-time
Family members		

Non-family members		
--------------------	--	--

7. Do you work full-time, or part time on the farm?

- Farming as main job (40 or more hours per week)
- Farming as a part time job (less than 40 hours per week)

8. If you have a non-farm-job, is this?

- Off-season only On-season only Both off- and on-season

9. How long have you worked in farming?

- Less a year 11-20 years
- 1- 4 years 21-30 years
- 5- 10 years More than 30 years

10. How many years have you been producing sugarcane?

- Less a year 11-20 years
- 1- 4 years 21-30 years
- 5- 10 years More than 30 years

11. What is your farm size?

- Less than 30 rai (Less than 5 ha)

- 30 – 59 rai (5 - 9.99 ha)
- 60 -249 rai (10 - 39.99 ha)
- 250 – 499 rai (40 – 80 ha)
- More than 499 rai (More than 80 ha)

12. In which region is your farm located?

- North
- North-East
- Central
- West
- East
- South

13. A) What is your average annual income from the farm based on production cycle period from April to March (excluding off-farm income) (all activities from both agricultural and non-agricultural activities)

- Less than 50,000 Baht
- 400,000-599,999 Baht
- 50,000-99,999 Baht
- 600,000-1,000,000 Baht
- 100,000-199,999 Baht
- More than 1,000,000 Baht
- 200,000-399,999 Baht

B) What proportion of this income comes from non-agricultural activities that are based on the farm

(please indicate in the box)

C) If you also work off the farm, what is your average monthly income from your non-farming job

- Less than 5,000 Baht 40,000-59,999 Baht
- 5,000-9,999 Baht 60,000-100,000 Baht
- 10,000-19,999 Baht More than 100,000 Baht
- 20,000-39,999 Baht

14. Tenure arrangements (Please answer the following questions)

- A) What proportion of the farm land do you own?
- B) What proportion of farm land is rented?

15. Could you please give a rough estimate of your average cane yield in tons per rai at your last harvest?

(please specify in the text box)

16. Do you have outstanding loans for (Please check in the box)?

	Land	
	Building	

Capital Expenditures	Farm maintainace	
	Machineries	
Operational Expenditures (Seasonal)	Hiring labour	
	Input materials (e.g. fertilizers, insecticide, pesticide etc.)	
	Farm management	

17. How much is your interest rate?

(please specify in the provided text box)

18. How many times have you attend any formal agricultural training courses in the past five years? (Please write down the number of times you have attended for each types of training)

Types of training	Number of times
Farming visiting	
Workshop	
Meeting related to cane activities	

19. Machinery/Truck ownership

I own all/most of the machinery needed for my farm operations

I do not own all the machinery I need, so I rent/hire them

I do not own all the machinery I need, so I borrow them

Other (please specify)

20. Distance from farm to contracting mill (Please specify in the text box)

Km

21. Have you identified a successor to take over the business after you?

Yes No If yes, who is it? (please indicate)

22. What breeding livestock do you have on your farm?

(Please write down the numbers in the text box)?

Dairy Beef Sheep

Goats Other

23. What proportion of your land is arable and pasture land (rai)?

Total farm areas		
1.Areas of pasture land	<input type="text"/>	2.Areas of arable land <input type="text"/>
1.1 Temporary grass	<input type="text"/>	2.1 Crop 1) <input type="text"/>
1.2 Permanently grass	<input type="text"/>	2.2 Crop 2) <input type="text"/>
1.3 Rough grass	<input type="text"/>	2.3 Crop 3) <input type="text"/>
		2.4 Crop 4) <input type="text"/>
		2.5 Crop 5) <input type="text"/>

24. What proportion of your land is suitable for cane production (rai)?

(Please specify)

25. Do you ever make a use of a farm advisor (either free or paid)?

Yes

No

SECTION B: GENERAL ATTITUDES, OBJECTIVES AND BEHAVIOURS: THE STUDY OF CANE FARMER DECISION MAKING

ALL THE INFORMATION IN THIS STUDY WILL BE KEPT CONFIDENTIAL AND USED FOR RESEARCH ONLY

This section of the questionnaire deals with attitudes and objectives in cane farming. For each question

- Please write “√” for the answer that best describes your opinion
 - Answer all of the items
 - Never write “√” more than once on each scale
 - If you want to write in any comments, please feel free to do so using the space provided in the last page
-

To what extent do you agree with a following statements:

Statements	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
26. It is important to have the best cane variety					
27. Cane farming is the thing I take the most pride in					
28. It is important to pay attention to cane and sugar market prices					
29. A good cane farmer is a competitive producer of cane sold in the free market					
30. It is very important to run my farm business efficiently					

31. Cane farming is satisfying					
32. Cane farming is my way of life					
33. Cane farming is likely to provide a secure retirement					
34. It would be good to give up cane farming					
35. Young people should be encouraged into cane farming					
36. Cane farmers get lots of support from their friends and family					

Statements	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
37. It is very depressing to farm cane					
38. Other jobs would be better than cane farming					
39. I actively seek new business opportunities (or sources of income) outside agriculture					
40. I often have ideas how to increase profit from cane production					
41. I often have ideas how to decrease the costs of cane production					
42. I think it is difficult to find the information I need to run my farm					

43. I don't consult with others before making decisions on my farm					
44. Consultation with professional advisors before making farm decision is necessary					
45. Visiting other cane farms is very important in order to improve my own farm					
46. Investing in new machinery and methods in cane farming is very necessary to improve my farm					
47. Investing in new machinery and methods results in too much debt					
48. Successful cane farmers take financial risks					
49. Borrowing via loans & cheap credits is appropriate for cane farming					
50. Borrowing money is bad for cane farming					

Statements	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
51. It is easy for cane farmers to apply for state loans and subsidies for their farm					
52. It is important for cane farmers to have access to cheap loans provided by government					
53. Cane policy changes are easy to understand					
54. Government is involved too much in cane farming business					
55. Government policy for the cane industry is not always clear					
56. Cane farmers should not receive any cane price support					
57. Cane farmers should not receive any income support					
58. The overall strategy in cane policy is unclear					
59. I am satisfied with the current government cane farming policy					
60. The cane policies are helpful for cane farmers					
61. Sometimes cane farmers are being informed about government policies too late to implement changes					

62. Even advisors can't tell you what the current legislation is					
63. Keeping up with the cane farming policies is very important					
64. I think my neighbours think I run my cane farming business in a good way					

65. I think other cane farmers believe that I run my farm in a good way					
66. I feel that my friends and family think I run my farm in a good way					
67. Friends and family think that cane farmers should not take off-farm jobs or embrace new careers. They should concentrate on cane farming					
68. Friends and family think government should support cane farmers					
69. Maximizing my farm profit is the most important goal when I make my farm management decisions					
70. Keeping debt as low as possible is important					
71. It is important to expand farm size					

72. It is important to have up-to-date machinery and equipment					
73. Trying new cane varieties is important					
74. It is important to improve farm the standard of farm management					
75. Improving my family's living standard is the most important goal when I take decisions about farm management					
76. Cane farming is more rewarding in terms of quality of life than it is in terms of money					
77. Cane farmers should devote all their land to produce sugarcane					
78. Cane farming is important to improve my quality of life					
79. Having other interests outside cane farming is important					
80. Planning for retirement is important					
81. Spending time with family is important					
82. It is important to stay in cane farming whatever happens					

83. Passing on my cane farm to a family member is important					
84. Off-farm work is necessary to stay in cane farming					
85. Cane farmers should not have to work off-farm to sustain their farming activities					
86. Having other skills outside cane farming is important					
87. Having investments outside cane farming is important					
88. I would like to maximize my free time					
89. Living in the countryside is more enjoyable than living in the city					
90. Cane farming provides enough income to meet family needs					
91. Cane farming is a challenging occupation					
92. A farm is the best place to raise family					
93. Cane farming could not survive without government supports					
94. Successful cane farming is a result from government support					

SECTION C: SOCIO-ECONOMIC FACTORS, MARKET CONDITION FACTORS AND BEHAVIOURAL RESPONSES UNDER GIVEN POLICY SCENARIO ALTERNATIVES

ALL THE INFORMATION IN THIS STUDY WILL BE KEPT CONFIDENTIAL AND USED FOR RESEARCH ONLY

This survey deals with attitudes, beliefs and intention to remain in sugar cane production. For each question:

- Please write “√” for the answer that best describes your beliefs, feelings and opinions about continuing cane farming
 - Answer all of the items
 - Never write “√” more than once on each scale
 - If you want to write in any comments, please feel free to do so using the space after each question
-

Baseline Scenario Alternative

(The Government Proposals for Reforming the Sugar Regime)

95. How satisfied are you with the new government policy proposals (as described above)?

Very satisfied	Satisfied	Neither satisfied or dissatisfied	Dissatisfied	Very dissatisfied

96. How likely is it that the new government policy proposals will negatively affect your farm business?

Very unlikely	Unlikely	Neither unlikely of likely	Likely	Very likely

97. What impact do you believe the new government policy proposals will have on cane farmers?

Strong negative impact	Moderate negative impact	Neither positive or negative impact	Moderate positive impact	Strong positive impact

98. Could you please indicate the impact of different elements of the planned changes to policy?

Policy Instrument	Strong negative impact	Moderate negative impact	Neither negative nor positive impact	Moderate Positive impact	Strong positive impact
Ending quota system					
Ending cheap loans and interest credits from government					
Floating domestic sugar prices					
Abolition of price support to cane farmers (e.g. cane price guarantee)					

99. General Attitude Toward Policy

To what extent do you agree with a following statements about the new government policy reform proposals?

Statements	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
My business will be slightly negatively affected by a drop in domestic sugar price					
My business will be strongly negatively affected by a drop in domestic sugar price					
A decrease in domestic sugar price will negatively impact my sugarcane production					

100. Opinions of peers towards the policy change

To what extent do you agree with following statements?

Statements	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
My family and friends think the new government policy proposals will help me maintain my cane farming business					
Other cane farmers like me think the new government policy proposals will help me maintain my cane farming business					

101. If the new government policy proposals are implemented, what would you do?

101.1 I intend to continue cane farming for the next five years

Definitely no	No	Neither no or yes	Yes	Definitely yes

101.2 I plan to continue cane farming for the next five years

Strongly disagree	Disagree	Neither disagree or agree	Agree	Strongly agree

102.3 I am confident that I will continue cane farming for the next five years

Not confident at all	Not very confident	Somewhat confident	Confident	Extremely confident

103.4 I have farmed cane continuously for the last five years

False

True

104. If you intend to continue cane farming for the next five years, what changes would you make to your farm in response to the proposed government policy reforms?

Statements	Very unlikely	Unlikely	Neither likely nor unlikely	Likely	Very Likely
I would <i>borrow money from commercial or non-government loan providers</i>					
I would <i>buy more machinery and equipment to reduce production cost</i>					
I would <i>plant another crop alongside the cane area</i>					

I would <i>increase my time for off-farm work</i>					
I would <i>continue growing cane just as I do today</i>					
I would <i>expand the size of my farm to spread overhead costs</i>					
I would <i>expand sugarcane production</i>					
I would <i>switch to another cane variety</i>					

105. If you intend to continue in cane production after the reforms for five years, how important would the following actions be?

Statements	Not important at all	No so important	Somewhat important	Very important	Extremely important
I would <i>borrow money from commercial or non-government loan providers</i>					
I would <i>buy more machines and instruments to reduce production cost</i>					
I would <i>plant another crop alongside the cane area</i>					
I would <i>increase my time for off-farm work</i>					
I would <i>continue growing cane just as I do today</i>					
I would <i>decrease cane production</i>					
I would <i>expand size of farm to spread overhead costs</i>					
I would <i>expand sugarcane production</i>					

I would <i>switch to another cane variety</i>					
---	--	--	--	--	--

Please answer each question below **by circling** the number on the scale from 1 to 5 that best describes your opinion

Some of these questions may appear to be similar but they address different issues.

In my opinion:

106.1 My continuing cane farming for the next five years would be;

Bad: 1: 2: 3: 4: 5: **Good**

Unpleasant: 1: 2: 3: 4: 5: **Pleasant**

Useless: 1: 2: 3: 4: 5: **Useful**

Invaluable: 1: 2: 3: 4: 5: **Valuable**

Unenjoyable: 1: 2: 3: 4: 5: **Enjoyable**

Harmful: 1: 2: 3: 4: 5: **Beneficial**

In my opinion:

106.2 Of all the farming alternatives available to me, cane farming is the most:

Unprofitable enterprise: 1: 2: 3: 4: 5: **Profitable enterprise**

107. Assuming that the government's planned reforms are implemented, how likely is it that...

Statements	Very unlikely	Unlikely	Neither likely nor unlikely	Likely	Very Likely
<i>The new government proposal plan will damage cane farmers</i>					
<i>A decrease in domestic sugar price will negatively affect my income on cane production</i>					
<i>My business will be strongly negatively affected by the price drop in domestic market</i>					
<i>A drop in domestic sugar price will negatively impact my sugarcane production</i>					
<i>Ending government support will affect my farm business</i>					
<i>I can get my business to be better than it is now under the new government proposal plan</i>					
<i>I would work off-farm to support my cane farming activities</i>					
<i>Not receiving any price supports (e.g. guarantee cane price, fixed domestic sugar price above the world price) will be bad for my cane business</i>					
<i>Not receiving any producer subsidies (e.g. cheap loans, low credits and interests) related to cane production will be bad for my cane business</i>					
<i>The new government proposals will interfere too much with my future farming plan</i>					

<i>No matter what the new government policy is, I will keep my farm running</i>					
---	--	--	--	--	--

108. Please indicate the magnitude of each of the impacts statements listed in the table.

Statements	Very weak	Weak	Neutral	Strong	Very strong
<i>The new government proposal plan will damage cane farmers</i>					
<i>A decrease in domestic sugar price will negatively affect my income from cane production</i>					
<i>My business will be strongly negatively affected by the price drop in domestic market</i>					
<i>A drop in domestic sugar price will negatively impact my sugarcane production</i>					
<i>Ending government support will affect my farm business</i>					
<i>I can get my business to be better than it is now under the new government proposal plan</i>					
<i>I should work off-farm to sustain my cane farming activities</i>					
<i>Not receiving any price supports (e.g. guarantee cane price, fixed domestic sugar price above the world price) will be bad for my cane business</i>					
<i>Not receiving any producer subsidies (e.g. cheap loans, low credits and interests) related to cane production will be bad for my cane business</i>					
<i>The new government proposals interfere too much with my future farming plan</i>					

<i>No matter the new government policy is, I will keep my farm running</i>					
--	--	--	--	--	--

109. To what extent do you **agree** with a following statements according to the new government proposal plan?

Statements	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
Other farmers like me will continue cane production for the next five years					

110. How likely are the following if the government introduces its proposed policy reforms?

Statements	Very unlikely	Unlikely	Neither likely nor unlikely	Likely	Very Likely
How likely is it that family and friends would think you should continue cane farming for the next five years?					
How likely is it that your neighbouring cane farmers would think you should continue cane farming for the next five years?					
How likely is it that sugar millers would think you should continue cane farming for the next five years?					
How likely is it that the government would think you should continue cane farming for the next five years?					

111. Subjective Norm Weight Composition

How do much you care about the opinions of the following groups?

Statements	Not at all	Care a little	Neutral	Care to some extent	Care very much
How much would you care if your family and friends thought you should continue cane farming for the next five years					
How much would you care if neighbouring cane farmers thought you should continue cane farming for the next five years					
How much would you care if sugar millers thought you should continue cane farming for the next five years					
How much would you care if the government thought you should continue cane farming for the next five years					

112. If the government reform proposals were introduced, to what extent would you **agree** with a following statements toward continuing cane farming for the next five years?

Statements	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
I am confident that I can continue cane farming in the next five years					
Continuing in cane farming in the next five years is completely up to me					

For me, to continue cane farming in the next five years is under my control					
I choose how I would continue cane farming in the next five years					

113. Under the government reform plan there may be **conditions/things** that would make continuing in cane farming in the next five years **easy or difficult**. To what extent do you agree with the following statements about your continuing in cane production for the next five years?

Statements	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
I believe that have got enough skills to continue					
I believe that I have sufficient resources to do this					
I will need lots of government support					
I believe have capacity to do it					
I believe have the necessary authority to do it					
I believe that have sufficient knowledge to do it					
I lack the money for necessary investment					
I believe that my farm is too small to be financially stable					
I would not be able to borrow money or sufficient funds					

114. Now for the same conditions as in question 17, please indicate **how likely** you would be to continue cane farming in the next five years under the new government proposal plan under the following conditions.

Statements	Very unlikely (to continue cane farming for the next five years)	Unlikely (to continue cane farming for the next five years)	Neither likely nor unlikely (to continue cane farming for the next five years)	Likely (to continue cane farming for the next five years)	Very Likely (to continue cane farming for the next five years)
With sufficient skill, I am					
With sufficient resources to grow cane, I am					
Having lots of government supports, I am					
With lots of capacity, I am					
With sufficient authority, I am					
With sufficient knowledge, I am					
Having lack of money to invest, I am					
Having small farm, I am					
If I will not be in much higher debt, I am					

115. To what extent do you **agree** with a following statements according to the government proposal plan?

Statements	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree

I feel morally obligated to continue cane farming for the next five years					
Continuing cane farming in the next five years is consistent with my moral principles, values, and beliefs					
I would feel guilty about the environmental consequences of not continuing in cane farming for the next five years					

116. To what extent do you agree with the following statements?

Statements	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
Cane farming in Thailand provides export dollars					
Cane farming in Thailand provides employment in the sector (transporters, refiners, retailers etc.)					
Cane farming in Thailand supports downstream businesses (adds more value by products)					

117. To what extent do you agree with the following statements?

Statements	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree

I would feel responsible for any problems resulting from not continuing cane farming business for the next five years					
I would contribute to economic problems if I did not continue cane farming business for the next five years					
I believe that all cane farmers must take responsibility for continuing cane farming business for the next five years					
All cane farmers are responsible for any economic problems caused by hazards by stopping or reducing cane production					

118. If under the new government reforms you decided you would not continue cane farming for the next five years, what would you do with your farm instead?

Statements	Very unlikely	Unlikely	Neither likely nor unlikely	Likely	Very Likely
I will switch to production of another crop					
I will start off-farm employment					
I will pass on my land to the next generation					
I will quit cane farming and rent out my land to other farmers					
I will quit cane farming and sell my land					

I will retire and remain on the farm					
I will retire and leave the farm					

119. What would make it more difficult for you to continue in cane farming after the government reforms?

Statements	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
My farm is too small to make a profit under the new government policy					
It would be much more financially difficult to continue cane farming under the new government policy					
Cane farming is not my way of my life					
There are lots of better off-farm opportunities that provide financially secured work					
I would need to get more expensive loans and credits from other providers to manage my farm because of higher restriction of credit					
Higher need to taking on substantial debt					
I will get insufficient income to support my family					

120. If you have any comments to offer on this survey, or suggestions for changes/improvements, please explain in the text box

Appendix C: Questionnaire – miller survey (English version)

PARTICIPANT INFORMATION SHEET

Reference number:

Name of researcher: Savita Tangwongkit

I am a PhD student in the School of Agricultural, Policy and Development at the University of Reading, UK. This survey forms part of my doctoral research programme.

The goal of my research project is to assess the likely impacts of a range of alternative policy regimes (scenarios) on the Thai sugar sector, in particular the responses of Thai sugar cane farmers and sugar millers

The information collected will help policy-makers to select the best and most suitable policy options that maximize benefits of all stakeholders in Thai cane and sugar industry. Therefore, it is very important to investigate the impact of different policy scenarios on Thai sugar millers and their likely responses to the impact. This is where I would like your help, and so I would like to invite you to complete the questionnaire that has been emailed to you. You have been selected as a possible participant because you have acknowledged expertise on Thai sugar sector as a key sugar producer and have played a significant part in determining a future direction of Thai sugar industry.

If you decide to participate you would have 7 weeks to complete of this questionnaire. Once the questionnaire is completed, please send it back to the researcher. Your responses to the survey will be kept confidential. I will store your name and email address so that I can contact you in 6 months' time to ask following up questions. The data you supply will be stored anonymously, i.e. your name and email address will be linked to your original responses by means of a unique code number, with the code number linked to your contact details in a separate password protected file. This record of your contact details will be destroyed at the end of my degree in September 2022. Your name and email address will not be published as part of my research, i.e. all data will be presented in aggregate form, so that it will not be possible to identify any individuals from their response.

Participation in this survey is entirely voluntary and you are free to withdraw from the survey at any time until 31stOctober 2020. You do not have to specify a reason for withdrawing, simply

write to me, or email, with your request using the contact details provided in this letter. If you wish to Your data will be used for the purpose of my PhD research only .

If at any stage, you wish to receive further information about this research project please do not hesitate to contact s.tangwongkit@pgr.reading.ac.uk by September 2022. The findings will be written up into my thesis, parts of which may also be published in academic journals. This will not affect your anonymity. By agreeing to this survey, you are acknowledging that you understand the terms and conditions of participation in this study and that you consent to these terms.

This research project has been reviewed according to the procedures specified by the University Research Ethics Committee and has been given a favourable ethical opinion for conduct.

Thank you very much for taking time to take part in this survey!

Savita Tangwongkit
(Postgraduate Research Student)

____ / ____ / ____

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Bagasse	
Other special sugar (Please specify)	

Part 3: Revenue Structure

Total Revenue (Baht)	
Business types	%of total business revenue
Sugar	
Ethanol	
Fertilizer business	
Biomass powerplants(Electricity)	
Paper business	
Bio-technology (Innovative or functional food, Pharmaceuticals, chemical, palatine bio sugar etc.)	
Revenue from selling other agricultural production and services (Please specify)	
Revenue from non-agricultural businesses (Please specify)	

Part 4: Production/ Production Process Structure

4.1 Cane crushing Process

4.1.1 Cane crushing Period (This year)

Start Date	
End Date	
Number of crushing Days	
Total hours of actual crushing (Approximate)	
Crushing Rate / 24. hrs. (Volume)	

4.1.2 Loss due to downtime during cane continuous crushing period

Which of these problems had occurred as the cause of stoppages during the crushing process?

Particulars	Has this problem occurred?	Level of impact (If the answer is YES)				
		Insignificant	Minor	Moderate	Major	Sever
Cane shortage (lack of suppliers)	<input type="checkbox"/> Yes <input type="checkbox"/> No					
Mechanical & Electrical failure	<input type="checkbox"/> Yes <input type="checkbox"/> No					

High levels of contaminants	<input type="checkbox"/> Yes <input type="checkbox"/> No					
Cane shortage (low yield due to rain)	<input type="checkbox"/> Yes <input type="checkbox"/> No					
Others 1)	<input type="checkbox"/> Yes <input type="checkbox"/> No					
Others 2)	<input type="checkbox"/> Yes <input type="checkbox"/> No					

4.1.3 Cane volume crushed in 2019

Total cane volume crushed (Metric tons)		Average cane sweetness level (C.C.S)
Burnt cane crushed volume	(Metric tons)	(C.C.S)
Fresh cane crushed volume	(Metric tons)	(C.C.S)

4.1.4 What is the length of the time lag between harvesting and crushing?

Time lag between harvesting and crushing	Percentage of your supply (%)
Less than 12 hr.	
12-24 hr.	
25-36 hr.	
37-48 hr.	
49-60 hr.	
61-72 hr.	
More than 72 hr.	

4.1.5 Cane volume supplied to factory during crushing period

Month	Cane Volume (% of total season supply)
November	
December	
January	
February	
March	
April	
May	

4.1.6 Percentage of Maximum Capacity Utilized

Capacity Utilization Parameters	Year 2016/2017	Year 2017/2018	Year 2018/2019	Year 2019/2020
Actual Output				
Maximum Possible Output				

4.2 Sugar and molasses Production

4.2.1 Sugar and Molasses Production Volume

Total sugar production volume metric tons		
1. Total White Sugar Volume.....metric tons	2. Total Raw Sugar Volume.....metric tons	3. Other Types Volume metric tons
Total molasses production metric tons		

4.2.2 Average sugar produced per ton of cane (Kg.)

4.2.3 Sugar Recovery (%)

4.2.4 Average molasses produced per ton of cane (Kg.)

Part 5: Sugar Distribution and Marketing Structure

5.Sugar Distribution Volume in 2019

Approximate sugar volume supplied to the domestic market	
Retail Market : White/refined sugar	..... metric tons
Raw sugar	..... metric tons
Processing or Industry : White/refined sugar	..... metric tons
Raw sugar	..... metric tons
Approximate sugar volume supplied to the TCSC (For price referencing)	
Raw sugar	..... metric tons
Approximate sugar volume exported	
White/Refined sugar	..... metric tons
Raw sugar	..... metric tons

Part 6: Contract Farming

6.1 Approaches to obtain cane supplied to production process by volume

Through direct contract-farming with cane famers	
No. of farmers or Percentage <input type="checkbox"/> persons/ <input type="checkbox"/> percent
Cane Volume or Percentage <input type="checkbox"/> metric tons/ <input type="checkbox"/> percent
Through contract from middlemen or cane quota leaders	
No. of farmers or Percentage <input type="checkbox"/> persons/ <input type="checkbox"/> percent
Cane Volume or Percentage <input type="checkbox"/> metric tons/ <input type="checkbox"/> percent

6.2 How many of the contracting cane farmers receive credit lines from the company?

persons

6.3 What is the average interest rate per year the company loans out to contracting-farmers?

%

Part 7: Human Resource

7.1 Total number of employees/staff persons

7.1.1 Number of employees in office	
No. of full- time employees	..... persons
No. of part-time employees	..... persons
7.1.2 Number of employees in factory	
No. of full- time employees	..... persons
No. of part-time employees	..... persons

Part 8: Financial Structure

8.1 What are the sources of your financial/investment capital?

- Borrow from financial institutions Informal lenders
- Own saving (Personal Capital) Company retained profits
- Partners in the company/ persons who are related Others (please specify)
in the company/ shareholders

8.2 Primary sources of your company borrowing

Borrowing sources	Is this your lender?	Level of importance (If the answer is YES)				
		Not important	Little important	Somewhat important	Important	Very important
The BAAC	<input type="checkbox"/> Yes <input type="checkbox"/> No					
Commercial Bank	<input type="checkbox"/> Yes <input type="checkbox"/> No					
The Cane and Sugar Fund (CSF)	<input type="checkbox"/> Yes <input type="checkbox"/> No					
Others 1).....	<input type="checkbox"/> Yes <input type="checkbox"/> No					
Others 2).....	<input type="checkbox"/> Yes <input type="checkbox"/> No					

8.3 Turnover

Turnover compared to previous year	Year 2017/2018 (Compared to 2016/2017)	Year 2018/2019 (Compared to 2017/2018)	Year 2019/2020 (Compared to 2018/2019)
Change in Sales	<input type="checkbox"/> Increase % <input type="checkbox"/> Decrease% <input type="checkbox"/> Same	<input type="checkbox"/> Increase % <input type="checkbox"/> Decrease% <input type="checkbox"/> Same	<input type="checkbox"/> Increase % <input type="checkbox"/> Decrease% <input type="checkbox"/> Same
Change in Net Profit	<input type="checkbox"/> Increase % <input type="checkbox"/> Decrease% <input type="checkbox"/> Same	<input type="checkbox"/> Increase % <input type="checkbox"/> Decrease% <input type="checkbox"/> Same	<input type="checkbox"/> Increase % <input type="checkbox"/> Decrease% <input type="checkbox"/> Same
Change in Production Capacity	<input type="checkbox"/> Increase % <input type="checkbox"/> Decrease% <input type="checkbox"/> Same	<input type="checkbox"/> Increase % <input type="checkbox"/> Decrease% <input type="checkbox"/> Same	<input type="checkbox"/> Increase % <input type="checkbox"/> Decrease% <input type="checkbox"/> Same

Part 9: Research and Development

9.1 Research/Development Capability

- My company has no research and development plan
- My company has a plan
- My company already has (answering more than 1 option is allowed)
- our own research and development within the organization*
 - Cooperation with other institutions/departments in terms of research and development*

9.2. Problems/obstacles in research development (Please indicate the level of impact of following issues)

Problems/issues	Not an obstacle at all	Minor obstacle	Neutral	Major obstacle	Sever obstacle
Financial constraints					
Human resource issue					
Lack of knowledge issue					
Lack of tools and machineries for the use of research and development project					

9.3 How is the government already supporting your R & D activities?

(Please indicate the level of importance of following activities)

Government's supporting activities	Not important at all	Little important	Somewhat important	Important	Very important
Improving tax measures					

Improving the process of using tax benefits					
Establishing research and development center					
Allocating budgets to support technology development					
Providing low interest loans					
Providing advisory services					

Part 10: Creating Production value and Cost Reductions

10.1 Has the company taken any steps to improve production value or reduce costs over the past 3 years and if so, How?

(Please explain the activities and how)

Improve production value

.....

Reduce loss

.....

10.2 Are you planning any activities to create production value or reduce costs in the nearly future?

(Please explain the activities and how)

Improve production value

.....

Reduce loss

.....

10.3 Please indicate the level of impact of following obstacles

Obstacles during performing activities in the past 3 years	In terms of increase production value					In terms of loss and cost reduction				
	No impact	Small Impact	Moderate impact	High Impact	Very high impact	No impact	Small impact	Moderate impact	High impact	Very high impact
Fluctuation from natural changes(climate/weather)										
-Capital Investment/ Fundraising/ requesting a loan										
Lack or limitation of knowledge and										

understanding about increasing value										
Selecting/ obtaining skilled and knowledgeable workers/staffs										
Cooperation from members/employees										
Rules and regulations/ government intervention										
Pursuit of technology and related innovation										
Price fluctuation from production factors										
Fluctuation in sugar price										
Transportation and logistics problem to deliver factors and product										
Problem in managing inbound logistics in delivering cane to factory										
Others 1)										
Others 2)										

Part 11 : Government’s Rules, Regulations and Policies

What are the government supports that facilitate your company?

Government’s role	Levels of frequency (If the answer is YES)				
	Never	Rarely	Sometim es	Very often	Always
Lending					
Training supports					
Sugar production supports					
Research and development in terms of cane variety and new products					
Research and development in terms of new technologies and innovation					
Logistics improvement					
Facilitating in terms of communication about market demand					
Keep informing about export market situation					
Negotiating with other countries to reduce trade barriers					
Negotiation with cane farmers					

Part 12 : How have market environment and market factors impacted your business since 2016?

Market environment and market factors	Levels of impact				
	No impact	Little impact	Moderate impact	High impact	Extremely high impact
Sugar demand fluctuates is not stable					
High fluctuation in sugar price					
The market is very competitive in terms of rivals					
profit margins are too low					
New research and development of rivals’ impact on your company					

SECTION B: Thai Sugar Refiners’ Responses: Responses toward Scenarios-Specific Policy

In this section, the participants will be given information about three specific policy regime scenarios used in this research. Participants must read the details of each scenario and then complete the relevant questions.

For each question:

- Please tick the box “√” for the answer that best describes your opinion
- Please write down short answers in the boxes provided where the question requires this
- Never write “√” more than once on each scale (unless the question directs you to do so)
- If you want to write any comments, feel free to do so using the space after each question

SECTION 1: VIEWS AND PREFERENCES FOR POLICY AND GENERAL

To what extent do you agree with a following statements

Statements	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1.1 My sugar business runs the best with strong government supports					
1.2 My sugar business could not prosper without government supports					
1.3 My business would benefit from less government’s regulations and restrictions					
1.4 Ending fixed domestic sugar price would improve the competitive position of the company					
1.5 Liberalized Thai sugar policies as much as possible is the best approach for my business					
1.6 I believe my business has a potentiality to gain market share from liberalized Thai sugar industry					
1.7 I believe liberalized policies would be damaging to my business					
1.8 My business’s capacity limit is too small to compete with our rivals without government’s intervention					
1.9 A drop on cane price is beneficial to my business especially in terms of raw material costs					
1.10 I think the most suitable policy approach for Thai sugar business is to maintain the protections as much as possible rather than freely liberalized.					
1.11 No matter what the policy package will be, I will keep my sugar mill running					
1.12 Higher market competitiveness, increase internal competition is good for sugar business					

Policy Scenarios Explanatory - Central Region

Libertarian Scenario (Central Region)

This scenario will be a move towards a freer market but keeps some essential controls that are in line with WTO's rules and regulations that ensure fairness among producers. Having a free market and sugar production will be market orientated. This policy regime aims to make sure that most efficient producers survive while discouraging the least efficient producers with persistently low yields to leave the industry and concentrate on other agricultural activities that more suited to the area. Sugar users and consumers benefit from a free market and more competition and will be able to hedge against price changes as these should be linked to the world market not politically manipulated to ensure a strong sustainable industry and allowing the industry to flourish and compete freely on the world sugar market and bring Thai sugar policy into line with the aim of WTO.

The basis of the 'Libertarian' scenario is **encouraging full market liberalization by removing all production support and market interventions**,

i.e. all trade and domestic consumption distorting mechanisms. These include

(Could you please indicate the level of impact on your sugar business of each of the elements within the libertarian policy outlines below)

Policy Instrument	High negative impact	Little negative impact	No impact	Little positive impact	High positive impact
2.1 Full abolition of quota system. No limitation and control over sugar millers in terms of quantity and price of sugar sold both domestically and internationally. <u>Millers are freely allowed to supply sugar based on their capability.</u>					
2.2 Floating domestic sugar price by ending domestic consumption distorting mechanism and eliminating the special 5 baht/kg tax on domestic sugar sales.					
2.3 Ending cheap loans and low interest credits provided by the government. However, the government will help the CSF obtain and access money from commercial banks at the lowest possible interest rates to help millers and farmers					
2.4 Full ending of import restrictions by freely allow sugar import					
2.5 Ending 'preliminary' and 'final' cane price payments system					
2.6 Ending restriction of sugar mill and trader license					

<p>2.7 Allowing the use of ‘cane syrup’ to produce other products rather than just ‘sugar’. Revenue from these products will be excluded from revenue-sharing system. Cane price for these products will be sold outright unconditionally. If this policy can be implemented, it will result in an increase in the production of new products. Having new products will also resulted in higher demand for raw material which is cane and will resulted in higher cane price.</p>					
<p>2.8 Decrease in government budget for direct supports to producers, while increase the budget for indirect supports such as promoting research, training, and development and ‘decoupled’ income supports etc.</p>					
<p>2.9 Categorizing the roles of the Cane and Sugar Fund (CSF) from being state-run to a private organization. The institution has been established by two parties (cane farmers and sugar millers) aiming to help stabilizing the system of the industry</p>					
<p>2.10 Revenue from the difference between domestic sugar price and referenced export price is still collected to the CSF as revenue of system to ensure the stability of the CSF. If sugar millers are able to export their sugar at price above referenced price, revenue from extra price becomes sugar millers’.</p>					
<p>2.11 Ending cane price guarantee and direct payment to cane farmers</p>					
<p>2.12 Direct supports must only come from non-state-run organization such as the CSF</p>					
<p>2.13 Cane farmers and sugar millers are considered as ‘partly partnership’. The 70:30 proportions of revenue-sharing system will be retained as part of being partnership. Farmers and sugar millers are sharing profit and undertaking risks together with respect to the production and sale of sugar and molasses. However, revenue from other value-added products produced from parts of cane</p>					

(bagasse and filter cakes etc.) besides molasses still will not be put into the revenue-sharing system. Therefore, their prices will be spited at new agreed price or agreed proportions between farmers and millers.					
2.14 Farmers who intend to quit cane farming will be compensated and paid under the structural adjustment programs such as retirement which is allowed in the Green Box by WTO					
2.15 Providing additional direct payment to cane farmers who delivered ‘unburnt’ cane while deducting certain amount of money from those who deliver ‘burnt’ cane through payments under environmental programs which will benefit sugar millers in terms of better cane quality and reduce the loss of sweetness in cane during transportation. This incentive will encourage farmers to improve their productivity.					
2.16 Reducing level of the restrictions to the new entrants who what to enter sugar mill business or existed millers who want to expand their mills. Millers are encouraged to increase their production efficiency. If millers’ productivity increases above cane, cane price will also increase.					

Changes by estimated percentage under Libertarian policy scenario

Central Region	Farm size scale			
	Total (all sizes)	Small (<10 ha)	Medium (10-80 ha)	Large (>80 ha)
% loss in cane production area	65.22%	36.22%	67.06%	64.71%
% loss in cane production area as a share of the total area lost		1.62%	58.56%	39.82%
% loss in cane production volume	66.35%	40.97%	68.45%	65.20%
% loss in cane production volume as a share of the total volume lost		1.91%	60.38%	37.71%
% of farmers intend to 'QUIT' cane farming	58.93%	41.67%	64.86%	54.14%
% of farmers intend to 'QUIT' cane farming as a share of the total farmers quit		15.15%	72.93%	12.12%
Central Region				
% of cane area that is likely to be convert to alternative crops (national)				25.32%
% cane area I likely to be convert to alternative crops (this region)				45.55%
% change in import volume				3.60%

% change in export volume	-9.20%
Estimated cane price	650 baht/ metric ton
% change in domestic sugar price	17 baht/kg (-24.13%)

RESPONSES TOWARD LIBERTARIAN REGIME

3. How satisfied are you with the impact from ‘Libertarian’ regime?

- Very dissatisfied Dissatisfied Neither dissatisfied nor satisfied
 Satisfied Very Satisfied

4. How likely is it that the impact from ‘Libertarian’ regime will negatively affect your sugar business?

- Very unlikely Unlikely Neither unlikely nor likely
 Likely Very likely

5. What impact do you believe the ‘Libertarian’ regime will have on your sugar business?

- Strong negative impact Moderate negative impact Neither positive nor negative impact
 Moderate positive impact Strong positive impact

6. How likely is it you would survive under ‘Libertarian’ regime?

- Very unlikely Unlikely Neither unlikely nor likely
 Likely Very likely

7. If the ‘Libertarian’ regime is implemented,?

- I will still not be able to survive under this policy regime
 I will still run my business but at the break-even level
 I will still run my business with little profit
 My business will not be much impacted in terms of profit.

8. If ‘Libertarian’ regime is implemented, what would you do with your sugar business?

- I would continue my sugar business just as I do today
 I would leave sugar business
 I would downsize my sugar production volume (By percent, please specify)
 I would expand my sugar production volume (By percent, please specify)

9. If the ‘Libertarian’ regime is imposed and you are going to continue your business, what are the company’s

response plans and strategies? Please explain (If you are ‘Not’ going to continue sugar mill business, please skip this question)

.....
.....

10. If there is a chance for you to leave the business, what are the reasons? Please explain

(If you are going to continue sugar mill business, please skip this question)

.....
.....

11. Please answer each question below by circling the number on the scale from 1 to 5 that best describes your opinion

(Some of these questions may appear to be similar but they address different issues).

In my opinion:

Under 'Libertarian' policy scenario, my continuing with sugar business for the next five years would be;

11.1 Bad: 1: 2: 3: 4: 5: **Good**

11.2 Invaluable: 1: 2: 3: 4: 5: **Valuable**

11.3 Harmful: 1: 2: 3: 4: 5: **Beneficial**

12. If cane and cane-syrup are allowed to be used to produce other product under 'Libertarian' regime based on the given condition provided from the information page, would you expand the use of cane syrup for other cane-related business?

Definitely no No Neither yes nor no Yes Definitely yes

13. If the answer is "Yes" or "Definitely Yes", what are other cane-related business you would consider expanding? (Please specify)

- 1).....
- 4).....
- 2).....
- 5).....

14. Supposed a degressive per-metric ton restructuring aid to sugar factories will be granted for factory closure, a part-leaving or renunciation of quota, how likely is it would you leave sugar business under this scenario?

Very unlikely Unlikely Neither unlikely nor likely
 Likely Very likely

15. How likely is it that you would be able to complete with the rivals in sugar mill business under this scenario?

Very unlikely Unlikely Neither unlikely nor likely
 Likely Very likely

16. How likely is it that you would be able to gain greater domestic market share if this scenario is implemented?

Very unlikely Unlikely Neither unlikely nor likely

Likely

Very likely

17. If the ‘Libertarian’ policy is implemented next year, my operation profit for the next five year is expected to be in

Surplus

Balance

Deficit

18 If this scenario is imposed, compared to 2017-2018, operating profit for the next? five years is expected to

Improve

Show no change

Worsen

(Go to Q.19)

(Go to Q.20)

19. If you answered that operating profit for the next five years is forecast to “Improve” , please select the reason(s). (Select all that apply)

Reasons		Levels of importance (If the answer is YES)				
		Not important at all	Somewhat important	Neutral	Important	Very Important
19.1 Increase in sales due to export expansion	<input type="checkbox"/> Yes <input type="checkbox"/> No					
19.2 Increase in local market sales	<input type="checkbox"/> Yes <input type="checkbox"/> No					
19.3 Increase in sale due to higher prices	<input type="checkbox"/> Yes <input type="checkbox"/> No					
19.4 Increase in sales due to development of new products	<input type="checkbox"/> Yes <input type="checkbox"/> No					
19.5 Increase in sale due to exchange rate fluctuations	<input type="checkbox"/> Yes <input type="checkbox"/> No					
19.6 Increased sales of higher-value products	<input type="checkbox"/> Yes <input type="checkbox"/> No					
19.7 Reduction in procurement costs (manufacturing only)	<input type="checkbox"/> Yes <input type="checkbox"/> No					
19.8 Reduction in personnel expenses	<input type="checkbox"/> Yes <input type="checkbox"/> No					

19.9 Reduction in other costs (improved cost competitiveness)	<input type="checkbox"/> Yes <input type="checkbox"/> No					
19.10 Improvement in sales efficiency	<input type="checkbox"/> Yes <input type="checkbox"/> No					
19.11 Improved production efficiency (manufacturing only)	<input type="checkbox"/> Yes <input type="checkbox"/> No					
19.12 Increase in cane volume supply	<input type="checkbox"/> Yes <input type="checkbox"/> No					
19.13 Decrease in raw cane price	<input type="checkbox"/> Yes <input type="checkbox"/> No					
19.14 Increase in sugar content	<input type="checkbox"/> Yes <input type="checkbox"/> No					

20. If you answered that operating profit for the next five years is forecast to “Worsen”, please select the reason(s). (Select all that apply)

Reasons		Levels of importance (If the answer is YES)				
		Not important at all	Somewhat important	Neutral	Important	Very Important
20.1 Decrease in sales due to sluggish exports	<input type="checkbox"/> Yes <input type="checkbox"/> No					
20.2 Decrease in local market sales	<input type="checkbox"/> Yes <input type="checkbox"/> No					
20.3 Decrease in cane volume supply	<input type="checkbox"/> Yes <input type="checkbox"/> No					
20.4 Reduction in sales due to higher prices	<input type="checkbox"/> Yes <input type="checkbox"/> No					
20.5 More government’s restrictions	<input type="checkbox"/> Yes <input type="checkbox"/> No					
20.6 Reduction in sales due to exchange rate fluctuations	<input type="checkbox"/> Yes <input type="checkbox"/> No					
20.7 Increase in procurement costs (manufacturing only)	<input type="checkbox"/> Yes <input type="checkbox"/> No					
20.8 Lack of progress in building sales network	<input type="checkbox"/> Yes <input type="checkbox"/> No					
20.9 Increase in personnel expenses	<input type="checkbox"/> Yes <input type="checkbox"/> No					

20.10 Higher interest rates	<input type="checkbox"/> Yes <input type="checkbox"/> No					
20.11 Insufficient price increase	<input type="checkbox"/> Yes <input type="checkbox"/> No					
20.12 Increase in fuel costs and utilities	<input type="checkbox"/> Yes <input type="checkbox"/> No					
20.13 Less government's intervention	<input type="checkbox"/> Yes <input type="checkbox"/> No					
20.14 Decrease in cane volume supply	<input type="checkbox"/> Yes <input type="checkbox"/> No					
20.15 Decrease in raw cane price	<input type="checkbox"/> Yes <input type="checkbox"/> No					
20.16 Decrease in sugar content	<input type="checkbox"/> Yes <input type="checkbox"/> No					

21. What actions will your company take in the next five years if this scenario is implemented

Actions	Definitel y no	No	Neither yes nor no	Yes	Defini tely yes
21.1 Cancellation or postponement of new investment / facility investment					
21.2 Downsizing of existing business					
21.3 Closure / withdrawal of business base (including part of a business base)					
21.4 Reduce staffing level					
21.5 Reduction in days/hours for manufacturing and operations					
21.6 Expanding of existing business					
21.7 Increase sales price					
21.8 Try to increase sugar production efficiency					
21.9 Reduce sales price					
21.10 Change suppliers					
21.11 Change delivering system					
21.12 Launch new business					
21.13 Reduction in costs through improve efficiency of production and sales					
21.14 Expand the range of value-added products					
21.15 Expand other non-sugar related business					
21.16 Expand the range of low-price products					
21.17 Borrowing more funds from commercial sources or non-government loan providers					
21.18 Borrowing more funds from the BAAC					
21.19 Purchasing cane from further areas/distances					

21.20 Focusing more on the opportunities from other sugar-related businesses					
21.21 Expanding our own cane farming to compensate the loss from local farmers					
21.22 Purchasing more machines and instruments to reduce production cost					
21.23 Investing more on research and development within my organization					
21.24 Investing more on research and development from outside my organization (private or academic research institution)					
21.25 Investing more money on encouraging my contracting-farmers to improve their cane quality					
21.26 Investing in advanced technology to increase sugar productivity and efficiency (e.g. be able to convert higher sugar from a ton of cane)					
21.27 Improving cane in-bound logistics management					

Government Proposal Plan Scenario (Central Region)

The aim of this government proposal plan is to remain some protection as well as remaining market being regulated to make sure that regulations are not discriminatory between stakeholders where the regime still be fair for all stakeholders to provide level of playing field and room among all producers so most producers are able to remain in their business.

The ‘Government Proposal Plan’ scenario is designed according to the government restructuring plan on entire system of Thai cane and sugar industry. The government’s goal is to find the industry’s new equilibrium that will still encourage cane farmers to remain in cane farming. The plan consists of 5 major guidelines. These include

1. The restructuring of Thai Cane and Sugar Acts of 1984 and other related legislations and regulations to allow the use of cane to produce ethanol include

- Ending quota system in part of sugar sold domestically. All sugar millers must stock ‘Sugar Reserve’ equal to one-month domestic consumption amount according to the ‘Buffer Stock Quantity’ set by the government to ensure the sufficient amount for domestic consumption
- Abolition in fixing sugar price allowing the sugar price flows according to market mechanism
- Ending 160 bath/metric ton direct payment being supported to cane farmers
- Encouraging the use of cane for bio-industry in increase value added to cane and sugar industry
- Ending cheap loans and low interest credits provided by the state and monetary supports

- Ending support from section 56 related to ‘preliminary’ and ‘final’ cane price payments only a part where the final price is below preliminary price which the difference will be deducted from next production-year preliminary price

2. Increasing cane and sugar productivity includes

- Reducing burnt cane volume in order to reduce environmental impacts and increase cane quality by inducing the regulation that deduct 30 bath per metric ton of burnt cane from farmers while compensating at the maximum of 120 baht per metric ton of cane to farmers to deliver fresh cane.
- Encouraging farmers to use agricultural machineries in cane plantation to reduce production costs and increase productivity.

3. Costs and production standard determination of cane and sugar

The goal is to be able to determinate sugar production standard of sugar mills. The regulation appoints that a metric ton of cane must be able to convert to sugar no less than 90 kilograms.

4. Stabilizing the Cane and Sugar Fund (CSF)

The goal is to reduce the issue in terms of interest rate costs where the state will help the CSF obtain and access to the lowest interest rate from commercial banks to help farmers access to purchasing machineries and improve irrigation system.

5. Establishing cane, sugar and downstream industry’s research and development institutions

The goal is to encourage bio economy and non-food industry to increase the value of cane as well as establishing Thailand Sugarcane Breeding Center (TSBC) to develop far better cane breeding to arrive at the new breeding that are suitable for cultivating in each region.

The policies under this scenario include

(Could you please indicate the level of impact on your sugar business of each of the elements within the Government Proposal Plan policy outlines below)

Policy Instrument	High negative impact	Little negative impact	No impact	Little positive impact	High positive impact
22.1 Ending quota system in part of sugar sold domestically. All sugar millers must stock ‘Sugar Reserve’ equal to one-month domestic consumption amount according to the ‘Buffer Stock Quantity’ set by the government to ensure the sufficient amount for domestic consumption					
22.2 Temporary deregulation of wholesale domestic sugar price controls and sugar sales administration which resulted in domestic wholesale price decline (to 15-17 baht/kg). Despite a drop in domestic sugar price, the domestic sugar wholesale price is still higher than the world price due to a decrease in					

<p>world sugar prices. In spite of deregulation of wholesale sugar price, sugar is still listed on List of Controlled Goods and Services. Therefore, the retail ceiling price of sugar sold domestically remains almost unchanged at 23.5 baht/kg (domestic sugar price is floated but the price ceiling is set to prevent millers from selling sugar above the ceiling price in domestic market).</p>					
<p>22.3 Eliminating the special 5 baht/kg tax on domestic sugar sales and is functionally replaced with <u>domestic sugar premium (the difference between domestic price and export price)</u> which has been introduced on domestic sugar which will be collected from sugar mills to the CSF which is used to help subsidize cane farmers when market price is lower than intervention prices. The difference of this new system from the old system is that the collected rate will not be guaranteed at fixed rate of 5 baht/kg of sugar which were cross-subsidized on domestic consumers' burden.</p>					
<p>22.4 Floating domestic sugar prices</p>					
<p>22.5 Sugar millers must collect the amount of money from the difference between domestic price and export price referenced by The Thailand Cane and Sugar Corporation (TCSC The Thailand Cane and Sugar Corporation (TCSC) to The CSF as the system's revenue. However, in this system, the collected rate will not be fixed at 5 baht/kg like in the past). In this case, sugar mill will benefit when the millers' export prices are higher than the referenced export price.</p>					
<p>22.6 Remaining the preliminary and final cane price system. But, <u>ending support from section 56 related to 'preliminary' and 'final' cane price payments only a part where the final price is below preliminary price which the difference will be deducted from next production-year preliminary price</u></p>					
<p>22.7 Maintaining cane price support program under the Cane and Sugar Act of 1984 where the</p>					

minimum price of cane was set at 700 baht per metric ton in 2019. However, this minimum price is lower than the past.					
22.8 Providing a <u>production cost subsidy</u> of 50 baht per metric ton of cane (a maximum of 5,000 metric tons per farmer) and 53 baht per metric ton <u>direct payments from the state-run Cane and Sugar Fund</u>					
22.9 Remaining the 70:30 revenue-sharing system (from sugar and molasses). Farmers do not receive additional payment from the sales of other products that sugar millers have invested.					
22.10 Ending low interest rate authorized by the state. However, the government will help the CSF obtain and access to the lowest interest rate from commercial banks to help millers and farmers					
22.11 Remaining import restrictions based on the matters allowed under agreement Thailand signed for such as import quota restriction. Sugar imports from ASEAN countries enter Thailand duty free under the AEC and do not count towards the import TRQ. Thailand's sugar TRQ is set at 13,760 metric tons with an in-quota tariff of 65 percent and an out-off-quota tariff of 94 percent (However, sugar imports are expected to remain marginal due to excess domestic sugar supplies)					
22.12 Remaining the licensed restriction on sugar mill expansion and new comers.					
22.13 The industry's restructuring on registration allowing the use of cane to produce ethanol will increase demand for molasses to produce ethanol which will result in higher molasses price and higher cane price alongside.					
22.14 Providing additional direct payment to cane farmers who delivered 'unburnt' cane while deducting certain amount of money from those who deliver 'burnt' cane through payments under environmental programs					

Changes by estimated percentage under Government Proposal Plan policy scenario

Central Region	Total (all sizes)	Farm size scale		
		Small (< 10 ha)	Medium (10-80 ha)	Large (>80 ha)
% loss in cane production area	16.80%	32.74%	18.96%	11.36%
% loss in cane production area as a share of the total area lost		5.17%	72.38%	22.44%
% loss in cane production volume	20.04%	32.96%	22.24%	14.37%
% loss in cane production volume as a share of the total volume lost		5.04%	71.87%	23.09%
% of farmers intend to 'QUIT' cane farming	19.64%	31.25%	14.71%	16.67%
% of farmers intend to 'QUIT' cane farming as a share of the total farmers quit		45.45%	45.45%	0.09%

Central Region	
% of cane area that is likely to be convert to alternative crops (national)	13.17%
% cane area I likely to be convert to alternative crops (this region)	9.64%
% change in import volume	1.30%
% change in export volume	-5.50%
Estimated cane price	725 baht/ metric ton
% change in domestic sugar price	21 baht/kg (-8.5%)

SECTION 3: GENERAL ATTITUDE TOWARD GOVERNMENT PROPOSAL PLAN REGIME

23. How satisfied are you with the impact from ‘Government Proposal Plan’ regime?

- Very dissatisfied Dissatisfied Neither dissatisfied nor satisfied
 Satisfied Very Satisfied

24. How likely is it that the impact from ‘Government Proposal Plan’ regime will negatively affect your sugar business?

- Very unlikely Unlikely Neither unlikely nor likely
 Likely Very likely

25. What impact do you believe that ‘Government Proposal Plan’ regime will have on your sugar business?

- Strong negative impact Moderate positive impact
 Moderate negative impact Strong positive impact
 Neither positive nor negative impact

26. How likely is it you would survive under ‘Government Proposal Plan’ regime?

- Very unlikely Unlikely Neither unlikely nor likely
 Likely Very likely

27. If the ‘Government Proposal Plan’ regime is implemented,?

- I will still not be able to survive under this policy regime
 I will still run my business but at the break-even level
 I will still run my business with little profit
 My business will not be much impacted in terms of profit.

28. If ‘Government Proposal Plan’ regime is implemented, what would you do with your sugar business?

- I would continue my sugar business just as I do today

- I would leave sugar business
- I would downsize my sugar production volume by..... percent (please specify)
- I would expand my sugar production volume by..... percent (please specify)

29. If the ‘Government Proposal Plan’ regime is imposed and you are going to continue your business, what are the company’s response plans and strategies? Please explain(If you are ‘Not’ going to continue sugar mill business, please skip this question)

.....

30. If there is a chance for you the leave the business, what are the reasons? Please explain
 (If you are going to continue sugar mill business, please skip this question)

.....

31. Please answer each question below by circling the number on the scale from 1 to 5 that best describes your opinion

(Some of these questions may appears to be similar but they address different issues).

In my opinion:

Under ‘**Government Proposal Plan**’ policy scenario, my continuing with sugar business for the next five years would be ;

31.1 Bad: 1: 2: 3: 4: 5: **Good**

31.2 Invaluable: 1: 2: 3: 4: 5: **Valuable**

31.3 Harmful: 1: 2: 3: 4: 5: **Beneficial**

32. How likely is it that you would expand the investment on ethanol production if the industry’s restructuring plan allow and encourage the use of cane to produce ethanol?

- Very unlikely Unlikely Neither unlikely nor likely
- Likely Very likely

33. How likely is it that you would be able to complete with the rivals in sugar mill business under this scenario?

- Very unlikely Unlikely Neither unlikely nor likely
- Likely Very likely

34. How likely is it that you would be able to gain greater domestic market share if this scenario is implemented?

- Very unlikely Unlikely Neither unlikely nor likely

Likely Very likely

35. If the ‘Government Proposal Plan’ policy is implemented next year, my operation profit for the next five year is expected to be in

Surplus Balance Deficit

36. If this scenario is imposed, compared to 2017-2018, operating profit for the five years is expected to

Improve Show no change Worsen

(Go to Q.37)

(Go to Q.38)

37. If you answered that operating profit for the next five years is forecast to “Improve” , please select the reason(s). (Select all that apply)

Reasons		Levels of importance (If the answer is YES)				
		Not important at all	Somewhat important	Neutral	Important	Very Important
37.1 Increase in sales due to export expansion	<input type="checkbox"/> Yes <input type="checkbox"/> No					
37.2 Increase in local market sales	<input type="checkbox"/> Yes <input type="checkbox"/> No					
37.3 Increase in sale due to higher prices	<input type="checkbox"/> Yes <input type="checkbox"/> No					
37.4 Increase in sales due to development of new products	<input type="checkbox"/> Yes <input type="checkbox"/> No					
37.5 Increase in sale due to exchange rate fluctuations	<input type="checkbox"/> Yes <input type="checkbox"/> No					
37.6 Increased sales of higher-value products	<input type="checkbox"/> Yes <input type="checkbox"/> No					
37.7 Reduction in procurement costs (manufacturing only)	<input type="checkbox"/> Yes <input type="checkbox"/> No					
37.8 Reduction in personnel expenses	<input type="checkbox"/> Yes <input type="checkbox"/> No					
37.9 Reduction in other costs (improved cost competitiveness)	<input type="checkbox"/> Yes <input type="checkbox"/> No					
37.10 Improvement in sales efficiency	<input type="checkbox"/> Yes <input type="checkbox"/> No					
37.11 Improved production efficiency (manufacturing only)	<input type="checkbox"/> Yes <input type="checkbox"/> No					
37.12 Increase in cane volume supply	<input type="checkbox"/> Yes <input type="checkbox"/> No					
37.13 Decrease in raw cane price	<input type="checkbox"/> Yes <input type="checkbox"/> No					
37.14 Increase in sugar content	<input type="checkbox"/> Yes <input type="checkbox"/> No					

38. If you answered that operating profit for the next five years is forecast to “Worsen” , please select the reason(s). (Select all that apply)

Reasons		Levels of importance (If the answer is YES)				
		Not important at all	Somewhat important	Neutral	Important	Very Important
38.1 Decrease in sales due to sluggish exports	<input type="checkbox"/> Yes <input type="checkbox"/> No					
38.2 Decrease in local market sales	<input type="checkbox"/> Yes <input type="checkbox"/> No					
38.3 Decrease in cane volume supply	<input type="checkbox"/> Yes <input type="checkbox"/> No					
38.4 Reduction in sales due to higher prices	<input type="checkbox"/> Yes <input type="checkbox"/> No					
38.5 More government’s restrictions	<input type="checkbox"/> Yes <input type="checkbox"/> No					
38.6 Reduction in sales due to exchange rate fluctuations	<input type="checkbox"/> Yes <input type="checkbox"/> No					
38.7 Lack of progress in building sales network	<input type="checkbox"/> Yes <input type="checkbox"/> No					
38.8 Increase in personnel expenses	<input type="checkbox"/> Yes <input type="checkbox"/> No					
38.9 Higher interest rates	<input type="checkbox"/> Yes <input type="checkbox"/> No					
38.10 Insufficient price increase	<input type="checkbox"/> Yes <input type="checkbox"/> No					
38.11 Increase in fuel costs and utilities	<input type="checkbox"/> Yes <input type="checkbox"/> No					
38.12 Less government’s intervention	<input type="checkbox"/> Yes <input type="checkbox"/> No					
38.13 Decrease in cane volume supply	<input type="checkbox"/> Yes <input type="checkbox"/> No					
38.14 Decrease in raw cane price	<input type="checkbox"/> Yes <input type="checkbox"/> No					
38.15 Decrease in sugar content	<input type="checkbox"/> Yes <input type="checkbox"/> No					

39. What actions will your company take in the next five years if this scenario is implemented

Actions	Definitely no	No	Neither yes nor no	Yes	Definitely yes
39.1 Cancellation or postponement of new investment / facility investment					

39.2 Downsizing of existing business					
39.3 Closure / withdrawal of business base (including part of a business base)					
39.4 Reduce staffing level					
39.5 Reduction in days/hours for manufacturing and operations					
39.6 Expanding of existing business					
39.7 Increase sales price					
39.8 Try to increase sugar production efficiency					
39.9 Reduce sales price					
30.10 Change suppliers					
39.11 Change delivering system					
39.12 Launch new business					
39.13 Reduction in costs through improve efficiency of production and sales					
39.14 Expand the range of value-added products					
39.15 Expand other non-sugar related business					
39.16 Expand the range of low-price products					
39.17 Borrowing more funds from commercial sources or non-government loan providers					
39.18 Borrowing more funds from the BAAC					
39.19 Purchasing cane from further areas/distances					
39.20 Focusing more on the opportunities from other sugar-related businesses					
39.21 Expanding our own cane farming to compensate the loss from local farmers					
39.22 Purchasing more machines and instruments to reduce production cost					
39.23 Investing more on research and development within my organization					
39.24 Investing more on research and development from outside my organization (private or academic research institution)					
39.25 Investing more money on encouraging my contracting-farmers to improve their cane quality					
39.26 Investing in advanced technology to increase sugar productivity and efficiency (e.g. be able to convert higher sugar from a ton of cane)					
39.27 Improving cane in-bound logistics management					

Protectionism Scenario (Central Region)

The major goal of this scenario is to help all cane farmers remain in sugar farming as much as possible and avoiding the shift to other crop production. Implementing this policy regime will allow ‘a soft landing’ for removal of supports so as to allow further times for cane farmers and sugar millers to become efficient to compete on the free market and help prolonging the protection of the least efficient sugar producers as well as still preventing free market competition between sugar millers.

The policies under this scenario include

(Could you please indicate the level of impact on your sugar business of each of the elements within the Government Proposal Plan policy outlines below)

Policy Instrument	High negative impact	Little negative impact	No impact	Little positive impact	High positive impact
40.1 Ending quota system in part of sugar sold domestically. All sugar millers must stock ‘Sugar Reserve’ equal to one-month domestic consumption amount according to the ‘Buffer Stock Quantity’ set by the government to ensure the sufficient amount for domestic consumption					
40.2 Temporary deregulation of wholesale domestic sugar price controls and sugar sales administration which resulted in domestic wholesale price decline (to 15-17 baht/kg). Despite a drop in domestic sugar price, the domestic sugar wholesale price is still higher than the world price due to a decrease in world sugar prices. In spite of deregulation of wholesale sugar price, sugar is still listed on List of Controlled Goods and Services. Therefore, the retail ceiling price of sugar sold domestically remains almost unchanged at 23.5 baht/kg (domestic sugar price is floated but the price ceiling is set to prevent millers from selling sugar above the ceiling price in domestic market). Ending a fix on domestic sugar price while setting a retail ceiling price is aimed to protect domestic consumers from collecting cross-subsidized money collected from domestic consumers as well as to protect their rights from millers selling over price.					

<p>40.3 Eliminating the special 5 baht/kg tax on domestic sugar sales and is functionally replaced with <u>domestic sugar premium (the difference between domestic price and export price)</u> which has been introduced on domestic sugar which will be collected from sugar mills to the CSF which is used to help subsidize cane farmers when market price is lower than intervention prices. The difference of this new system from the old system is that the collected rate will not be guaranteed at fixed rate of 5 baht/kg of sugar which were cross-subsidized on domestic consumers' burden.</p>					
<p>40.4 Floating domestic sugar prices</p>					
<p>40.5 Sugar millers must collect the amount of money from the difference between domestic price and export price referenced by The Thailand Cane and Sugar Corporation (TCSC) to The CSF as the system's revenue. However, in this system, the collected rate will not be fixed at 5 baht/kg like in the past). In this case, sugar mill will benefit when the millers' export prices are higher than the referenced export price.</p>					
<p>40.6 Remaining the preliminary and final cane price system. But, <u>ending support from section 56 related to 'preliminary' and 'final' cane price payments only a part where the final price is below preliminary price which the difference will be deducted from next production-year preliminary price</u></p>					
<p>40.7 Ending '<u>maintaining cane price support program</u>' under the Cane and Sugar Act of 1984. Therefore, government <u>will not</u> provide a production costs subsidy. However, the minimum cane prices will be set around 800-850 baht/metric ton which is higher than the minimum cane price in 'Government Proposal Plan' scenario. <u>Direct payments support to cane farmers will only come from The CSF</u> only if it is necessary.</p>					

<p>40.8 Cane farmers and sugar millers are considered as being <u>‘Partnership’</u> where both parties are sharing profits and undertaking risks together based on the partnership concept. Revenue from other value-added products produced from parts of cane (bagasse and filter cakes etc.) besides molasses will be spitted to cane farmers and will be put into the revenue-sharing system. Therefore, however, <u>the 70:30 proportions of revenue-sharing system will be adjusted</u> where farmers will receive the lower revenue proportion due to the higher investment costs of sugar millers. However, farmers will still benefit from new products produced from bagasse and filter cake in terms of higher cane price.</p>					
<p>40.9 Farmers who intend to quit cane farming will be compensated and paid under <u>the structural adjustment programs</u> such as retirement which is allowed in the Green Box by WTO</p>					
<p>40.10 Ending cheap loans and low interest credits provided by the government. However, the government will help the CSF obtain and access to the lowest interest rate from commercial banks rather than receiving from the state to help millers and farmers</p>					
<p><u>40.11 Liberalizing sugar imports from other countries while remaining import restrictions based on the matters allowed under agreement Thailand signed for such as import quota restriction.</u> Sugar imports from ASEAN countries enter Thailand duty free under the AEC and do not count towards the import TRQ. Thailand’s sugar TRQ is set at 13,760 metric tons with an in-quota tariff of 65 percent and an out-off-quota tariff of 94 percent (However, sugar imports are expected to remain marginal due to excess domestic sugar supplies)</p>					
<p>40.12 Remaining the licensed restriction on sugar mill expansion and new comers to avoid investors locating new factories where is not appropriated.</p>					

40.13 The industry’s restructuring on registration allowing the use of cane to produce ethanol will increase demand for molasses to produce ethanol which will result in higher molasses price and higher cane price alongside.					
40.14 Additional direct payment to cane farmers who delivered “unburnt” cane through payments under environmental programs which will benefit sugar millers in terms of better cane quality and reduce the loss of sweetness in cane during transportation. This incentive will encourage farmers to improve their productivity					
40.15 Without direct payments supported by the state, government is able to increase the budget for indirect supports such as promoting research, training, and development and ‘decoupled’ income supports etc. The most essential parts needed much more focus are developments or irrigation system, in-bound logistics transportation, and new cane breeding etc.					
40.16 The Cane and Sugar Fund (CSF) will not be seen as ‘state-run’ organization					
40.17 Allowing the use of ‘cane syrup’ to produce other products rather than just ‘sugar’. Revenue from these products will be excluded from revenue-sharing system. Cane price for these products will be sold outright unconditionally. If this policy can be implemented, it will be resulted in production increase of new products. Having new products will also resulted in higher demand for raw material which is cane and will resulted in higher cane price.					
40.18 The industry’s restructuring on registration allowing the use of cane to produce ethanol will increase demand for molasses to produce ethanol which will result in higher molasses price and higher cane price alongside.					

Changes by estimated percentage under Protectionism policy scenario

Central Region	Farm size scale
----------------	-----------------

	Total (all sizes)	Small (< 10 ha)	Mediu m (10- 80 ha)	Large (>80 ha)
% loss in cane production area	11.24%	18.75 %	13.87%	0.00%
% loss in cane production area as a share of the total area lost		5.43%	94.57%	0.00%
% loss in cane production volume	9.80%	16.23 %	12.07%	0.00%
% loss in cane production volume as a share of the total volume lost		5.25%	94.25%	0.00%
% of farmers intend to 'QUIT' cane farming	16.98%	22.00 %	17.07%	0.00%
% of farmers intend to 'QUIT' cane farming as a share of the total farmers quit		22.22 %	77.78%	0.00%

Central Region

% of cane area that is likely to be convert to alternative crops (national)	16.91%
% cane area I likely to be convert to alternative crops(this region)	9.70%
% change in import volume	0.76%
% change in export volume	2.50%
Estimated cane price	850 baht/ metric ton
% change in domestic sugar price	22 baht/kg (-5%)

SECTION 4: GENERAL ATTITUDE TOWARD PROTECTIONISM REGIME

41.How satisfied are you with the impact from ‘Protectionism’ regime?

- Very dissatisfied Dissatisfied Neither dissatisfied nor satisfied
 Satisfied Very Satisfied

42.How likely is it that the impact from ‘Protectionism’ regime will negatively affect your sugar business?

- Very unlikely Unlikely Neither unlikely nor likely
 Likely Very likely

43.What impact do you believe that ‘Protectionism’ regime will have on your sugar business?

- Strong negative impact Moderate negative impact Neither positive nor negative impact
 Moderate positive impact Strong positive impact

44. How likely is it you would survive under ‘Protectionism’ regime?

- Very unlikely Unlikely Neither unlikely nor likely
 Likely Very likely

45. If the ‘Protectionism’ regime is implemented,?

- I will still not be able to survive under this policy regime
 I will still run my business but at the break-even level
 I will still run my business with little profit
 My business will not be much impacted in terms of profit

46. If ‘Protectionism’ regime is implemented, what would you do with your sugar business?

- I would continue my sugar business just as I do today
 I would leave sugar business
 I would downsize my sugar production volume by percent (Please specify)
 I would expand my sugar production volume by percent (Please specify)

47. If the ‘Protectionism’ regime is imposed and you are going to continue your business, what are the company’s response plans and strategies? Please explain (If you are ‘Not’ going to continue sugar mill business, please skip this question)

.....
.....

48. If there is a chance for you to leave the business, what are the reasons? Please explain

(If you are going to continue sugar mill business, please skip this question)

.....
.....

49. Please answer each question below by circling the number on the scale from 1 to 5 that best describes your opinion

(Some of these questions may appear to be similar but they address different issues).

In my opinion:

Under ‘Protectionism’ policy scenario, my continuing with sugar business for the next five years would be ;

49.1 Bad: 1: 2: 3: 4: 5: **Good**

49.2 Invaluable: 1: 2: 3: 4: 5: **Valuable**

49.3 Harmful: 1: 2: 3: 4: 5: **Beneficial**

50. If cane and cane-syrup are allowed to be used to produce other product under ‘Libertarian’ regime based on the given condition provided from the information page, would you expand to other cane-related business?

Definitely no No Neither yes nor no Yes Definitely yes

51. If the answer is” Yes” or “Definitely Yes”, what are other cane-related business you would consider expanding? (Please specify)

- 1).....
 2).....
 3).....
 4).....
 5).....

52. How likely is it that you would be able to complete with the rivals in sugar mill business under this scenario?

Very unlikely Unlikely Neither unlikely nor likely
 Likely Very likely

53. How likely is it that you would be able to gain greater domestic market share if this scenario is implemented?

Very unlikely Unlikely Neither unlikely nor likely
 Likely Very likely

54. If the ‘Protectionism ‘policy is implemented next year, my operation profit for the next five year is expected to be in

Surplus Balance Deficit

55. If this scenario is imposed, compared to 2017-2018, operating profit for the five years is expected to

Improve Show no change Worsen

(Go to Q.56)

(Go to Q.57)

56. If you answered that operating profit for the next five years is forecast to “Improve” , please select the reason(s). (Select all that apply)

Reasons		Levels of importance (If the answer is YES)				
		Not important at all	Somewhat important	Neutral	Important	Very Important
56.1 Increase in sales due to export expansion	<input type="checkbox"/> Yes <input type="checkbox"/> No					
56.2 Increase in local market sales	<input type="checkbox"/> Yes <input type="checkbox"/> No					
56.3 Increase in sale due to higher prices	<input type="checkbox"/> Yes <input type="checkbox"/> No					
56.4 Increase in sales due to development of new products	<input type="checkbox"/> Yes <input type="checkbox"/> No					

56.5 Increase in sale due to exchange rate fluctuations	<input type="checkbox"/> Yes <input type="checkbox"/> No					
56.6 Increased sales of higher-value products	<input type="checkbox"/> Yes <input type="checkbox"/> No					
56.7 Reduction in procurement costs (manufacturing only)	<input type="checkbox"/> Yes <input type="checkbox"/> No					
56.8 Reduction in personnel expenses	<input type="checkbox"/> Yes <input type="checkbox"/> No					
56.9 Reduction in other costs (improved cost competitiveness)	<input type="checkbox"/> Yes <input type="checkbox"/> No					
56.10 Improvement in sales efficiency	<input type="checkbox"/> Yes <input type="checkbox"/> No					
56.11 Improved production efficiency (manufacturing only)	<input type="checkbox"/> Yes <input type="checkbox"/> No					
56.12 Increase in cane volume supply	<input type="checkbox"/> Yes <input type="checkbox"/> No					
56.13 Decrease in raw cane price	<input type="checkbox"/> Yes <input type="checkbox"/> No					
56.14 Increase in sugar content	<input type="checkbox"/> Yes <input type="checkbox"/> No					

57. If you answered that operating profit for the next five years is forecast to “Worsen” , please select the reason(s). (Select all that apply)

Reasons		Levels of importance (If the answer is YES)				
		Not important at all	Somewhat important	Neutral	Important	Very Important
57.1 Decrease in sales due to sluggish exports	<input type="checkbox"/> Yes <input type="checkbox"/> No					
57.2 Decrease in local market sales	<input type="checkbox"/> Yes <input type="checkbox"/> No					
57.3 Decrease in cane volume supply	<input type="checkbox"/> Yes <input type="checkbox"/> No					
57.4 Reduction in sales due to higher prices	<input type="checkbox"/> Yes <input type="checkbox"/> No					
57.5 More government’s restrictions	<input type="checkbox"/> Yes <input type="checkbox"/> No					
57.6 Reduction in sales due to exchange rate fluctuations	<input type="checkbox"/> Yes <input type="checkbox"/> No					
57.7 Increase in procurement costs (manufacturing only)	<input type="checkbox"/> Yes <input type="checkbox"/> No					
57.8 Lack of progress in building sales network	<input type="checkbox"/> Yes <input type="checkbox"/> No					
57.9 Increase in personnel expenses	<input type="checkbox"/> Yes <input type="checkbox"/> No					
57.10 Higher interest rates	<input type="checkbox"/> Yes <input type="checkbox"/> No					

57.11 Insufficient price increase	<input type="checkbox"/> Yes <input type="checkbox"/> No					
57.12 Increase in fuel costs and utilities	<input type="checkbox"/> Yes <input type="checkbox"/> No					
57.13 Less government's intervention	<input type="checkbox"/> Yes <input type="checkbox"/> No					
57.14 Decrease in cane volume supply	<input type="checkbox"/> Yes <input type="checkbox"/> No					
57.15 Decrease in raw cane price	<input type="checkbox"/> Yes <input type="checkbox"/> No					
57.16 Decrease in sugar content	<input type="checkbox"/> Yes <input type="checkbox"/> No					

58. What actions will your company take in the next five years if this scenario is implemented

Actions	Definitely no	No	Neither yes nor no	Yes	Definitely yes
58.1 Cancellation or postponement of new investment / facility investment					
58.2 Downsizing of existing business					
58.3 Closure / withdrawal of business base (including part of a business base)					
58.4 Reduce staffing level					
58.5 Reduction in days/hours for manufacturing and operations					
58.6 Expanding of existing business					
58.7 Increase sales price					
58.8 Try to increase sugar production efficiency					
58.9 Reduce sales price					
58.10 Change suppliers					
58.11 Change delivering system					
58.12 Launch new business					
58.13 Reduction in costs through improve efficiency of production and sales					
58.14 Expand the range of value-added products					
58.15 Expand other non-sugar related business					
58.16 Expand the range of low-price products					
58.17 Borrowing more funds from commercial sources or non-government loan providers					
58.18 Borrowing more funds from the BAAC					
58.19 Purchasing cane from further areas/distances					

58.20 Focusing more on the opportunities from other sugar-related businesses					
58.21 Expanding our own cane farming to compensate the loss from local farmers					
58.22 Purchasing more machines and instruments to reduce production cost					
58.23 Investing more on research and development within my organization					
58.24 Investing more on research and development from outside my organization (private or academic research institution)					
58.25 Investing more money on encouraging my contracting-farmers to improve their cane quality					
58.26 Investing in advanced technology to increase sugar productivity and efficiency (e.g. be able to convert higher sugar from a ton of cane)					
58.27 Improving cane in-bound logistics management					

Section 5 Opinions toward best policy option

59. For the your business to be prospered, what type of the policy is the best option for you in terms of Quota system?

- Retaining Quota A volume as sugar reserve volume for domestic consumption in order to prevent sugar shortage in domestic market while floating domestic sugar price. Each mill is allocated sugar volume they must sell domestically. In terms of import, remaining import restrictions to the point are allowed under WTO requirements
- Retaining Quota A volume as sugar reserve volume for domestic consumption in order to prevent sugar shortage in domestic market while floating domestic sugar price and liberalizing import. However, each mill is not allocated sugar volume they must sell domestically i.e. every mill has the right to sell sugar in domestic market at any volume they want until the Quota volume is reached.
- Completely ending quota system means that every mill has the rights to sell sugar domestically and internationally at any point they want while the domestic sugar price is floated, and all import restrictions are abolished

60. For your business to be prospered, what type of the policy is the best option for you in term of revenue-sharing system if cane syrup is allowed to produce other new products rather than just sugar?

- Taking all cane-related products into account and re-adjusting the revenue proportion based on the price of main product produced from cane (decrease farmers' proportion). In this case, farmers and millers are still considered as being in partnership

Retain the status quo for the remaining 70:30 revenue-sharing proportion for the MAIN PRODUCTS , i.e. raw sugar, white sugar and molasses. For the cane that is used to produce other products such as ethanol, biochemicals will be sold in the open market

Cane will be completely sold-outright for all products without the revenue-sharing arrangement. However, every mill must accept one condition, which is that you are required to purchase cane from farmers who want to sell to your factory from areas close to the factory within the nominal radius (or in case that your factory is the closest to particular farmers)

Others (Please explain)

.....

61. To what extent do you agree with a following statements?

Statements	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
61.1 The more liberalization, the harder my business to be prospered					
61.2 I believe that protectionist policies are essential to our industry in the next five years					
61.3 The government should retain protectionist policies in the short run, while also encouraging libertarian policies for long-run sustainability					
61.4 Immediately implementing libertarian policy regime is best suited for our industry					
61.5 Only the large-scale sugar refiners survive if the libertarian policy regime is immediately implemented					
61.6 Allowing the use of cane to produce other product will help solving farmer leaving cane farming issue					
61.7 Despite a decrease in sugar revenue due to the lower price, allowing the sugar mill to use cane to produce something else will keep the industry survive					
61.8 The continued existence of the CSF is very essential					

69. In your opinion, how shall sugar cane sustainability be supported at cane growing level?

Farmer engagement and training Farmers’ price premium

Mechanization and Technology Supply chain transformation

70. In your opinion, how shall sustainability be supported at sugar refiner level?

- Government policies Traders' policies Traders' incentives Technology
- Farmers' engagement Valorization of by-products such as ethanol, biomass, electricity generation, pulp, fertilizer, particle board etc.

71. In your opinion, how shall sustainability be supported at trade production level?

- Government policies Buyer' sustainable purchasing policies
- Financial incentives Regional market liberalization
- Technology Farmers' engagement
- Traders commitment to sustainability

72. For the survival and sustainability of Thai cane and sugar industry as a whole, I agree that

- Ending support policies which will result in the existence of the only efficient farmers and millers remain in the industry is the best way forward. The less efficient farmers and millers who obtain high costs and do not obtain enough resources and skills should be encouraged to leave cane and sugar industry
- All cane farmers and sugar millers should always be encouraged to remain in business
- Some support policies should be maintained during the period of transition to more libertarian policies

73. Which policy scenario do you think would be the best option for your business?

- Baseline Scenario Protectionism Scenario Libertarian Scenario

Please, explain the reasons

.....
.....

74. Do you have any suggestions regarding the types of preferable policies you would like the government to consider for the benefits of your business and the industry? Please explain

Appendix D: Cane and sugar productions, prices, sales, and distribution

Cane Production					Cane prices			Sugar production		
Crop year (A.D.)	Crop year (B.E.)	Cultivated Area (Million Rai)	Cane Volume (Million Ton)	Cane Production Volume (MT/Rai)	Cane prices			Extraction Rate (Kg/ MT of cane)	Sugar volume (Million MT)	C.C.S.
					Priliminary cane price (Baht/MT)	Final cane price (Baht/MT)	Difference			
1991/92	34/35	6.06	47.51	7.84	399	480	81.0	100.06	4.26	10.91
1992/93	35/36	6.04	34.71	5.75	420	499	79.3	104.23	3.62	11.60
1993/94	36/37	6.03	37.57	6.23	490	533	43.0	101.75	3.82	11.30
1994/95	37/38	5.64	50.46	8.95	520	570	49.7	104.35	5.27	11.76
1995/96	38/39	6.24	57.69	9.25	500	538	37.6	104.45	6.03	11.84
1996/97	39/40	6.00	56.24	9.37	500	561	60.9	103.47	5.80	11.78
1997/98	40/41	5.74	42.20	7.35	600	703	102.6	97.02	4.09	11.10
1998/99	41/42	5.45	50.06	9.19	500	485	-15.4	103.72	5.19	11.66
1999/20	42/43	5.88	53.13	9.04	450	478	28.3	103.90	5.52	11.70
2000/01	43/44	5.85	48.65	8.32	600	689	88.7	102.41	4.98	11.62
2001/02	44/45	6.04	59.49	9.85	530	520	-9.5	103.85	6.14	11.72
2002/03	45/46	6.65	74.07	11.14	500	534	33.8	98.36	7.30	11.17
2003/04	46/47	7.15	64.48	9.02	465	504	38.9	108.71	6.99	12.09
2004/05	47/48	6.49	47.82	7.37	620	658	37.7	108.22	5.17	12.17
2005/06	48/49	5.90	46.69	7.91	800	847	46.5	103.56	4.84	11.61
2006/07	49/50	6.76	63.80	9.44	800	702	-97.8	105.33	6.72	11.91
2007/08	50/51	6.07	73.31	11.81	600	672	72.4	106.63	7.82	12.09
2008/09	51/52	6.86	66.46	9.69	830	918	87.9	108.13	7.19	12.28
2009/10	52/53	6.89	68.48	9.94	965	1000	34.7	101.17	6.93	11.58
2010/11	53/54	8.46	95.36	11.75	945	1039	94.1	101.33	9.66	11.78
2011/12	54/55	8.94	97.98	10.96	1000	1075	74.5	104.63	10.25	12.04
2012/13	55/56	9.33	100.00	10.72	950	999	49.0	100.28	10.02	11.64
2013/14	56/57	9.84	103.66	10.53	900	958	58.3	108.93	11.29	12.56
2014/15	57/58	10.96	105.96	9.67	900	854	-45.8	106.66	11.30	12.23
2015/16	58/59	10.94	94.05	8.60	808	881	73.5	104.05	9.78	11.95
2016/17	59/60	9.86	92.95	9.53	1050	1084	33.9	107.81	10.02	12.28
2017/18	60/61	9.89	134.93	13.64	880	791	-89.4	108.78	14.68	12.48
2018/19	61/62	11.96	130.93	10.75	700	681	-19.2	111.33	14.58	12.64
2019/20	62/63	10.71	74.89	7.09	750	833	83.2	110.75	8.29	12.68

Year (A.D.)	Year (B.E.)	Sale and distribution of sugar		Sugar prices	
		Exports	Domestic consumption	Average annual world price (Raw sugar NY No.11) (Baht/kg)	Domestic white retail price (Baht/kg)
1991	2534	2.72	1.1	5.06	12.00
1992	2535	3.52	1.17	5.07	12.00
1993	2536	2.27	1.27	5.57	12.00
1994	2537	2.67	1.37	6.69	12.00
1995	2538	3.84	1.52	7.35	12.00
1996	2539	4.5	1.58	6.81	12.00
1997	2540	4.07	1.71	8.28	12.00
1998	2541	2.31	1.70	8.80	12.50
1999	2542	3.23	1.64	5.44	12.50
2000	2543	4.07	1.68	7.47	13.25
2001	2544	3.21	1.81	8.93	13.25
2002	2545	4.01	1.83	7.44	13.25
2003	2546	5.18	1.94	6.85	13.25
2004	2547	4.66	1.85	7.62	13.25
2005	2548	3.02	2.02	10.06	13.25
2006	2549	2.20	2.28	12.94	17.50
2007	2550	3.68	2.29	8.80	17.50
2008	2551	4.88	2.31	10.14	21.50
2009	2552	5.10	2.28	14.10	21.50
2010	2553	4.48	2.46	18.84	21.50
2011	2554	6.68	2.57	19.88	21.50
2012	2555	7.54	2.69	16.41	21.85
2013	2556	6.79	2.76	12.64	21.85
2014	2557	7.57	2.80	11.20	21.85
2015	2558	8.27	2.81	11.13	21.85
2016	2559	6.72	2.92	11.26	21.85
2017	2560	7.20	2.93	11.79	21.85
2018	2561	11.42	2.55	8.68	16.78
2019	2562	10.61	2.58	8.41	15.58
2020	2563	5.91	2.36	8.84	17.25

Source: OCSB (Various dates)

Appendix E: Characteristics and of stakeholders contributing to policy scenario design

ID No.	Interviewee	Informant group	Years of experience in cane and sugar industry
1	The (Former) Secretary-General of the Office of Cane and Sugar Board (OCSB)	Government based policy making staff	More than 30 years
2	The Group Head of Cane Sugar and Related Sugar Development Bureau Division, The OCSB	Government based policy making staff	12 years
3	The Director of the Division of Strategy and Planning, Department of Industry, The OCSB	Government based policy making staff	More than 30 years
4	The Director Cane and Sugar Promotion Center Region 1	Government based policy making staff	27 years
5	The Director of Thai Sugar Millers Corporation Limited (TSMC)	Non-governmental agency	15 years
6	The Director Cane Sugar and Related Sugar Development Bureau, The OCSB	Government based policy making staff	More than 25 years
7	Associate Professor, Faculty of Agriculture, Kasetsart University / The OCSB Senior Expert	Academics (University staff)	More than 30 years
8	The Deputy Permanent Secretary of Ministry of Industry	Government based policy making staff	15 years
9	Agricultural Extensionist, Department of Agricultural Extension	Government based staff (Regional-level)	8 years
10	Assistant Professor, Deputy head of Department of Farm Mechanics, Faculty of Agriculture, Kasetsart University	Academics (University staff)	20 years
11	Associate Professor, Faculty of Agriculture, Kasetsart University	Academics (University staff)	20 years
12	Deputy Secretary – General (The OCSB)	Government based policy making staff	25 years
13	Committee of the OCSB board (Miller representative)	Non-governmental agency	17 years
14	Director Bureau of Central Administrator	Government based policy making staff	More than 30 years
15	The Director of the Thai and Sugar Fund (CSF)	Non-governmental agency	More than 30 years
16	Subject Matter Specialist, the Department of Agriculture Extension	Government based staff (Regional-level)	20-25 years
17	Deputy Secretary – General (The OCSB)	Government based policy making staff	30 years
18	General Manager of Thai Cane and Sugar Co.,Ltd (TCSC)	Non-governmental agency	20 years
19	Subject Matter Specialist, the Department of Agriculture Extension	Government based staff (Regional-level)	More than 30 years
20	Subject Matter Specialist, the Department of Agriculture Extension	Government based staff (Regional-level)	20 years
21	Associate Professor, Department of Horticulture, Faculty of Agriculture, Kasetsart University	Academics (University staff)	15-20 years
22	Managing Direct of Siam Brit .Co.,Ltd. (Sugar broker agent) / Tate &Lyle Southeast Asia Representative	Non-governmental agency	n/a

Appendix F: Example of coding scheme used for qualitative analysis

The screenshot displays a software interface for qualitative analysis. On the left, a tree view shows a coding scheme for 'Strength collaboration'. The tree includes categories like 'Background (responsibility and influence)', 'Thai Cane and Sugar Industry during the Acts', 'Strength', 'legislation mechanism (The Thai Cane and Sugar Act of...', 'Weakness', and 'Government Proposal Plan Scenario'. Each category has associated files and reference counts.

The main panel shows a detailed view of a reference. The reference text is: "collaboration is the strength because it gather all sectors to participate among each other." Below the text, there are several reference highlights with their respective coverage percentages: Reference 4 (0.95% coverage), Reference 5 (0.16% coverage), Reference 1 (1.17% coverage), and Reference 3 (0.22% coverage). The interface also shows a summary of the reference and a list of files used for coding.

The screenshot displays the same software interface, but with a different coding scheme selected. The tree view on the left shows a coding scheme for 'Libertarian Policy Scenario'. The main panel shows a detailed view of a reference. The reference text is: "impacted and survive will be the large-scale farmers which accounted for 10-15 percent". Below the text, there are several reference highlights with their respective coverage percentages: Reference 1 (0.36% coverage), Reference 2 (0.88% coverage), Reference 1 (0.44% coverage), Reference 2 (0.44% coverage), and Reference 1 (1.41% coverage). The interface also shows a summary of the reference and a list of files used for coding.

**Appendix G: Rotation Component Matrix and Cronbach's Alpha score
of all original TPB variables from farm survey**

Rotated Component Matrix^a

	Component				
	1	2	3	4	5
Normative_Beliefs_SN_1	.352	-.068	.797	-.074	-.028
Normative_Beliefs_SN_2	.282	-.110	.856	-.120	-.011
Normative_Beliefs_SN_3	.280	-.064	.879	-.121	-.004
Normative_Beliefs_SN_4	.250	-.045	.874	-.145	-.039
Control_Beliefs_PBC_1	.898	-.030	.238	-.139	.060
Control_Beliefs_PBC_2	.888	-.019	.212	-.118	.028
Control_Beliefs_PBC_3	.765	.072	.125	-.153	-.005
Control_Beliefs_PBC_4	.927	-.029	.236	-.115	.004
Control_Beliefs_PBC_5	.928	-.045	.224	-.097	.017
Control_Beliefs_PBC_6	.921	-.027	.208	-.102	.008
Reverse_Control_Beliefs_PBC_7	-.147	-.162	-.061	.731	.166
Reverse_Control_Beliefs_PBC_8	-.260	.094	-.171	.605	-.052
Reverse_Control_Beliefs_PBC_9	-.095	.084	-.110	.816	-.038
Reverse_Behavioural_Beliefs_ATT_6	-.177	.568	-.136	.332	-.050
Reverse_Behavioural_Beliefs_ATT_7	.045	.065	-.062	.037	.849
Reverse_Behavioural_Beliefs_ATT_11	-.462	.344	-.287	.093	-.139
Bahavioural_Beliefs_ATT_10	-.102	.385	-.171	-.002	-.229
Bahavioural_Beliefs_ATT_1	-.059	.658	-.201	.076	.193
Bahavioural_Beliefs_ATT_2	.071	.852	-.029	-.008	.223
Bahavioural_Beliefs_ATT_3	.067	.890	-.017	.006	.190
Bahavioural_Beliefs_ATT_4	.039	.884	-.035	.023	.168
Bahavioural_Beliefs_ATT_5	-.013	.816	.022	-.019	-.079
Bahavioural_Beliefs_ATT_8	-.054	.759	.039	-.108	-.320

Bahavioural_Beliefs_ATT_9	-.039	.755	.018	-.056	-.301
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Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.^a

a. Rotation converged in 5 iterations.

Labels: Attitude Variables based on the original version of farm surveys

ATT_1: The policy approach will damage cane farmers

ATT_2: A decrease in domestic sugar price will negatively affect my income from cane production

ATT_3: My business will be strongly negatively affected by the price drop in domestic market

ATT_4: A drop in domestic sugar price will negatively impact my sugarcane production

ATT_5: Ending government support will affect my farm business

ATT_8: Not receiving any price supports (e.g. guarantee cane price, fixed domestic sugar price above the world price) will be bad for my cane business

ATT_9: Not receiving any producer subsidies (e.g. cheap loans, low credits and interests) related to cane will be bad for my cane business

ATT_10: The policy approach will impose too much interfere with my future farming plan

ATT_6: I can get my business to be better than it is now under this scenario

ATT_7: I can do more work off-farm to support my cane farming activities

ATT_11: No matter what this policy approach is, I will keep my farm running

1. Libertarian scenario

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.871	.884	11

Item Statistics

	Mean	Std. Deviation	N
Bahavioural_Beliefs_ATT_1	20.3571	5.77767	154
Bahavioural_Beliefs_ATT_2	18.8247	5.79512	154
Bahavioural_Beliefs_ATT_3	18.9935	5.63659	154
Bahavioural_Beliefs_ATT_4	18.5130	5.98390	154
Bahavioural_Beliefs_ATT_5	18.3961	5.87608	154
Bahavioural_Beliefs_ATT_8	17.9351	5.85855	154
Bahavioural_Beliefs_ATT_9	17.0390	6.54884	154
Bahavioural_Beliefs_ATT_10	16.0325	7.25756	154
Reverse_Behavioural_Beliefs_ATT_6	14.3636	8.88916	154
Reverse_Behavioural_Beliefs_ATT_7	6.9026	6.84542	154
Reverse_Behavioural_Beliefs_ATT_11	9.1234	7.22589	154

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Bahavioural_Beliefs_ATT_1	156.1234	1909.743	.684	.528	.853
Bahavioural_Beliefs_ATT_2	157.6558	1882.293	.741	.749	.849
Bahavioural_Beliefs_ATT_3	157.4870	1864.448	.806	.878	.846
Bahavioural_Beliefs_ATT_4	157.9675	1838.568	.807	.862	.844
Bahavioural_Beliefs_ATT_5	158.0844	1850.914	.798	.699	.845
Bahavioural_Beliefs_ATT_8	158.5455	1926.393	.638	.600	.856
Bahavioural_Beliefs_ATT_9	159.4416	1882.026	.640	.595	.855
Bahavioural_Beliefs_ATT_10	160.4481	1923.791	.490	.292	.866
Reverse_Behavioural_Beliefs_ATT_6	162.1169	1776.993	.577	.381	.862
Reverse_Behavioural_Beliefs_ATT_7	169.5779	2225.043	.026	.078	.896
Reverse_Behavioural_Beliefs_ATT_11	167.3571	1995.211	.374	.234	.875

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
176.4805	2288.709	47.84045	11

2. Government Proposal scenario

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.862	.874	11

Item Statistics

	Mean	Std. Deviation	N
Bahavioural_Beliefs_ATT_1	18.5253	6.59830	158
Bahavioural_Beliefs_ATT_2	18.6646	5.71356	158
Bahavioural_Beliefs_ATT_3	18.5000	5.61816	158
Bahavioural_Beliefs_ATT_4	17.9177	6.07172	158
Bahavioural_Beliefs_ATT_5	17.4684	6.72544	158
Bahavioural_Beliefs_ATT_8	17.5063	6.24627	158
Bahavioural_Beliefs_ATT_9	16.8481	6.63630	158
Bahavioural_Beliefs_ATT_10	14.6582	7.00752	158
Reverse_Behavioural_Beliefs_ATT_6	12.9747	8.51148	158
Reverse_Behavioural_Beliefs_ATT_7	7.3038	7.29078	158
Reverse_Behavioural_Beliefs_ATT_11	7.3165	6.52881	158

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Bahavioural_Beliefs_ATT_1	149.1582	1846.019	.666	.511	.842
Bahavioural_Beliefs_ATT_2	149.0190	1851.879	.778	.829	.837
Bahavioural_Beliefs_ATT_3	149.1835	1853.756	.789	.879	.836
Bahavioural_Beliefs_ATT_4	149.7658	1814.282	.804	.858	.833
Bahavioural_Beliefs_ATT_5	150.2152	1835.813	.670	.553	.842
Bahavioural_Beliefs_ATT_8	150.1772	1830.720	.743	.761	.837
Bahavioural_Beliefs_ATT_9	150.8354	1814.113	.723	.741	.838
Bahavioural_Beliefs_ATT_10	153.0253	2012.292	.327	.214	.868
Reverse_Behavioural_Beliefs_ATT_6	154.7089	1793.010	.557	.370	.852
Reverse_Behavioural_Beliefs_ATT_7	160.3797	2207.727	.009	.167	.891
Reverse_Behavioural_Beliefs_ATT_11	160.3671	2034.947	.322	.194	.867

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
167.6835	2267.148	47.61457	11

3. Protectionism scenario

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.823	.827	11

Item Statistics

	Mean	Std. Deviation	N
Bahavioural_Beliefs_ATT_1	16.9467	6.92800	150
Bahavioural_Beliefs_ATT_2	17.4667	6.56272	150
Bahavioural_Beliefs_ATT_3	17.6867	6.39330	150
Bahavioural_Beliefs_ATT_4	17.3400	6.51568	150
Bahavioural_Beliefs_ATT_5	17.3600	6.52952	150
Bahavioural_Beliefs_ATT_8	17.8133	6.37569	150
Bahavioural_Beliefs_ATT_9	17.4533	6.55446	150
Bahavioural_Beliefs_ATT_10	14.5667	6.38835	150
Reverse_Behavioural_Beliefs_ATT_6	12.8067	8.41754	150
Reverse_Behavioural_Beliefs_ATT_7	7.0867	7.06626	150
Reverse_Behavioural_Beliefs_ATT_11	6.7133	6.16696	150

Item–Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item–Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Bahavioural_Beliefs_ATT_1	146.2933	1656.477	.497	.302	.808
Bahavioural_Beliefs_ATT_2	145.7733	1565.653	.724	.793	.787
Bahavioural_Beliefs_ATT_3	145.5533	1551.927	.778	.871	.782
Bahavioural_Beliefs_ATT_4	145.9000	1558.614	.746	.851	.785
Bahavioural_Beliefs_ATT_5	145.8800	1581.086	.695	.601	.790
Bahavioural_Beliefs_ATT_8	145.4267	1667.065	.532	.681	.805
Bahavioural_Beliefs_ATT_9	145.7867	1647.283	.554	.658	.803
Bahavioural_Beliefs_ATT_10	148.6733	1866.933	.140	.103	.838
Reverse_Behavioural_Beliefs_ATT_6	150.4333	1601.173	.464	.276	.813
Reverse_Behavioural_Beliefs_ATT_7	156.1533	1880.721	.088	.127	.845
Reverse_Behavioural_Beliefs_ATT_11	156.5267	1786.305	.308	.222	.824

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
163.2400	1984.774	44.55081	11

Labels: PBC variables based on the original version of farm surveys

PBC_1: I believe that have got enough skills to continue

PBC_2: I believe that I have sufficient resources to do continue

PBC_3: I will need lots of government support

PBC_4: I believe have capacity to continue

PBC_5: I believe have the necessary authority to continue

PBC_6: I believe that have sufficient knowledge to do continue

PBC_7: I lack the money for necessary investment

PBC_8: I believe that my farm is too small to be financially stable

PBC_9: I would not be able to borrow money or sufficient funds

1. Libertarian scenario

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.768	.736	9

Item Statistics

	Mean	Std. Deviation	N
Control_Beliefs_PBC_11_4_115_1	13.4416	6.27891	154
Control_Beliefs_PBC_11_4_115_2	13.0649	6.33558	154
Control_Beliefs_PBC_11_4_115_3	15.7078	6.24544	154
Control_Beliefs_PBC_11_4_115_4	13.6688	6.02506	154
Control_Beliefs_PBC_11_4_115_5	13.6948	5.77274	154
Control_Beliefs_PBC_11_4_115_6	13.7987	5.87381	154
Reverse_Control_Beliefs_PBC_114_115_7	7.5974	4.63648	154
Reverse_Control_Beliefs_PBC_114_115_8	9.5974	5.63314	154
Reverse_Control_Beliefs_PBC_114_115_9	10.3766	5.39557	154

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Control_Beliefs_PBC_11_4_115_1	97.5065	649.363	.849	.864	.675
Control_Beliefs_PBC_11_4_115_2	97.8831	665.542	.779	.775	.688
Control_Beliefs_PBC_11_4_115_3	95.2403	732.262	.560	.552	.728
Control_Beliefs_PBC_11_4_115_4	97.2792	661.523	.847	.912	.679
Control_Beliefs_PBC_11_4_115_5	97.2532	671.432	.855	.897	.680
Control_Beliefs_PBC_11_4_115_6	97.1494	677.527	.812	.849	.687
Reverse_Control_Beliefs_PBC_114_115_7	103.3506	989.484	-.173	.294	.815
Reverse_Control_Beliefs_PBC_114_115_8	101.3506	1006.399	-.217	.264	.832
Reverse_Control_Beliefs_PBC_114_115_9	100.5714	974.782	-.129	.255	.819

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
110.9481	960.468	30.99142	9

2. Government proposal scenario

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.786	.765	9

Item Statistics

	Mean	Std. Deviation	N
Control_Beliefs_PBC_11_4_115_1	14.7848	6.01626	158
Control_Beliefs_PBC_11_4_115_2	15.0570	6.01934	158
Control_Beliefs_PBC_11_4_115_3	16.3987	6.11768	158
Control_Beliefs_PBC_11_4_115_4	15.1899	5.87573	158
Control_Beliefs_PBC_11_4_115_5	15.2089	5.90159	158
Control_Beliefs_PBC_11_4_115_6	15.4367	5.77766	158
Reverse_Control_Beliefs_PBC_114_115_7	7.8228	5.18022	158
Reverse_Control_Beliefs_PBC_114_115_8	8.9430	5.25314	158
Reverse_Control_Beliefs_PBC_114_115_9	9.9620	5.59445	158

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Control_Beliefs_PBC_11_4_115_1	104.0190	708.401	.764	.835	.720
Control_Beliefs_PBC_11_4_115_2	103.7468	698.789	.799	.839	.714
Control_Beliefs_PBC_11_4_115_3	102.4051	729.822	.672	.580	.734
Control_Beliefs_PBC_11_4_115_4	103.6139	687.105	.869	.953	.704
Control_Beliefs_PBC_11_4_115_5	103.5949	687.899	.861	.953	.705
Control_Beliefs_PBC_11_4_115_6	103.3671	692.527	.866	.902	.706
Reverse_Control_Beliefs_PBC_114_115_7	110.9810	989.879	-.084	.203	.829
Reverse_Control_Beliefs_PBC_114_115_8	109.8608	1045.254	-.246	.272	.847
Reverse_Control_Beliefs_PBC_114_115_9	108.8418	984.045	-.074	.285	.833

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
118.8038	989.343	31.45383	9

3. Protectionism scenario

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.733	.718	9

Item Statistics

	Mean	Std. Deviation	N
Control_Beliefs_PBC_11_4_115_1	16.6267	5.46931	150
Control_Beliefs_PBC_11_4_115_2	16.1200	5.92562	150
Control_Beliefs_PBC_11_4_115_3	17.5067	5.31901	150
Control_Beliefs_PBC_11_4_115_4	16.8133	5.46543	150
Control_Beliefs_PBC_11_4_115_5	16.7533	5.48939	150
Control_Beliefs_PBC_11_4_115_6	16.7867	5.44600	150
Reverse_Control_Beliefs_PBC_114_115_7	7.5533	4.76500	150
Reverse_Control_Beliefs_PBC_114_115_8	8.3267	5.30986	150
Reverse_Control_Beliefs_PBC_114_115_9	9.8867	5.61103	150

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Control_Beliefs_PBC_11_4_115_1	109.7467	532.620	.789	.884	.638
Control_Beliefs_PBC_11_4_115_2	110.2533	518.164	.772	.790	.635
Control_Beliefs_PBC_11_4_115_3	108.8667	578.949	.603	.493	.675
Control_Beliefs_PBC_11_4_115_4	109.5600	527.845	.812	.903	.633
Control_Beliefs_PBC_11_4_115_5	109.6200	522.908	.831	.919	.629
Control_Beliefs_PBC_11_4_115_6	109.5867	527.613	.817	.887	.632
Reverse_Control_Beliefs_PBC_114_115_7	118.8200	788.739	-.186	.288	.791
Reverse_Control_Beliefs_PBC_114_115_8	118.0467	825.427	-.302	.262	.814
Reverse_Control_Beliefs_PBC_114_115_9	116.4867	774.238	-.141	.310	.798

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
126.3733	761.591	27.59694	9

Appendix H: Correlation between indirect measure (expectancy-value) and direct measure of TPB variables and behavioural intention

Variable	Correlations	
	Direct-Indirect	Intention
Libertarian scenario		
Attitude	-0.170**	-0.386*
Subjective norms	0.627*	0.430*
Perceived Behavioural control	0.456*	0.031
Government Proposal scenario		
Attitude	-0.058	-0.200**
Subjective norms	0.560*	0.595*
Perceived Behavioural control	0.505*	0.238*
Protectionism scenario		
Attitude	-0.188**	-0.087
Subjective norms	0.661*	0.659*
Perceived Behavioural control	0.527*	0.103

*Notes: Significance level * p<0.01, ** p<0.05*

Appendix I: Competitiveness score and ranking of investigated sugar millers

ID	Productivity index	Sugar production	Crushing capacity	ETR of sugar	Molasses production	ETR of molasses	% of crushing rate within 12 hours after harvesting	% crushing productivity (availability of cane)	Input Index	Cane Vol.	% of fresh cane	C.C.S.	Business structure and sophistication factor index	Range of related business	Sugar revenue over entire businesses	R&D	Total score	Rank	
Weights	33.34%	4.76%	4.77%	4.77%	4.76%	4.76%	4.76%	4.76%	33.33%	11.11%	11.11%	11.11%	33.33%	11.11%	11.11%	11.11%			
NE11	5.1	6	6	5	6	3	3	7	5.7	6	7	4	6.3	5	7	7	5.714	1	Highly competitive
N2	4.6	4	4	5	4	4	4	7	5.0	4	7	4	6.3	7	5	7	5.302	2	Highly competitive
NE2	5.4	7	6	7	5	1	6	6	4.7	4	3	7	4.3	3	3	7	4.810	3	Highly competitive
C9	5.0	5	6	4	5	3	7	5	3.0	6	2	1	6.3	5	7	7	4.778	4	Highly competitive
NE6	4.6	5	5	6	4	2	4	6	6.0	5	6	7	3.7	5	5	1	4.746	5	Highly competitive
E2	4.9	6	6	5	6	3	3	5	5.0	6	2	7	4.3	3	3	7	4.730	6	Competitive
NE10	4.6	5	4	7	4	2	5	5	5.0	4	4	7	4.3	3	3	7	4.635	7	Competitive
N6	5.7	7	7	3	7	4	5	7	5.0	7	4	4	3.0	3	5	1	4.572	8	Competitive
NE12	5.0	6	5	5	5	4	5	5	5.0	6	2	7	3.7	1	3	7	4.556	9	Competitive
N1	4.3	4	4	6	3	3	3	7	4.7	4	6	4	4.7	7	3	4	4.540	10	Competitive
N5	5.1	7	7	4	6	2	4	6	5.3	7	5	4	2.3	3	3	1	4.270	11	Average competitive_high productivity and cane quality
NE1	3.9	4	4	6	3	1	4	5	5.7	7	3	7	2.3	3	3	1	3.952	12	Average competitive_high productivity and cane quality
NE4	4.0	3	3	7	2	1	5	7	4.3	3	3	7	3.3	3	3	4	3.889	13	Average competitive_high productivity and cane quality
C13	4.4	5	5	3	5	3	5	5	2.7	5	2	1	4.3	3	3	7	3.810	14	Average competitive_lower productivity and input
NE5	4.9	6	6	5	5	2	5	5	4.7	6	4	4	1.7	1	3	1	3.730	15	Average competitive_high productivity and cane quality
N7	4.7	5	6	4	5	3	4	6	4.0	5	3	4	2.3	3	3	1	3.683	16	Average competitive_high productivity and cane quality
NE8	4.3	3	3	6	2	4	6	6	4.0	2	3	7	2.7	1	3	4	3.651	17	Average competitive_high productivity and cane quality
NE9	3.7	3	4	4	3	3	5	4	4.0	3	2	7	3.0	3	5	1	3.571	18	Average competitive_high productivity and cane quality
C10	3.3	2	2	2	2	5	5	5	3.0	1	7	1	4.3	5	7	1	3.540	19	Average competitive_lower productivity and input
NE7	4.1	4	4	5	4	5	3	4	4.0	4	4	4	2.3	3	3	1	3.492	20	Average competitive_high productivity and cane quality
C12	3.0	2	2	4	2	3	3	5	3.0	2	6	1	4.3	5	7	1	3.444	21	Average competitive_lower productivity and input
NE13	3.6	3	3	4	2	1	5	7	3.7	3	1	7	1.7	1	3	1	2.968	22	Average competitive_lower productivity and input
C3	3.1	2	2	3	2	2	4	7	2.0	2	3	1	3.7	7	3	1	2.937	23	Average competitive_lower productivity and input
N4	3.7	3	3	3	2	3	5	7	2.3	2	4	1	2.3	3	3	1	2.794	24	Average competitive_lower productivity and input
N8	2.6	3	2	1	2	3	4	3	3.0	2	3	4	2.3	3	3	1	2.635	25	Average competitive_lower productivity and input
C7	3.0	2	2	2	2	3	5	5	3.0	2	6	1	1.7	1	3	1	2.556	26	Average competitive_lower productivity and input
C14	3.7	3	3	4	2	3	5	6	2.7	2	2	4	1.0	1	1	1	2.460	27	Average competitive_lower productivity and input
C11	2.7	2	2	3	1	4	5	2	3.7	1	6	4	1.0	1	1	1	2.460	28	Average competitive_lower productivity and input
C4	3.0	2	2	1	2	3	6	5	2.0	2	3	1	2.3	3	3	1	2.445	29	Average competitive_lower productivity and input
E1	3.0	1	2	3	1	3	5	6	2.0	1	1	4	2.3	3	3	1	2.445	30	Average competitive_lower productivity and input
C6	3.3	2	3	2	2	4	5	5	2.3	2	4	1	1.7	1	3	1	2.429	32	Average competitive_lower productivity and input
C8	3.3	2	2	2	2	4	6	5	3.0	2	6	1	1.0	1	1	1	2.429	33	Average competitive_lower productivity and input
N3	3.3	3	3	3	2	2	5	5	3.0	2	3	4	1.0	1	1	1	2.429	31	Average competitive_lower productivity and input
C2	3.6	3	3	3	2	3	4	7	2.0	2	3	1	1.7	1	3	1	2.413	34	Average competitive_lower productivity and input
NE3	2.6	1	1	6	1	2	6	1	3.7	1	3	7	1.0	1	1	1	2.413	35	Average competitive_lower productivity and input
E3	2.9	1	1	3	1	7	2	5	2.3	1	2	4	1.0	1	1	1	2.064	36	Least competitive
C5	3.3	2	2	2	2	4	6	5	1.7	1	3	1	1.0	1	1	1	1.984	37	Least competitive
C1	2.9	1	1	3	1	4	5	5	1.0	1	1	1	1.0	1	1	1	1.619	38	Least competitive

Appendix J: WTO domestic subsidy boxes (Exempt from reduction commitments)

WTO domestic subsidy boxes (Exempt from reduction commitments)	Agreement or commitment	Type of allowable measures
Blue Box (Exemptions to reduction commitments of production limiting programmes)	Article 6.5 of the AoA	Direct payments associated with production limiting programmes (Blue Box) not in Green Box but excluded from AMS.
Green Box (Government payments or programmes that were considered trade-neutral, or at least minimally trade-distorting. Hence, measures for which unlimited support can be provided)	Annex 2 of the AoA	<ol style="list-style-type: none"> 1. The provision of general services for agriculture, such as research and extension, pest and disease control, product inspection, and technical assistance and training for producers 2. Expenditures on public stockholding for domestic food security 3. Expenditures on domestic food aid 4. Payments to producers for decoupled income support 5. Payments for income insurance and income safety net programs 6. Subsidies for disaster relief (including crop insurance) 7. Payments designed to promote structural adjustment through producer retirement 8. Payments designed to promote structural adjustment through resource (land) retirement 9. Payments designed to promote structural adjustment through investment 10. Payments under environmental programs and 11. Payments to producers in disadvantaged regions under regional assistance programs.
Amber Box (Domestic support for agriculture that is considered to distort trade and therefore subject to reduction commitments. Technically calculated as “Aggregate Measurement of Support” (AMS))	Article 1 and Annexes 3 and 4 of the AoA	Nearly all domestic support measures considered to distort production and trade (with some exceptions) fall into the amber box, which is defined in Article 6 of the Agriculture Agreement except those in the blue, green, development boxes. These include measures to support prices, or subsidies directly related to production quantities. These supports are subject to limits. “De minimis” minimal supports for both product-specific and non-product-specific support are allowed, defined as a share of the value of agricultural production. This threshold is generally 5% of the value of agricultural production for developed countries, 10% for most developing countries.
Development Box- Special & differential measures (The type of support that fits into the developmental category are measures of assistance, whether direct or indirect, designed to encourage agricultural and rural development and that are an integral part of the development programmes of developing countries)	Article 6.2 of the AoA	<ol style="list-style-type: none"> 1. Investment subsidies which are generally available to agriculture in developing country members 2. Agricultural input subsidies generally available to low-income or resource-poor producers in developing country members 3. Domestic support to producers in developing country members to encourage diversification from growing illicit narcotic crops.

Appendix K: In-depth interview – Ethical Clearance

School of Agriculture, Policy and Development **ETHICAL CLEARANCE GRANTED**  **University of Reading**

Form 2. MSc PhD Staff Ethical Clearance Submission Form

PLEASE allow a minimum of 3 weeks for this process.

You must not begin your research until you have obtained consent as evidenced by this form returned from the APD student Office signed and dated. Ethical Clearance cannot be granted retrospectively.

This form can only be used if the application :

- Does not involve participants who are patients or clients of the health or social services
- Does not involve participants whose capacity to give free and informed consent may be impaired within the meaning of the Mental Capacity Act 2005
- Does not involve patients who are 'vulnerable'
- Does not involve any element of risk to the researchers or participants
- Does not involve any participants who have a special relationship to the researchers/investigators

If any of the above apply, please refer to the APD Ethics Chair to decide whether an application can be made through the APD review process or whether the application needs to be referred to the full University Committee.

It is the applicant's responsibility to check for any particular requirements of a funder regarding ethical review. Some funders may require that the application is reviewed by full University Committee and not the devolved School committee.

Full details of the University Research Ethics procedures are available at <http://www.reading.ac.uk/internal/res/ResearchEthics/reas-REethicshomepage.aspx> and you are encouraged to access these pages for a fuller understanding. Some helpful advice is available on this link <http://www.reading.ac.uk/internal/res/ResearchEthics/reas-REwhatdoinneedtodo.aspx> and the FAQs are particularly relevant.

ALL QUESTIONS MUST BE COMPLETED.

APD Ethical Clearance Application Reference Number : 00941P

1. APPLICANT DETAILS:

Main applicant name:	Savita Tangwongkit
Name of academic supervisor/project investigator:	Philip Jones
Email Address (decision will be emailed here):	s.tangwongkit@prg.reading.ac.uk
MSc Student	<input type="checkbox"/>
PhD Student	<input checked="" type="checkbox"/>
Staff Member	<input type="checkbox"/>
Other (please specify)	Click here to enter text.

2. PROJECT DETAILS:

Title of project: The Survival Of Thai Sugar Producers And Stakeholders In The Wake Of WTO-enforced Changes To The Thai Sugar Regime

Please provide a lay summary of the project, including what is being investigated and why:

In 2016, Brazil challenged the Thai sugar regime at the WTO . Brazil argued that state support, both for domestic sugar producers and exporters had provided unfair protection and allowed Thailand to increase market share in the world sugar market to be come the world second largest sugar exporter. Brazil also argued that these subsidies had decreased the world sugar price.This case is based on the claim that this government intervention is inconsistent with the international trade agreement with WTO, to which Thailand is a signatory. Consequently, for Brazil to withdraw the complaint, Thailand must reform the Thai sugar regime in order to comply with WTO rules. All stakeholders in the Thai sugar setor will be impacted by

these reforms, including producers, sugar millers and policy makers.

Overall, This research aims to investigate the likely impacts of a range of alternative policy regimes (scenarios) on the Thai sugar sector, in particular the responses of Thai sugar cane farmers, millers and other sugar stakeholders to policy changes. Specifically, this research will attempt to investigate the impacts on key elements of the Thai sugar industry for a suite of policy reform scenarios. First, a policy choice framework will be used to explore policy makers' intention and decision-making to identify a suite of policies that would be effective in the Thai sugar sector. Subsequently, the likely responses of farmers and millers to different types of policy scenarios will be explored.

Procedure. Please outline the project's research protocol (what procedures, research methods and analysis methods are being used) : In this research, there are 3 main studies that will be explored. The first study is called Policy Scenario Analysis (the subject of this ethical clearance application) in which alternative policy scenarios will be developed based on different levels of intensity of government support. Qualitative methods will be used in conjunction with data collected from policy-makers and academics. The process of data collection will be by means of in-depth interview with policy makers and academics, formulating policy scenarios by using qualitative data analysis, and setting up workshops with farmers' representatives, respectively. The analysis of this discursive data will be undertaken using NVivo. Later, a sensitivity analysis will be undertaken on the processed data by means of modelling and simulations.

The expert stakeholders involved in the interviews will be identified by a search of directories of various government departments connected with the management of the Thai sugar sector and policy setting in particular. A search of qualified academic stakeholders will be undertaken by a review of publications and university websites. These approaches will be supplemented by a 'snowballing' approach, where interviewed stakeholders are asked if they would suggest professional colleagues or collaborators who might also be interviewed. Potential participants in the stakeholder survey will be initially contacted by email and telephone for recruitment purposes. Once participation has been secured, participants will be sent an information sheet (see attached supporting document) describing the nature and purpose of the study, their part in it and their rights concerning confidentiality and withdrawal from the study. As indicated in the information sheet, agreement to participate in the study will be taken as consent to use and publish the data they supply. The information sheet will be translated from English prior to use.

The data gathered from this stakeholder consultation exercise will be used to inform the design of a set of alternative policy scenarios for use in a large-scale survey of the effects of alternative policy options on Thai sugar producers (and refiners). These subsequent studies will be subject to a second ethical clearance application. The methodologies and research protocols used in connection with the farmer and refiner surveys will be reported in the ethical clearance application for the data instruments to be used in these two surveys.

Period over which the data collection is to be undertaken (note: data collection CANNOT commence until ethical approval has been granted as evidenced by this form signed and returned).

Proposed Start Date: 01/03/2019
Proposed End Date: 01/04/2019

3. THE RESEARCH:

- a) **Nature and number of participants** who are expected to take part in your survey/focus group. Please estimate if uncertain. As ethical clearance involving minors is more complex because of safeguarding and consent issues, please consider carefully whether you need to involve minors under the age of 16 in your research.

Participants	Number participating
Minors under 16 years of age	0

Students	0
Other members of the University	0
Members of the general public	0
Businesses	0
Government officials	13
Other <i>If other please specify:</i>	Academics 12

b) Funding. Is the research supported by funding from a research council or other external sources for example a charity or business?

Yes If yes, please specify funder : [Click here to enter text.](#)
 No

If yes, it is the responsibility of the applicant to check for any particular requirements of the funder regarding ethical review. Some funders may require that the application is reviewed by full University Committee and not the devolved School committee.

c) Recruitment. Please describe recruitment procedures. How have participants been selected? Are there any inclusion/exclusion criteria? Participants must be told on the Participant Information Sheet how and why they have been selected. You should attach any recruitment materials to this application. [The participants for indepth-interview in the study of policy scenario analysis are the government policy makers working in the Thai cane and sugar industry particularly in policy development as well as academics who have been consultants for the government specifically in this field.](#)

d) Exceptions. Does the research involve minors, medical patients, individuals with learning difficulties, vulnerable adults, participants recruited through social service departments, or anyone in a special relationship with yourself/data collectors? E.g. Supervisor; lecturer to a group of students; or person in a position of responsibility for participants.

Yes
 No

If yes, this may result in referral to the University Research Ethics Committee (please note their deadlines). Please provide extra detail here: [Click here to enter text.](#)

e) Where is the data collection to be undertaken? Specify country(ies) and specific location(s) [The data will be collected by video call interview with participants from Thailand](#)

f) What forms of data collection does the research involve?

Group discussion/ workshop
 Personal interviews
 Telephone interviews
 Questionnaire/paper survey
 Postal survey
 Email/ online survey
 Which software tool will be used, if any? [Skype](#)
 Other (specify): [Click here to enter text.](#)

g) Who will undertake the collection and/or analysis of data?

Myself
 Other MSc students
 Other Higher degree students

- Other contract research and/or academic staff
- Individuals outside University
- External organisations

If individuals outside the University and/or external organisations are involved in the collection or analysis of data, give brief details below. Indicate how the ethical procedures and standards of the University will be satisfied: [Click here to enter text.](#)

h) Does the research require participants to consume any food products?

- No
- Yes

If yes, please provide full details and indicate measures in place to ensure excellent food hygiene standards and ensure participant safety. [Click here to enter text.](#)

i) Do you consider there are any potential ethical issues in this project? Does the research require collection of information that might be considered sensitive in terms of confidentiality, potential to cause personal upset, etc.?

- No
- Yes

If yes, please provide full details and indicate how these issues will be addressed, how researchers will manage participant reaction. Support and de-brief sheets should be attached if relevant. [Click here to enter text.](#)

j) Will the research involve any element of intentional deception at any stage? (i.e. providing false or misleading information about the study, or omitting information)?

- No
- Yes

If yes, this must be justified here. You should also consider including debriefing materials for participants which outline the nature and justification of the deception used. [Click here to enter text.](#)

k) Are participants offered a guarantee of anonymity and/or that the information they supply will remain confidential?

- Yes
- No

If yes, give brief details of the procedures to be used to ensure this and particularly if the data has 'linked' or 'keyed' anonymity (eg. where published results are anonymous but participant details are recorded and held separately to the responses but keyed with reference number) : **Data supplied by respondents is published anonymously, respondent replies are identified only with a reference number, while all respondent identifiers are held securely and separately.**

l) Will participants be required to complete a separate consent form? Many APD applications do not require participants to complete a separate consent form. Please see the templates provided.

- Yes. Names, addresses and copies of completed forms will be given to APD student office
- No. The data collection is anonymous and a combined information/consent sheet supplied
- Neither of the above, or the research involves participants under the age of 16

If 'neither of the above' selected, or the research involves participants under the age of 16, please outline the specific circumstances. [Click here to enter text.](#)

m) Will participants be offered any form of incentive for undertaking the research?

- No
- Yes

If yes, give brief details, including what will happen to the incentive should the participant later withdraw their input or decide not to proceed : [Click here to enter text.](#)

4. DATA PROTECTION

Data Storage, data protection and confidentiality. Please make sure you are familiar with the University of Reading's guidelines for data protection and information security. <http://www.reading.ac.uk/internal/imps/>

Please outline plans for the handling of data to ensure data protection and confidentiality. Covering the following issues: Will any personal information be stored? How and where will the data be stored? Who will have access to the data? When will it be deleted?

The responses to the interview will be kept confidential. Respondent name and email will be stored for 6 months in case it is necessary to contact the participants for follow up questions. Respondent identity and reference number will be linked by means of a password protected spreadsheet held separately (password known only myself and my supervisors) which will be destroyed by the end of 2022. The participants' name and email address will not be published as part of the research, and all data will be presented in aggregate form so that it will not be possible to identify any individual from their responses. The discussion data will be collected in form of anonymised transcripts of audio/video recordings which will be used only by myself and my supervisors for the purpose of the project. Once the discussion has been transcribed the original recording will be deleted. Anonymity will not be protected by identifying the transcript of the interview by a reference number only.

Applicants: Please now scroll to Section 7 to input your :

- Information Sheet(s) for Participants (mandatory)
- Data Collection Tools, for example: recruitment materials, interview/focus group protocols (how you are conducting the process), interview/focus group questions, questionnaires, online survey questions, debriefing and fact sheets
- Consent Forms (optional, may not be necessary if consent assumed in Information Sheet)

If the text boxes do not allow input in the desired format, please append documents separately to the email when sending this form.

Please then email your completed form (and any separate supporting documents) to your supervisor/project investigator. Project investigators or independent academics may return form directly to sapdethics@reading.ac.uk

A decision on whether ethical clearance has been granted will be emailed to you via the APD Student Office along with your authorised form.

You may NOT proceed with your data collection until ethical approval has been granted as evidenced by return of this approved form.

Note: The process of obtaining ethical approval does not include an assessment of the scientific merit of the questionnaire. That is the separate responsibility of your supervisor/project investigator in discussion with yourself.

5. Supervisor/project investigator review. Section to be completed by supervisor/PI where relevant.

Participant information sheet(s), data collection tools and any other supporting information may be pasted in [section 7 below](#). Alternatively they may be attached to this email. Please review these documents and then complete the checklist below.

Checklist. Does this application and supporting documents adequately address the following ?

- The safety of the researcher(s) and those collecting data, the safety of the participant(s)
- Is the language /grammar/content appropriate (i.e. University standards and reputation upheld)
- There are no questions that might reasonably be considered impertinent or likely to cause distress to the participants
- The researcher has provided the participant information sheet (mandatory)
- The researcher has provided the questionnaire or survey/ workshop, focus group or interview questions (mandatory)
- The Participant Information Sheet gives sufficient information for the participants to give their INFORMED consent
- A separate consent form has been included (optional)
- Data will be handled, stored and deleted appropriately according to University guidelines, and the participants have been adequately informed about this in the Participant Information Sheet
- The Participant Information Sheet contains all relevant sections

- I am satisfied that this application meets the minimum standards for APD Ethical Clearance to be granted**

Supervisor/Project Investigator, please forward this form as a WORD document and any separate supporting documents to sapdethics@reading.ac.uk. The form will be logged by the student office and allocated to an APD ethics committee reviewer. The APD ethics reviewer will review the application and complete section 6.

6. APD ethics committee review. Section to be completed by APD Ethics Committee member.

Decision

- | | |
|---|---|
| <input type="checkbox"/> Clearance refused | <input type="checkbox"/> Resubmission required |
| <input checked="" type="checkbox"/> Clearance granted as presented | <input type="checkbox"/> No need to resubmit once amended |
| <input type="checkbox"/> Clearance granted subject to revisions suggested | <input type="checkbox"/> May require further information |
| <input type="checkbox"/> Referred to APD Research Ethics Chair | |

Ethics Committee Member please enter comments, reasons for rejection, summary of revisions required before proceeding (if applicable):

[Click here to enter text.](#)

Committee Member Name: **GIACOMO ZANELLO**

Date Reviewed : **13/02/2019**

Appendix L: Farm survey – Ethical Clearance

School of Agriculture, Policy and Development

**ETHICAL CLEARANCE
GRANTED**



**University of
Reading**

Form 2. MSc PhD Staff Ethical Clearance Submission Form

PLEASE allow a minimum of 3 weeks for this process.

You must not begin your research until you have obtained consent as evidenced by this form returned from the APD student Office signed and dated. Ethical Clearance cannot be granted retrospectively.

This form can only be used if the application :

- Does not involve participants who are patients or clients of the health or social services
- Does not involve participants whose capacity to give free and informed consent may be impaired within the meaning of the Mental Capacity Act 2005
- Does not involve patients who are 'vulnerable'
- Does not involve any element of risk to the researchers or participants
- Does not involve any participants who have a special relationship to the researchers/investigators

If any of the above apply, please refer to the APD Ethics Chair to decide whether an application can be made through the APD review process or whether the application needs to be referred to the full University Committee.

It is the applicant's responsibility to check for any particular requirements of a funder regarding ethical review. Some funders may require that the application is reviewed by full University Committee and not the devolved School committee.

Full details of the University Research Ethics procedures are available at <http://www.reading.ac.uk/internal/res/ResearchEthics/reas-REethicshomepage.aspx> and you are encouraged to access these pages for a fuller understanding. Some helpful advice is available on this link <http://www.reading.ac.uk/internal/res/ResearchEthics/reas-REwhatdoneedtodo.aspx> and the FAQs are particularly relevant.

ALL QUESTIONS MUST BE COMPLETED.

APD Ethical Clearance Application Reference Number : 001030P

1. APPLICANT DETAILS:

Main applicant name:	Savita Tangwongkit
Name of academic supervisor/project investigator:	Philip Jones
Email Address (decision will be emailed here):	s.tangwongkit@prg.reading.ac.uk
MSc Student	<input type="checkbox"/>
PhD Student	<input checked="" type="checkbox"/>
Staff Member	<input type="checkbox"/>
Other (please specify)	Click here to enter text.

2. PROJECT DETAILS:

Title of project: **The Survival Of Thai Sugar Producers And Stakeholders In The Wake Of WTO-enforced Changes To The Thai Sugar Regime**

Please provide a lay summary of the project, including what is being investigated and why:

In 2016, Brazil challenged the Thai sugar regime at WTO . Brazil argued that an extensive system of subsidy, both for domestic sugar producers and exporters had allowed Thailand to increase market share in the world sugar market, materially helping Thailand become the world's second largest sugar exporter. Brazil also argued that these subsidies have decreased the world sugar price. This case is based on the claim that this government intervention is inconsistent with the international trade agreement with WTO, to which Thailand is a signatory. Consequently, for Brazil to withdraw the

complaint, Thailand must reform its sugar regime in order to comply with WTO rules. All stakeholders in the Thai sugar sector will be impacted by these reforms, including sugarcane farmers, sugar millers and policy makers.

Overall, This research aims to investigate the likely impacts of a range of alternative policy regimes (scenarios) on the Thai sugar sector, in particular the responses of Thai sugar cane farmers, millers and other sugar stakeholders. First, a policy choice framework will be used to explore policy makers' intention and decision-making to identify a suite of policies that would be effective in the Thai sugar sector. Subsequently, the likely responses of farmers and millers to different types of policy scenarios will be explored, by means of a large-scale survey.

Procedure. Please outline the project's research protocol (what procedures, research methods and analysis methods are being used) : This research programme consists of 3 main studies: (i) a survey of sugar sector policy stakeholders; (ii) a survey of cane farmers (this is the object of this ethical clearance application); and (iii) a survey of sugar refiners.

The first study involves Policy Scenario Analysis, where three alternative policy scenarios will be developed based in the intensity of levels of government support. Qualitative methods will be used in the study of these policy scenarios, after gathering data from policy-makers and academics by means of in-depth interviews. The formulation of policy scenarios is delivered by qualitative data analysis, involving the use of workshops with farmers' representatives. Later, modelling and simulations will be undertaken to perform sensitivity analysis. This stakeholder consultation was the subject of an earlier ethical clearance application.

In order to investigate what farmers would do in response to changes in policy, a large-scale farmer survey will be designed and conducted. A sample of 400 cane farmers will be selected, stratified by region and farm size groups. Questionnaires will be used to collect data from this sample. Three different questionnaire variants will be used on three sub-samples, reflecting the three different policy scenarios defined in the stakeholder study. The questionnaire will be divided into three sections. All participants will answer Section A, which will capture farm and farmer socio-demographic information. All respondents will complete Section B, which contains questions related to their general attitudes, beliefs and objectives for cane farming business. These questions will make significant use of 5-point ranking scales. There will be three different versions of Section C, reflecting three different policy scenarios. Three sub-groups within the sample will be presented with one of these three different versions of Section C. Participants will be given information about policy scenario before being asked to provide their answers. This briefing material will express the scenarios in terms that farmers will be directly familiar with, for example, market prices, quota volumes etc. Section C will collect information on farmer attitudes and intentions to act in response to the policy scenarios. The information collected is consistent with the requirements for an analysis of farmer intentions under Theory of Planned Behaviour (TPB) analysis, i.e. outcome attitudes, subjective norms, perceived behavioural control and behavioural intention. Analysis of this data will be used to identify farmer intentions to continue cane farming and any consequent management adjustments. This information will help policy-makers to select the best policy options that maximize benefits of all producers in the industry.

Period over which the data collection is to be undertaken (note: data collection CANNOT commence until ethical approval has been granted as evidenced by this form signed and returned).

Proposed Start Date: 06/01/2019
Proposed End Date: 31/07/2019

3. THE RESEARCH:

- a) **Nature and number of participants** who are expected to take part in your survey/focus group. Please estimate if uncertain. As ethical clearance involving minors is more complex because of safeguarding and consent issues, please consider carefully whether you need to involve minors under the age of 16 in your research.

Participants	Number participating
Minors under 16 years of age	0
Students	0
Other members of the University	
Members of the general public	0
Businesses	0
Government officials	0
Other <i>If other please specify:</i>	402 Cane Famers

- b) **Funding.** Is the research supported by funding from a research council or other external sources for example a charity or business?

Yes If yes, please specify funder : [Click here to enter text.](#)
 No

If yes, it is the responsibility of the applicant to check for any particular requirements of the funder regarding ethical review. Some funders may require that the application is reviewed by full University Committee and not the devolved School committee.

- c) **Recruitment.** Please describe recruitment procedures. How have participants been selected? Are there any inclusion/exclusion criteria? Participants must be told on the Participant Information Sheet how and why they have been selected. You should attach any recruitment materials to this application. **The participants for the survey in this study consist 402 Thai sugarcane farmers. The participants will be selected by random sampling within stratification classes. Farmer names and addresses have been obtained from an official database of sugar cane farmers held by the Office of the Cane and Sugar Board (OCSB) of Thailand. All requisite permissions for the use of this data and the conduct of the survey have been secured. Farmers will be approached with the questionnaire for this study during the on-farm exercise to collect data on sugar cane production costs undertaken by the OCSB, as well as at visits by farmers to millers.**

- d) **Exceptions.** Does the research involve minors, medical patients, individuals with learning difficulties, vulnerable adults, participants recruited through social service departments, or anyone in a special relationship with yourself/data collectors? E.g. Supervisor; lecturer to a group of students; or person in a position of responsibility for participants.

Yes
 No

If yes, this may result in referral to the University Research Ethics Committee (please note their deadlines). Please provide extra detail here: [Click here to enter text.](#)

- e) **Where is the data collection to be undertaken?** Specify country(ies) and specific location(s) **The data will be collected by face-to-face interview using the attached questionnaire. The interviews will be carried out on both farm and during farmer visits to millers, by professional data collection agents working on behalf of the OCSB.**

- f) **What forms of data collection does the research involve?**

Group discussion/ workshop
 Personal interviews
 Telephone interviews

- Questionnaire/paper survey
- Postal survey
- Email/ online survey
- Which software tool will be used, if any? [Click here to enter text.](#)
- Other (specify): [Click here to enter text.](#)

g) Who will undertake the collection and/or analysis of data?

- Myself
- Other MSc students
- Other Higher degree students
- Other contract research and/or academic staff
- Individuals outside University
- External organisations

If individuals outside the University and/or external organisations are involved in the collection or analysis of data, give brief details below. Indicate how the ethical procedures and standards of the University will be satisfied: The data collection agents of the OCSB, Thailand, will undertake the data collection via face-to-face interviews, using the attached questionnaire. This will increase data accuracy as the OCSB agents are experts in this area. These agents will be fully briefed, by myself, on the content of the questionnaire and the purposes of the survey prior to the data collection exercise. At this time they will be made aware of the need for compliance with any standards and ethical considerations of the University of Reading that may be applicable.

h) Does the research require participants to consume any food products?

- No
- Yes

If yes, please provide full details and indicate measures in place to ensure excellent food hygiene standards and ensure participant safety. [Click here to enter text.](#)

i) Do you consider there are any potential ethical issues in this project? Does the research require collection of information that might be considered sensitive in terms of confidentiality, potential to cause personal upset, etc.?

- No
- Yes

If yes, please provide full details and indicate how these issues will be addressed, how researchers will manage participant reaction. Support and de-brief sheets should be attached if relevant. [Click here to enter text.](#)

j) Will the research involve any element of intentional deception at any stage? (i.e. providing false or misleading information about the study, or omitting information)?

- No
- Yes

If yes, this must be justified here. You should also consider including debriefing materials for participants which outline the nature and justification of the deception used. [Click here to enter text.](#)

k) Are participants offered a guarantee of anonymity and/or that the information they supply will remain confidential?

- Yes
- No

If yes, give brief details of the procedures to be used to ensure this and particularly if the data has 'linked' or 'keyed' anonymity (eg. where published results are anonymous but participant details are recorded and held separately to the responses but keyed with reference number) : [Click here to enter text.](#)

l) Will participants be required to complete a separate consent form? Many APD applications do not require participants to complete a separate consent form. Please see the templates provided.

- Yes. Names, addresses and copies of completed forms will be given to APD student office
 No. The data collection is anonymous and a combined information/consent sheet supplied
 Neither of the above, or the research involves participants under the age of 16

If 'neither of the above' selected, or the research involves participants under the age of 16, please outline the specific circumstances. [Click here to enter text.](#)

m) Will participants be offered any form of incentive for undertaking the research?

- No
Yes

If yes, give brief details, including what will happen to the incentive should the participant later withdraw their input or decide not to proceed : [Click here to enter text.](#)

4. DATA PROTECTION

Data Storage, data protection and confidentiality. Please make sure you are familiar with the University of Reading's guidelines for data protection and information security.

<http://www.reading.ac.uk/internal/imps/>

Please outline plans for the handling of data to ensure data protection and confidentiality. Covering the following issues: Will any personal information be stored? How and where will the data be stored? Who will have access to the data? When will it be deleted?

The responses to the survey will be kept confidential. Name and contact information will be stored for 6 months in case there is a necessity to contact the participants for follow up questions. Name and contact information will be linked to the original responses by means of a unique code identifier. These identifiers and their linked contact information will be held in password -protected spreadsheet file, with the password known only me and my supervisors. This information will be destroyed by the end of 2022. The participants' name and contact information will not be published as part of the research and all data will be presented in aggregate form so that it will not be possible to identify any individual from their responses. The survey will be collected using anonymised questionnaires which will be used by myself and my supervisors for the purpose of this project. Once the survey has been translated into English, the original Thai language questionnaires will be destroyed. The English language versions of eh questionnaire will be securely retained for five years by the University of Reading and then destroyed. The questionnaires will contain no personal identifiers beyond a code number.

Applicants: Please now scroll to Section 7 to input your :

- Information Sheet(s) for Participants (mandatory)
- Data Collection Tools, for example: recruitment materials, interview/focus group protocols (how you are conducting the process), interview/focus group questions, questionnaires, online survey questions, debriefing and fact sheets
- Consent Forms (optional, may not be necessary if consent assumed in Information Sheet)

If the text boxes do not allow input in the desired format, please append documents separately to the email when sending this form.

Please then email your completed form (and any separate supporting documents) to your supervisor/project investigator. Project investigators or independent academics may return form directly to sapdethics@reading.ac.uk

5. Supervisor/project investigator review. Section to be completed by supervisor/PI where relevant.

Participant information sheet(s), data collection tools and any other supporting information may be pasted in [section 7 below](#). Alternatively they may be attached to this email. Please review these documents and then complete the checklist below.

Checklist. Does this application and supporting documents adequately address the following ?

- The safety of the researcher(s) and those collecting data, the safety of the participant(s)
- Is the language /grammar/content appropriate (i.e. University standards and reputation upheld)
- There are no questions that might reasonably be considered impertinent or likely to cause distress to the participants
- The researcher has provided the participant information sheet (mandatory)
- The researcher has provided the questionnaire or survey/ workshop, focus group or interview questions (mandatory)
- The Participant Information Sheet gives sufficient information for the participants to give their INFORMED consent
- A separate consent form has been included (optional)
- Data will be handled, stored and deleted appropriately according to University guidelines, and the participants have been adequately informed about this in the Participant Information Sheet
- The Participant Information Sheet contains all relevant sections

- I am satisfied that this application meets the minimum standards for APD Ethical Clearance to be granted**

Supervisor/Project Investigator, please forward this form as a WORD document and any separate supporting documents to sapdethics@reading.ac.uk. The form will be logged by the student office and allocated to an APD ethics committee reviewer. The APD ethics reviewer will review the application and complete section 6.

6. APD ethics committee review. Section to be completed by APD Ethics Committee member.

Decision

- | | |
|--|---|
| <input type="checkbox"/> Clearance refused | <input type="checkbox"/> Resubmission required |
| <input type="checkbox"/> Clearance granted as presented | <input type="checkbox"/> No need to resubmit once amended |
| <input checked="" type="checkbox"/> Clearance granted subject to revisions suggested | <input type="checkbox"/> May require further information |
| <input type="checkbox"/> Referred to APD Research Ethics Chair | |

Ethics Committee Member please enter comments, reasons for rejection, summary of revisions required before proceeding (if applicable):

Section 4:

It says the names will be kept for 6 months and then later it says "These identifiers and their linked contact information will be held in password -protected spreadsheet file, with the password known only me and my supervisors. This information will be destroyed by the end of 2022." - The contact information should be destroyed after 6 months, and the data by the end of 2020. Need to rewrite above sentence accordingly and verify with supervisor, need to change information sheet accordingly.

Q13A, Q16, Q17, Q95, Q97 - add option "prefer not to say"

Information sheet: Need to provide information to participants about the procedure how to withdraw from the survey, i.e. respondents need to store their referene number.

Committee Member Name: Ariane Kehlbacher

Date Reviewed : 09/05/2019

APD Ethics Committee member electronic signature (For signature, save document as pdf, then open pdf and use 'sign' option. Alternatively check here if no electronic signature used)

APD Ethics Committee Member : Now please email this completed form (as signed pdf) to sapdethics@reading.ac.uk together with any separate supporting documents . The student office will record the outcome and return the completed form to the applicant with the decision.

Appendix M: Miller survey – Ethical clearance

School of Agriculture, Policy and Development

**ETHICAL CLEARANCE
GRANTED**



Form 2. MSc PhD Staff Ethical Clearance Submission Form

PLEASE allow a minimum of 3 weeks for this process.

You must not begin your research until you have obtained consent as evidenced by this form returned from the APD student Office signed and dated. Ethical Clearance cannot be granted retrospectively.

This form can only be used if the application :

- Does not involve participants who are patients or clients of the health or social services
- Does not involve participants whose capacity to give free and informed consent may be impaired within the meaning of the Mental Capacity Act 2005
- Does not involve patients who are 'vulnerable'
- Does not involve any element of risk to the researchers or participants
- Does not involve any participants who have a special relationship to the researchers/investigators

If any of the above apply, please refer to the APD Ethics Chair to decide whether an application can be made through the APD review process or whether the application needs to be referred to the full University Committee.

It is the applicant's responsibility to check for any particular requirements of a funder regarding ethical review. Some funders may require that the application is reviewed by full University Committee and not the devolved School committee.

Full details of the University Research Ethics procedures are available at <http://www.reading.ac.uk/internal/res/ResearchEthics/reas-REethicshomepage.aspx> and you are encouraged to access these pages for a fuller understanding. Some helpful advice is available on this link <http://www.reading.ac.uk/internal/res/ResearchEthics/reas-REwhatdoineedtodo.aspx> and the FAQs are particularly relevant.

ALL QUESTIONS MUST BE COMPLETED.

APD Ethical Clearance Application Reference Number : 001296

1. APPLICANT DETAILS:

Main applicant name:	Savita Tangwongkit
Name of academic supervisor/project investigator:	Philip Jones, Professor C S Srinivasan
Email Address (decision will be emailed here):	s.tangwongkit@prg.reading.ac.uk
MSc Student	<input type="checkbox"/>
PhD Student	<input checked="" type="checkbox"/>
Staff Member	<input type="checkbox"/>
Other (please specify)	Click here to enter text.

2. PROJECT DETAILS:

Title of project: The Survival of Thai Sugar Producers and Stakeholders in the Wake of Changes to the Thai Sugar Regime

Please provide a lay summary of the project, including what is being investigated and why: Over a decade, Thailand has become the world's fourth largest sugarcane producer and second largest sugar exporter. While there have been a number of drivers of this growth, the primary driver has been wide-ranging government support measures. Recently, the Thai government has emphasized the need for policy reform as a part of a boarder industry restructuring to bring the Thai cane and sugar sector up-to-date with the current and future developments in the international sugar market. Because of the sector's historical dependence on government support, any such reform is likely to have a very significant impact on the fortunes of all stakeholders in the sector, including sugarcane farmers, sugar millers and policy makers. This research aims to explore the impact of three policy scenarios, representing a spectrum of policy approaches, on Thai cane and sugar producers. First, a policy choice framework has been used with policy makers and academics' to identify a

set of three policies that would be effective in the Thai sugar sector. Second these scenarios were presented to a sample of sugar cane producers to explore their likely responses. In the survey for which this ethical clearance application is being made, the responses of a sample of sugar millers, both to the policy scenarios and farmer responses, will be explored.

Procedure. Please outline the project's research protocol (what procedures, research methods and analysis methods are being used) : Sugar millers' responses to change in policy will be investigated by means of survey (this is the object of this ethical clearance application). A sample of 15-20 sugar millers will be selected, representing around 30-40 % of the total population. A survey will be used to collect data from this sample. The survey questionnaire will be divided into 2 main sections. First is section A which will capture information on the socioeconomic characteristics of the company including: products produced, business diversification, revenue sources, outputs, financial position, distribution and marketing, human resources, research & development and attitudes towards the government's regulations and policies. Section B contains questions aimed at their reactions to the three different exploratory scenarios. Respondents will complete this section by answering questions related to the 'libertarian' , 'government proposal plan' and 'protectionism' scenarios, respectively. At the beginning of each scenario section, explanatory information about the policy scenario will be given. All respondents must read in policy information pages before completing the questionnaire. This and other information generated by this project will help policy-makers to select the best policy options that maximizes benefits of all stakeholders in Thai cane and sugar industry.

The survey will be distributed by e-mail to sugar millers. Personal identifiers will not be stored with the data collected. Sugar millers will be identified only with a code number in the dataset. The link between the code number and the refiners' identity will be stored separately in another secure file. Quantitative methods will be used to analyse the data by using Microsoft Excel (for storage) and SPSS software (for analysis).

Period over which the data collection is to be undertaken (note: data collection CANNOT commence until ethical approval has been granted as evidenced by this form signed and returned).

Proposed Start Date: 01/08/2020
Proposed End Date: 01/10/2020

3. THE RESEARCH:

- a) **Nature and number of participants** who are expected to take part in your survey/focus group. Please estimate if uncertain. As ethical clearance involving minors is more complex because of safeguarding and consent issues, please consider carefully whether you need to involve minors under the age of 16 in your research.

Participants	Number participating
Minors under 16 years of age	0
Students	0
Other members of the University	0
Members of the general public	0
Businesses	15-20 sugar millers
Government officials	0
Other <i>If other please specify:</i>	0

- b) **Funding.** Is the research supported by funding from a research council or other external sources for example a charity or business?

Yes If yes, please specify funder : [Click here to enter text.](#)
No

If yes, it is the responsibility of the applicant to check for any particular requirements of the funder regarding ethical review. Some funders may require that the application is reviewed by full University Committee and not the devolved School committee.

- c) **Recruitment.** Please describe recruitment procedures. How have participants been selected? Are there any inclusion/exclusion criteria? Participants must be told on the Participant Information Sheet how and why they have been selected. You should attach any recruitment materials to this application. **The participants for this survey consist of 15-20 sugar millers. The participants will be selected by stratified sampling based on region where factory is located. Contact names and addresses will be obtained from The Office of Cane and Sugar Board (OCSB) online database. Millers will be recruited by means of an invitation letter, which will explain the nature of the research and their potential role in it.**

- d) **Exceptions.** Does the research involve minors, medical patients, individuals with learning difficulties, vulnerable adults, participants recruited through social service departments, or anyone in a special relationship with yourself/data collectors? E.g. Supervisor; lecturer to a group of students; or person in a position of responsibility for participants.

Yes
No

If yes, this may result in referral to the University Research Ethics Committee (please note their deadlines). Please provide extra detail here: [Click here to enter text.](#)

- e) **Where is the data collection to be undertaken?** Specify country(ies) and specific location(s) **The data will be collected by using the attached questionnaire, which will be e-mailed to participants whose factory is located in the Central, North, North-East and East regions, Thailand. There will be no need for site visits, as data can be collected from the UK. Participants will be able to contact the researcher by telephone and email if they require more explanation or advice on completing the questionnaire.**

- f) **What forms of data collection does the research involve?**

Group discussion/ workshop
Personal interviews
Telephone interviews
Questionnaire/paper survey
Postal survey
Email/ online survey
Which software tool will be used, if any? [Click here to enter text.](#)
Other (specify): [Click here to enter text.](#)

- g) **Who will undertake the collection and/or analysis of data?**

Myself
Other MSc students
Other Higher degree students
Other contract research and/or academic staff
Individuals outside University
External organisations

If individuals outside the University and/or external organisations are involved in the collection or analysis of data, give brief details below. Indicate how the ethical procedures and standards of the University will be satisfied: [Click here to enter text.](#)

h) Does the research require participants to consume any food products?

No
Yes

If yes, please provide full details and indicate measures in place to ensure excellent food hygiene standards and ensure participant safety. [Click here to enter text.](#)

i) Do you consider there are any potential ethical issues in this project? Does the research require collection of information that might be considered sensitive in terms of confidentiality, potential to cause personal upset, etc.?

No
Yes

If yes, please provide full details and indicate how these issues will be addressed, how researchers will manage participant reaction. Support and de-brief sheets should be attached if relevant. [Click here to enter text.](#)

j) Will the research involve any element of intentional deception at any stage? (i.e. providing false or misleading information about the study, or omitting information)?

No
Yes

If yes, this must be justified here. You should also consider including debriefing materials for participants which outline the nature and justification of the deception used. [Click here to enter text.](#)

k) Are participants offered a guarantee of anonymity and/or that the information they supply will remain confidential?

Yes
No

If yes, give brief details of the procedures to be used to ensure this and particularly if the data has 'linked' or 'keyed' anonymity (eg. where published results are anonymous but participant details are recorded and held separately to the responses but keyed with reference number) : [Click here to enter text.](#)

l) Will participants be required to complete a separate consent form? Many APD applications do not require participants to complete a separate consent form. Please see the templates provided.

- Yes. Names, addresses and copies of completed forms will be given to APD student office
 No. The data collection is anonymous and a combined information/consent sheet supplied
 Neither of the above, or the research involves participants under the age of 16

If 'neither of the above' selected, or the research involves participants under the age of 16, please outline the specific circumstances. [Click here to enter text.](#)

m) Will participants be offered any form of incentive for undertaking the research?

No
Yes

If yes, give brief details, including what will happen to the incentive should the participant later withdraw their input or decide not to proceed : [Click here to enter text.](#)

4. DATA PROTECTION

Data Storage, data protection and confidentiality. Please make sure you are familiar with the University of Reading's guidelines for data protection and information security. <http://www.reading.ac.uk/internal/imps/>

Please outline plans for the handling of data to ensure data protection and confidentiality. Covering the following issues: Will any personal information be stored? How and where will the data be stored? Who will have access to the data? When will it be deleted?

The responses to the survey will be kept confidential. Name and contact information will be stored for 6 months in case it is necessary to contact the participant for follow up questions. Name and contact information will be linked to the original responses in the stored dataset by means of a unique code identifier. These identifiers and their linked contact information will be held in password-protected spreadsheet file, with the password known only by myself and my supervisors. The electronic data file and contact information will be destroyed by the end of 2022. The participant's identities will not be published as a part of the research and data will be presented in aggregate form so that it will not be possible to identify any individual from their responses. The survey will be collected using anonymised questionnaires which will be used by myself and my supervisors for the purpose of this research project. Once the survey has been translated to English, the original Thai language questionnaires will be destroyed. The English language versions of questionnaires will be securely retained for five years by the University of Reading and then destroyed. The questionnaires will contain no personal identifiers beyond a code number.

Applicants: Please now scroll to Section 7 to input your :

- Information Sheet(s) for Participants (mandatory)
- Data Collection Tools, for example: recruitment materials, interview/focus group protocols (how you are conducting the process), interview/focus group questions, questionnaires, online survey questions, debriefing and fact sheets
- Consent Forms (optional, may not be necessary if consent assumed in Information Sheet)

If the text boxes do not allow input in the desired format, please append documents separately to the email when sending this form.

Please then email your completed form (and any separate supporting documents) to your supervisor/project investigator. Project investigators or independent academics may return form directly to sapdethics@reading.ac.uk

A decision on whether ethical clearance has been granted will be emailed to you via the APD Student Office along with your authorised form.

You may NOT proceed with your data collection until ethical approval has been granted as evidenced by return of this approved form.

Note: The process of obtaining ethical approval does not include an assessment of the scientific merit of the questionnaire. That is the separate responsibility of your supervisor/project investigator in discussion with yourself.

5. Supervisor/project investigator review. Section to be completed by supervisor/PI where relevant.

Participant information sheet(s), data collection tools and any other supporting information may be pasted in [section 7 below](#). Alternatively they may be attached to this email. Please review these documents and then complete the checklist below.

Checklist. Does this application and supporting documents adequately address the following ?

- The safety of the researcher(s) and those collecting data, the safety of the participant(s)
- Is the language /grammar/content appropriate (i.e. University standards and reputation upheld)
- There are no questions that might reasonably be considered impertinent or likely to cause distress to the participants
- The researcher has provided the participant information sheet (mandatory)
- The researcher has provided the questionnaire or survey/ workshop, focus group or interview questions (mandatory)
- The Participant Information Sheet gives sufficient information for the participants to give their INFORMED consent
- A separate consent form has been included (optional)
- Data will be handled, stored and deleted appropriately according to University guidelines, and the participants have been adequately informed about this in the Participant Information Sheet
- The Participant Information Sheet contains all relevant sections

- I am satisfied that this application meets the minimum standards for APD Ethical Clearance to be granted**

Supervisor/Project Investigator, please forward this form as a WORD document and any separate supporting documents to sapdethics@reading.ac.uk. The form will be logged by the student office and allocated to an APD ethics committee reviewer. The APD ethics reviewer will review the application and complete section 6.

6. APD ethics committee review. Section to be completed by APD Ethics Committee member.

Decision

- | | | |
|--|-------------------------------------|----------------------------------|
| Clearance refused | <input type="checkbox"/> | Resubmission required |
| Clearance granted as presented | <input type="checkbox"/> | |
| Clearance granted subject to revisions suggested | <input checked="" type="checkbox"/> | No need to resubmit once amended |
| Referred to APD Research Ethics Chair | <input type="checkbox"/> | May require further information |

Ethics Committee Member please enter comments, reasons for rejection, summary of revisions required before proceeding (if applicable):

- As an exception, I approve this application even if Question 3K is not completed. The data collection can start conditional to the satisfactory approval of the supervisors of how anonymity will be managed (Question 3K).
- Section 4: You specify that the data will be destroyed no later than 31/12/2022. In the Participant Information Sheet it is stated September 2022, please make the two dates consistent. More importantly, think carefully if this is appropriate. By then you assume you have already had the viva and published all the papers.

Committee Member Name: GIACOMO ZANELLO

Date Reviewed : 26/06/2020

APD Ethics Committee member electronic signature (For signature, save document as pdf, then open pdf and use 'sign' option. Alternatively check here if no electronic signature used)