A Systematic Method of Developing Information Sharing Systems based on Activity Theory

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بسم الله الرحمن الرحيم

In the name of Allah, the entirely merciful, the especially merciful.

Author's Declaration

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

Abdulla Ali Alhefei.

Dedication

This PhD thesis is dedicated to

my Mother, my lovely Family,

Brothers, Sisters and

my Friends for their

support and encouragement.

Acknowledgements

"He who does not thank people, does not thank Allah". (Prophet Muhammad).

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Abstract

Information sharing in policing enables proactive and preventative work to enhance welfare, security and safety for the public; however, achieving these goals requires having an effective and efficient mechanism for sharing information within and between organisations. There is currently no systematic approach to specifically analyse the requirements of an information sharing system, which motivates the need to develop such an approach. In this research, the Activity Theory was taken as a basis to identify the requirements of the approach and design a suitable framework, which was then evaluated through the use of two case studies in the public sector in the United Arab Emirates (UAE).

This research aims to design an information sharing framework that takes proper account of the actors and their activities to improve the information sharing system. To this end, it presents the development of the Activity Theory-based Information Sharing Analysis (AcTIShA) Framework, proposing a mechanism for analysing the information need and supporting the information sharing. This framework incorporates the concept of information analysis adopted from the Activity Theory, which is used for understanding the information. The Activity Theory plays a crucial role in analysing the elements concerned with the information, such as actors, actions, information artefacts and purposes within the organisation's activities. To illustrate the application of the AcTIShA-Framework, a system design based on its use is demonstrated.

The design science research paradigm is adopted to evaluate the outcomes of the framework through two case studies. These were carried out in two different public sectors of the UAE, namely the Ministry of Interior and the Ministry of Health, to evaluate the AcTIShA-Framework. The focus group method was conducted with a variety of participants from both sectors to discuss and evaluate the information sharing

mechanism. It is demonstrated that the framework provides a systematic and versatile approach to be utilised to improve the sharing of the information among organisations, and that it will benefit the development of information sharing systems.

The conclusions, contributions and suggestions drawn from this study are used to extend the activities of information sharing. Finally, the research provides guidance for developing information sharing systems.

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List of Abbreviations

AcTIShAF	Activity Theory-based Information Sharing Analysis Framework
AIS	Artificial Intelligence Software
CA	Competent Authority(s)
CPSS	Civilian Private Security Services
CSCW	Computer Supported Cooperative Work
CSS	Crime Similarity System
DSR	Design Science Research
FBI	Federal Bureau of Investigation
GIS	Geographic Information Service
IAANA	Information Artefacts for Action Network Analysis
IRS	Information Requirement Set
IS	Information System(s)
MDT	Mobile Data Terminal
MOH	Ministry of Health
MOI	Ministry of Interior
PSCRD	Private Security Companies Regulatory Department
PSCs	Private Security Companies
PSG	Private Security Guard(s)
PSM	Premises Security Manager
SG	Security Guard(s)
SS	Security Supervisor(s)
UAE	United Arab Emirates

Related Publications

- Alhefeiti, A. & Nakata, K. (2017), November. A framework for information-sharing analysis based on activity theory. In *Proceedings of the 3rd International Conference on Communication and Information Processing* (pp. 151-157). *ACM.*

- Alhefeiti, A. & Nakata, K., (2016), August. A preliminary study on information sharing practice between police and private security companies in the United Arab Emirates. In socially aware organisations and technologies. Impact and challenges: *17th IFIP WG 8.1 International Conference on Informatics and Semiotics in Organisations, ICISO 2016, Campinas, Brazil, August 1-3, 2016, Proceedings* (Vol. 477, p. 231). *Springer.*

Chapter 1: INTRODUCTION

1.1   Research Background and Motivation

The main task of any police force is to ensure safety for properties and people's lives; the police prevent and detect crime by preserving law and instruction (Luen & Al-Hawamdeh, 2001). The entire research presented here has been carried out with reference to the United Arab Emirates (UAE), where the Private Security Companies Regulatory Department (PSCRD) and Private Security Companies (PSCs) play a main role to maintain security and safety. Therefore, the PSCRD needs to be an important feature of the police work. Further, the police have to be proactive in managing and regulating crime prevention and safety, in order to provide a professional security services for the whole Emirates, cities, and towns; the PSCRD implemented the Civilian Private Security Services (CPSS) system to enhance the level of security. Essentially, implementing and enhancing the information sharing within the PSCs and PSCRD can help to prevent and detect crime. There is a lack of systematic method to analyse information sharing that leads to information sharing system design. Therefore, developing and enhancing information sharing methods and designing a beneficial information sharing framework among the police and PSCs in their operations and activities are vitally important in the Ministry of Interior in the UAE.

Security is one of the most vital components of any country's development, and every government has a practical and moral obligation to ensure that its citizens are secure from any danger or harm. Therefore, supportive collaboration and information sharing between the police departments and PSCs becomes a critical task for ensuring security

and safety for all. Regardless, there exist some challenges in the current security system such as an inconsistency and inefficiency in communication and information sharing that hinder collaborative policing. This includes the understanding related to CPSS, its roles, its various aspects, and the understanding about its working. These challenges focuses on the information sharing for supporting collaboration in policing for managing crime prevention and safety with the help of the CPSS.

In recent years, the scope and size of the CPSS has grown at a faster pace. The growth is dramatic in terms of its economies of scale. It is due to this reason that the security concerns are increasing day by day; these concerns include crime prevention and safety assurance, which make the society feel secure, and determining the priorities of all the regulatory authorities at all levels. The security concerns alert the sectors at all levels involving country, local, and personal levels because of the high demand to increase security. Police forces' roles and contributions are significant to make their society feel highly secure.

Existing research has studied the effects of information sharing, which is used to enhance competitive benefits in the context of huge commercial enterprises (Fowler & Pryke, 2003). The information sharing in the police departments within a society has also resulted in an increased number of external security staff being contracted when crime and other anti-social behaviours increase in the society. This has resulted in improved hybrid policing as well as increasing the proliferation of bodies responsible for community policing. This has enhanced the signalling of crimes and improvement of control signals for insecurity. Through the PSCs, societies have been given the power to authorise some people to promote public safety through visible patrols, which is the

primary element of reassurance policing. "The information shared has enabled the police to counter the feelings of insecurity through a visible presence within the society" (Rowland & Coupe, 2014, p. 269).

1.2   Research Problem

Police departments in the UAE support the security and safety of society, and this is at the top of their priorities to maintain the stability of citizens' lives. To fulfil this requirement, PSCs are providing security services throughout the country at significant and highly sensitive premises. Unsworth (2014) supported that the information sharing and interaction research is common for a diversity of complex information sharing environments; however, little of such research is associated with policing and the public. Research is limited by issues of ethics, data maintenance and confidentiality. Further, a research gap exists between in the policing and security conceptualisations of information sharing and approaches to effective information system management. The PSCRD regulates, manages, controls and monitors the PSCs. It is crucial for information to be shared between the PSCRD and PSCs; however, ineffective information sharing is evident between the two parties.

In this research, data were collected through conducting interviews and running several scenarios. It was found that from the police perspective, ineffective information sharing between the PSCRD and PSCs creates obstacles that make it difficult for the police to do their jobs effectively. Furthermore, police departments require support from PSCs to maintain safety and security in the UAE; however, information sharing and communication between the PSCRD and PSCs are considered ineffective because of two particular issues: one is the delay in information being reported to the police control room

and the second issue is the inaccuracy of the information shared. According to Wyllie (2009) investigated problems associated with policing information sharing and argued that technology is not the primary factor in information sharing issues for law enforcement agencies. Rather, organisational inertia, behavioural and cultural impediments and operational and structural barriers were found to be the primary obstacles to collaboration and information sharing. Fundamentally, the information sharing tools and systems have been introduced without systematic understanding and proper analysis and consideration of information sharing activities. Therefore, in order to develop a better information sharing system it need to have a better method of understanding how information is carried out and what kind of tools is useful and needed in order to support information sharing.

1.3 Research Aim and Objectives

This research seeks to analyse the practice of communication and information sharing between organisations in the UAE and review the existing literature, while also addressing the limitations of the existing methods for information sharing systems; to this end, it develops a suitable framework which it then evaluates. Therefore, the aim of this research is to develop a systematic method for developing information sharing systems that enables understanding of information sharing needs and practices within policing to inform the choice of tools in the UAE. The following objectives have been set to achieve this aim:

Objective 1:   To review approaches to information sharing in public/private sector work;

Objective 2:   To examine the current practices of information sharing between the parties in the UAE;

Objective 3:   To analyse the limitations in information sharing within policing in the UAE;

Objective 4:   To develop a systematic method of developing information sharing systems; and

Objective 5:   To evaluate the proposed framework through case studies.

These objectives of the research seek to fulfil the main aim of the study, and are devised to answer the research questions. The next section explains the expected contributions of this research.

1.4   Expected Contributions

This research aims to benefit the future researchers and the users in the government sectors in the UAE. The lack of information sharing has been explored and the use of such an approach has been limited so far within the policing in the UAE. This research deeply explores the process of the potential of this method and thus develops a systematic framework for designing the information sharing mechanism. This research has two expected contributions. The first is the theoretical contribution, to enhance the understanding of information sharing between organisations, departments and individuals. This is due to the lack of information sharing between these stakeholders. It is therefore necessary to develop an information sharing framework to improve the information sharing system between organisations, and then enhance the framework as

a solution to the research problems. The second is the practical contribution, which is to provide an effective and efficient operational framework which can be adopted by organisations to analyse information sharing operations and information sharing in distributed applications.

1.5   Stucture of Thesis

The structure of this thesis is illustrated in Figure 1.1. This thesis is divided into eight chapters: Introduction, Literature Review, Theoretical Foundation, Research Methodology, Activity Theory-based Information Sharing Analysis Framework, Case Studies: Application of the AcTIShA-Framework Model, Evaluation and Conclusions.
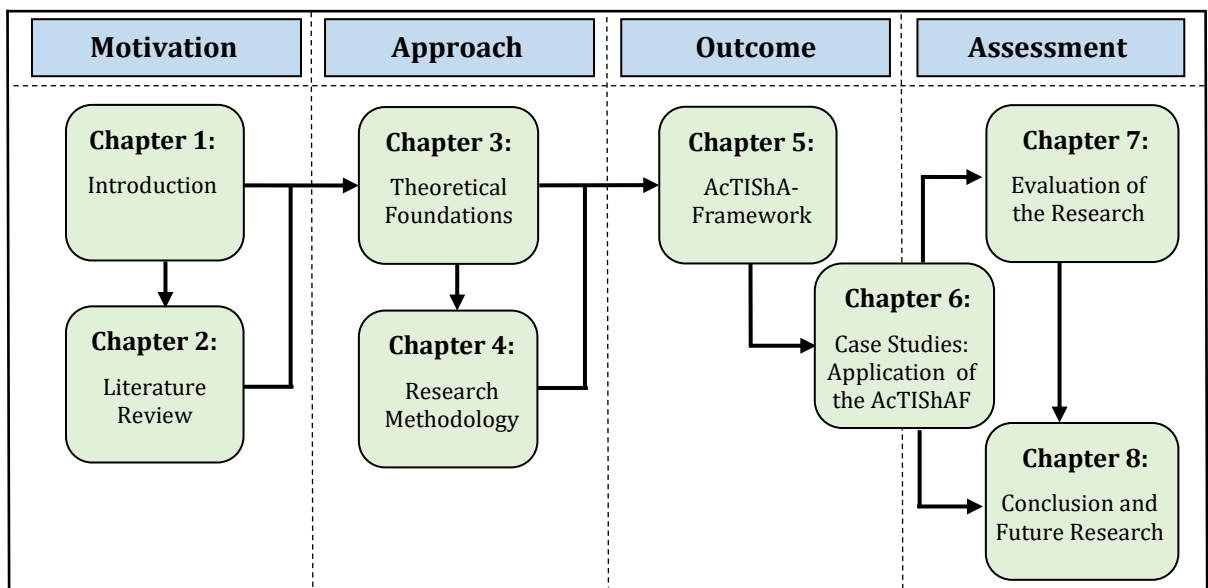
Figure 1.1. Structure of the thesis

Chapter One: Introduction

This chapter briefly introduces the research area and sets out the research problem, background of the research, motivation behind the research, and research questions. The

chapter also states the research aim and objectives, and clarifies the expected contributions of the research.

Chapter Two: Literature Review

This chapter presents a broad review of literature related to collaboration and information sharing, then examines policing as a case for the research and looks at police practices in various countries.

Chapter Three: Theoretical Foundations

This chapter presents the theoretical foundations that underlie the research. Two distinct theories, semiotics and the Activity Theory, are used to analyse and develop the framework of the information sharing mechanism in an organisational context.

Chapter Four: Research Methodology

This Chapter outlines the research methodology, including the philosophical assumptions made. A critical realism approach is used as a guidance, and the main paradigm in this research is the design science research, coupled with a qualitative methodology which involves conducting interviews and focus groups. These methods and techniques are used for data collection and evaluation purposes for this research.

Chapter Five: Activity Theory-Based Information Sharing Analysis Framework

This chapter presents a framework for developing the information sharing system based on the Activity Theory. It also discusses how the information can be analysed within each

activity with the specific instruments and actions. The chapter provides a new concept of understanding the information and its requirements in the organisation context.

Chapter Six: Case Studies: Application of the AcTIShAF

This chapter provides an evaluation of the proposed framework by presenting case studies within the police and health departments in the UAE. It also demonstrates the usability and applicability of the proposed framework by offering findings in terms of effective information sharing.

Chapter Seven: Evaluation of the Research

This chapter presents an evaluation of the research. The chapter critically examines each component of the research and explains the benefits of these components.

Chapter Eight: Conclusion and Future Research

This chapter provides an overview of the research and its conclusions. It discusses the contributions of the study, its limitations, and offers suggestions for future research.

1.6 Chapter Summary

This chapter has introduced the components of the research domain. Firstly, it explained the research background, motivation and problem. Secondly, the research questions were formulated and the aim and objectives of the research were set out. Thirdly, it discusssed the expected contributions of the research, and outlined the structure and content of the

thesis. The background to the research will now be examined in the Literature Review chapter.

Chapter 2: LITERATURE REVIEW

2.1   Chapter Overview

This chapter fills in the background to the study introduced in Chapter 1 by reviewing the relevant literature. It discusses the significance of the collaboration between the police and private security sector. Information sharing is essential for management and supporting protection within the society. The chapter defines information sharing, data sharing systems, and the importance of sharing information in the security sector. In addition, the section discusses various technology systems used in information sharing in police departments. Collaboration amongst the community members, police, and private security agencies is analysed. Lastly, the chapter considers the Information Systems (IS) used in the groupware time-space matrix and how the technology can be adopted by various security agencies and governments.

2.2   Collaboration in Police Activities

Maintenance of law and order in a nation and among community members needs effective collaboration between police officers, different police departments and private security agencies. Such collaboration is necessary in order to achieve the designated goals and objectives when dealing with crime-related issues (Amron, 2002). Collaboration in police activities occurs when different departments, police officers and security agencies work together to accomplish certain goals (Aleksandra *et al.*, 2013). Liaison between Private Security Companies and the police plays a significant part in the maintenance of security as well as safety within communities. The private security sector is seen as a subordinate to the police during operations. The fundamental role of both the police and private

security sectors is to ensure maximum security throughout (Amron, 2002). Moreover, police officers from different departments are supposed to collaborate and work together as teams, together with private security companies, in preventing crime and maintaining peace (Aleksandra *et al.*, 2013).

Globally, inter-organisational collaboration has been found to be fruitful in the management and operation of organisations. Collaborative activity is an essential arena when delivering quality services to the people. The concept of collaboration provides a successful ongoing process in sustaining the activities of organisations (Hickman & Reaves, 2006). The role of collaboration in management is essential and depends much on communication and technology. However, the process of cooperation depends on the objectives of the participating organisations as well as the agencies. Improved collaboration may involve a restructuring of institutions by improving information flows to achieve effective goals (Brown, 2007).

Effective collaboration between police and private security companies should be dedicated to achieving both long-term and short-term goals in providing security and safety within the society (Berlin *et al.*, 2012). The importance of adequate oversight by the civilian private security services depends on the collaboration between CPSS and police services. The activities of private security agency services should abide by the administrative laws and policies (Pardo, 2010).

2.2.1 Definition of Collaboration

Collaboration is a process that involves two or more parties working together towards achieving specific goals (Petri, 2010), who notes that collaboration has been defined as "the act of working jointly to achieve specific goals within the definite period" (p. 74).

However, the description of collaboration varies from one sector to another. In healthcare, Baggs and Schmitt (1988) define collaboration as a process whereby nurses and physicians cooperatively work together by sharing responsibilities in problem-solving, making the appropriate decision, and improving the health outcome of patients. Collaboration between physicians and nurses enhances the health of patients by ensuring proper healthcare. On the other hand, collaboration is defined as the mutual sharing of information and is not separable from the source and the recipient, as it occurs in the social networks (Bao & Bouthillier, 2017).

Bronstein (2003) defines collaboration as an interdisciplinary approach in social work to improve human well-being. Similarly, Nelson *et al.* (1993) state that collaboration is defined as "a cooperative relationship between organisations which relies on neither market nor the hierarchical mechanism of control" (p. 2). Collaboration involves a "process of organising different groups of an organisation's employees into smaller units" (Marcel & Pare, 2003, p.6). Collaborative arrangements will also define the responsibilities within a given department, which include collaborative activities. Collaboration occurs among different organisations and is considered an inter-organisational phenomenon (Petri, 2010). Interdisciplinary collaboration in healthcare has reduced the mortality rate in many countries, especially the developing nations (Petri, 2010).

Some features of collaboration should be taken into account. It may include different forces coming together to achieve particular objectives. The main purpose of the collaborative relationship involves parties strategically working together by cooperating and determining to achieve the shared goals and objectives (McEwen & Weisburd, 2011).

Collaborative effort leads to satisfactory results due to teamwork and cooperation among the parties. The process of collaboration increases success during decision-making and problem solving. Communication is essential before, during, and after collaboration. Parties share ideas, knowledge, and experience to attain specific visions. Stewart and Morris (2009) claim that partnership has been successful in maintaining global security, and it is a process whereby different organisations and departments come together with a common objective to achieve.

2.2.2 Collaboration and Communication Benefits

Effective communication is vital in organisational collaboration. Different organisations agree to work together based on agreement (Marcel & Pare, 2003). Through communication, organisations can share strategic plans collaboratively in achieving goals. Leaders of the agencies should use appropriate channels to communicate strategies. Employees of the organisations must be included in operational activities, including decision-making. Communication skills must be employed to have an effective working process (Bronstein, 2003). The management should share the visions of the organisations through seminars. Continuous training of employees depends on the communications channels used (Inokuchi *et al.*, 2013).

Collaborations with various organisations and departments should be based on similar visions, missions, and goals. The collaborating institutions must have similar objectives and purposes. The agencies should work towards achieving the common goals. Through a collaborative process, both private security companies and police departments can work together to maintain law and order. The collaboration can deal with creative thinking in any given organisation (Hickman & Reaves, 2006). One significant question

that all employees and organisations should answer is *why have collaboration*? The goal of collaboration is to deliver sustainable services within a limited time and appropriately. Shared visions and goals enable organisations to use the available resources sustainably (Bronstein, 2003). Collaborations increase individuals' and teams' performance through raising motivation and morale. Employees are self-motivated through teamwork and remain committed to achieving the goals and objectives of the organisation (Lindsay *et al.,* 2011).

Collaboration leads to "unity as the employees are allowed to interact with each other and learn new skills and techniques" (p.14) through the interaction using mobile technology (Lindsay *et al*., 2011). Organisations collaborating have achieved big dreams in various fields such as health, education, climate change, security, and agriculture. Various organisations have partnered together by collecting and using the available resources to solve human problems with challenges (Bharosa *et al*., 2009).

In the health sector, organisations such as foundations, hospitals and health research centres have collaborated toward combating various diseases such as cholera, malaria, HIV AIDS, and other illnesses (Curtis, 2001). The organisations raise the available funds together to solve community problems. In addition, different states have also come together to solve global issues such as climate change, hunger, drought and diseases during disaster rapid response (Bharosa *et al*., 2009). Collaboration has led to globalisation, and human interaction has been broadened. The success of collaboration depends on the type of leadership among the organisation. Leadership is a process of influencing and promoting individuals to participate in a particular manner with the aim of achieving defined goals and objectives. The motivation of other individuals might be

accomplished in an assortment of ways that influence leadership styles to solve the challenges affecting information sharing (Bharosa *et al.*, 2009).

2.2.3 Collaboration in Policing

The private security sector and the police work together to ensure maximum security and safety in the society (Hersberger *et al.*, 2005). In the security context, both the police and private forces must holistically cooperate in a manner without competition and as a united team. Collaboration between federal and local police and the local law enforcement in the U.S. has been successful through cooperation (Stewart, 2011). The main purpose of cooperation between the police and private agencies is to increase efficiency in security services. Collaboration in police activities occurs when different departments, police officers, and security agencies work together to accomplish certain goals (Aleksandra *et al.*, 2013). Liaison between private security companies and the police plays a significant part in the maintenance of security in addition to safety within communities.

Law enforcement officers should work together with private agencies and community members to deliver adequate security and safety. Collaboration in providing police services is crucial and should be done in a strategic manner (Pardo, 2010). The police officers, departments, and other security agencies should have a common goal of ensuring peace and security. In addition, the police are expected to collaborate when dealing with drug trafficking and other illegal activities such as terrorism and piracy (Stewart, 2011).

Collaboration is considered to be a fundamental feature of law enforcement, especially in matters of community policing (Carter, 2015). Negative impacts have been faced concerning the law enforcement not collaborating in an efficient way, including failures that allowed the occurrence of violent crimes (Rose & Hibsman, 2014). Various arguments

have been raised among the police to describe the benefits of collaboration in the Police Department, for example, that it seeks to avoid the duplication of efforts of an individual or a company engaged on the same activity and instead distributes efforts in the most effective manner. Advocacy is also an important factor in further enhancing policing, especially in the allocation of resources for collaborative efforts involving two or more enforcement agencies (Madon *et al.*, 2016).

Collaboration in policing is associated with the development of more public recognition and the visibility of cooperation between the community and the police. It is therefore necessary for the police to form a collaborative partnership with the public, as it enables them to acquire the answers to pressing community problems (Davis, 2014). Previous evidence from law enforcement agencies has shown that the police can seldom resolve issues of public safety by themselves. Given this, they encourage the formation of interactive partnerships with the stakeholders and other interest groups within the community. Through the approach of problematic collaborative resolution, the partnerships formed can then be exploited to achieve interrelated goals that bring about an increase in the public trust and the improvement of problem resolution (Rose & Hibsman, 2014). For effective collaboration to be undertaken in policing, individual elements should be present, such as teamwork tactics, an action plan, expertise, and an open form of direct communication. Furthermore, there should be trust among the partners and stakeholders who have a vested interest in the entire collaboration (Sanders, 2014).

2.2.3.1 Views of the Relationship between the Police and Private Security Companies

The partnership between the private security sector and police departments provides for communities to leverage the available resources towards protection from threats and combating them. Stewart (2011) asserts that police chiefs play a vital role in planning and organising effective collaboration between the police and other law enforcement agencies. The most successful and efficient means of combating criminals such as terrorists has required a partnership between the police and private security sector through collaboration; the security agencies can combat, prevent and reduce cases of crime within the society (Abrams, 2013). Psychologically, police officers are mostly restrained and operate in isolated constraints, thereby disconnecting them from socialising with community members. The restrained association between the public and police creates fear. Private security guards (PSGs) are always living within the community, creating friendly environments with the public, thus making society more cooperative with them than the police (Pardo, 2008).

During operations, the police and private security companies jointly work together when gathering information from the public. The partnership between the police and private security sectors leads to knowledge and experience sharing between the two agencies (Hersberger *et al.*, 2005). Here, information-sharing plays a vital role in the collaboration. The police and private sectors must share valuable information before joining forces in any operations to avoid confusion and contradiction. The enforcement of law depends on many factors such as public and private participation. However, collaboration between the police and private security sectors is hindered by numerous

factors such as lack of understanding, technology adoptions and the differences in training, skills, and experience (Aleksandra *et al.*, 2013).

The police and private security sector in the UAE work together in many circumstances such as providing security and safety to both people and property. The government has strengthened and empowered the private sectors by giving them security licenses and permits. The departments collaborate during operations to identify and arrest (Abrams, 2013). Collaboration in the law enforcement agencies across all the levels of the government could have prevented the September 11 attack by leading to appropriate policing (Stewart, 2011). Collaboration between law enforcement agencies such as the federal and local police in Texas has been possible through proper coordination (Stewart, 2011).

The private security sector has always been engaged to offer support to the police during emergencies and attacks. Similarly, the police intelligence works as a team with the private security companies during crime investigations (Abrams, 2013). However, there should be a limit during collaborative missions to restore peace law and order. In many circumstances, private security companies are not allowed to arrest without the help of the police force. Moreover, the private sectors are mostly guarding businesses, wealthy homes, companies, and organisations. Some private security firms are stable enough to carry out night patrols within the communities with the collaboration of the police force. The private security companies collaborate closely with the police in maintaining law and order (Pardo, 2010).

The role played by the private security sector has increased drastically with many companies emerging to deliver security services. In the U.S., the Federal Bureau of

Investigation (FBI) agencies collaborate with private security agencies to deliver safety measures to the people (Davies & Murphy, 2005). The dramatic increase in private security agencies has boosted security measures in many nations. The collaboration between police officers and private security agencies has delivered successful operations, especially in circumstances where the police have failed (Davies & Murphy, 2005). The civilian private security services offer services similar to police forces by preventing crimes, protecting people and property as well as information. However, police officers cannot carry out their activities and roles without collaboration. The police force should work together as a team and collaborate with other security agencies and departments.

Civilian private security services do not offer their services for free. The facilities are paid for and mostly used to protect private homes, business and companies. Similarly, the CPSS are separated from public entities but collaborate in delivering security (Brown, 2007). The private security services are also obligated to offer anti-piracy, anti-terrorism and drug protection services at both national and international levels.

2.2.3.2   Police Collaboration and Activities

Police leadership and management include various law enforcement leaders such as officers, researchers, lawyers, judges, and the other stakeholders. Their activities are complex and thereby require collaborations. There is a need for effective collaboration between the police and other stakeholders, including community members. Police officers must work together when delivering services to the community. The communities' members should work together with police officers in combating crime (Hersberger *et al.*, 2005). Criminal activities in the society occur within the members of the organisation who know each other well. Gangsters, terrorists, pirates, and drug harlots are found within the

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community. Police officers can only make their investigations by cooperating with the public and other security agencies. Similarly, collaboration between police officers and other stakeholders like regulates the activities of police. Police officer are not allowed to take the law in their hands. The maintenance of law and order should be done within the constitutions without violating human rights (Brown, 2007).

Police activities involve and require maximum collaboration. Teamwork in the police force is essential to deliver effective services (McEwen & Weisburd, 2011). Police and the existence of a systematic framework between the two stakeholders assures security within any given locality. Police officers are exposed to dangerous circumstances during their daily activities, such as patrols. Different departments in police forces should communicate and share useful information related to crime. A lack of collaboration between private security companies and the police may slow the process of investigation, thereby causing more problems (McEwen & Weisburd, 2011). In practice, the police have always been seen working with partners when performing their daily activities.

Liaison with the police makes it easy to maintain law and order. Many nations, including the UAE, have embraced law enforcement by both the police and private security agencies. The UAE government promotes collaboration between the police and private security agencies (Brown, 2007). The partnership has also been highly adopted in recent developments in the security sectors. Community policing requires the participation of all the security agencies to promote security and safety in the society. Collaboration between the police and private sectors has not only protected the organisation from criminal threats but also safeguarded the officers. Effective collaboration requires resources, training and public participation (Abell, 2008). The

community members should be involved in decision-making and the police in matters related to security. The police get orders from top management and have to operate according to the instructions (Pardo, 2010). The top leaders must incorporate community members in all the operations to ensure maximum security and safety.

2.3   Information Sharing in Police Activities

Information sharing is the process of exchanging data between different departments and organisations. The data are sent to senders and receivers through an appropriate channel with the aim of receiving relevant information (Lewis & Lewis, 2012). The exchange of data between various organisations and people should be done with permission and consent. Information sharing among the law enforcement agencies has developed considerably across all the sectors of government, including the police sector, as reported by Butalia *et al.*, (2017). The benefit of this is that there has been an improvement in the capability of the law enforcement to identify, avert and even react to acts such as terrorism. Furthermore, sharing information in the law enforcement sector is not an independent process. It entails a broad range of processes in a wide number of communities at all levels of government (Ma *et al.*, 2015). With information sharing, the element of interagency collaboration is achieved. The local, state, and federal enforcement agencies have collaboratively conducted activities to ensure that they deal with the criminal activities in an efficient way (Shah & Fayaz, 2016). As such, they have formed alliances and developed greater collaborations that streamline normal procedures, facilitate the enactment of new policing standards across the board, and co-created systems that give officers the capability to cooperate and even share information.

In the context of such collaboration, the creation of the Joint Terrorism Task Forces (JTTF), which is sponsored by the FBI and fusion centres, has been a representation of a change in culture and preparedness in the aspect of information sharing. Besides, the two stakeholders have led to major agreements being arrived at and partnerships formed to exchange reports on operational data, case files and the investigative information on open and closed investigations (VanderSloot *et al.*, 2016).

Lewandowski and Carter (2017) contend that information sharing must be involved in data analytics and dissemination for these partnerships to prosper efficiently. In the past, the police and correctional agencies have been independent in regard to certain aspects. They entail the Geographic Information System mapping procedures and data analytics to support the activity of operational planning. Mapping is often used by the officials in charge of correction to assign probation and by parole officers to make decisions on the parole terms of convicts. The assigning exercise is usually undertaken by the geographic location where the parolees and probationers are directed to the centres of treatment and service (Bao & Bouthillier, 2017). Additionally, decisions on sites for the creation of new facilities within a community are also encumbered by the exercise of choosing a location that is agreeable to all the participants in the process, which has been seriously challenged by the insufficiency of field data (Wout *et al.*, 2010). Nonetheless, sharing the corrections data on those who are on probation and those waiting to be released within a short time may enable the correctional agencies to assist law enforcement partners in improving the safety of officers and reduce the degree of crime and further increase the rates of investigative clearance (VanderSloot *et al.*, 2016).

2.3.1 Information Sharing

To obtain a better understanding of information sharing, it is vital to investigate the practice of its dissemination empirically and quantitatively (Levy & Ramim, 2016). With the several factors involved and the considerable diversity that may be present, the behaviour of information sharing may be quite difficult to observe directly. One may, however, consider assessing the level of the interactions between the various actors who participate in the activity of information sharing (Takahagi *et al.*, 2015). It has been shown that the number of interactions is an indication of the information sharing between the players. Most organisations usually have certain forms of mechanisms for distributing information. However, this may only take place in the form of paper or as a policy that may later fail when a crisis occurs (Bao & Bouthillier, 2017).

Wu, Chuang, & Hsu (2014) state that there exists a financial risk that can occur due to inadequate funding and from factors such as delayed timelines of completion and anticipated program savings, which are quite significant in projects that entail government funding for information technology. Organisational commitment to privacy, on the other hand, is another hazard that may occur in data sharing (Leidner & Jarvenpaa, 1995). In this case, cloud services and new forms of technologies such as data mining may bring up complex privacy risks. This development may require basic proficiency and unwavering commitment to the entire concept of public policing. The concerns of the public may be quite broad and extensive, but they have been perceived to be quite unpredictable. Liao *et al.* (2016) point out that there are also risks that occur when undertaking an examination of risk in projects and proposals in data sharing, despite the association of information sharing with numerous benefits.

The sharing of information is also widely practised in the government, with the benefits extending to the citizens in terms of service access (Ma *et al*, 2015). Since the 1960s, there have been fears of the risks that would occur as a result of centralising information, especially in the light of accusations of government data mining and unequally distributed access to databases. The hazards observed that would mostly occur were the lack of accountability and enforceable rights, and the inability to correct errors once data travels. Additionally, there are also risks of the loss of control of data by agencies, legal complexity due to sharing among the Federal, Provincial and Territorial (FPT) agencies, incomplete records and the concern of greater transparency. Further risks are hostile users and decisions arrived at due to the utilisation of data that are inaccurate and unrelated, without informing the public (Sayogo *et al.*, 2014).

2.3.1.1 Information Sharing and Technologies Practices

The effective sharing of data, knowledge and intelligence reports within different jurisdictions and forces is one of the factors that affect law enforcement in the greatest way (Sandler, 2010). The success of service provision for any human-oriented service amenities depends greatly on information, its dissemination, and use. Technologies have revolutionised the way information is shared, not least between people, but also between agencies in governance. Leidner and Jarvenpaa (1995) claim that a major part of this effort has been observed to occur between enabling technologies and the management of information. These technologies are made possible by physical and virtual structures that represent the requirement for information, and they have been undertaken to assist firms in extricating and even managing information as a form of corporate reserve (Chen *et al.* 2014).

Cooperative information sharing plays a critical role in organisational management. According to an article written by Mariani & Rodden (1996) on collaborative information sharing, data sharing among organisations has been realised as the most valuable aspect of the daily operations of the group. Information sharing is the process of exchanging vital and crucial information between people, organisations, and institutions with the aim of informing the party and getting back a response (Zhao & White, 2012). Technology is essential in maintaining and transferring information among different groups. The advancement in mass communications and the computer has had a more prominent influence in supporting information sharing between agencies. Information sharing is vital and plays an essential role in the cooperative world by connecting different agencies and organisations. Most data systems are encrypted to enhance security. Information sharing has enabled companies to manage operations efficiently between various departments and organisations (Zhao & White, 2012).

Xiaowen and France (2002) suggest that information sharing can be seen as a type of information behaviour and has attracted the attention of many researchers and practitioners in the library and information science. The role of information sharing behaviour remains unclear. Additionally, information sharing measurement techniques in the police are unavailable and more studies should be done (Lewandowski & Nestel, 2016). The components of information sharing such as the transfer and exchange of quantitative perspectives are uncertain (Cooper & Spencer-Dawe, 2006).

Cooper and Spencer-Dawe (2006) hold the view that information sharing is an umbrella covering a wide range of cooperative practices in sharing data which are accidentally encountered to ascertain formulation and retrieval. Collaborative

information sharing argues that the process of information sharing is a collective information sharing. Collaboration in information is not an individual behaviour but involves social networks among cooperating community members and other agencies. Inokuchi *et al.* (2013) observe that information sharing in the health sector has led to quick decision-making processes during emergencies.

Cooper and Spencer-Dawe (2001) further argue that information is sharing a phenomenon that is influenced by many factors other than personal attitude and attributes. Shaw (2000) disagreed with Cooper and Spencer-Dawe (2012) by identifying their main types of coordination in the supply chain, e.g., simple information exchanges such as vendors and customer exchange data in business. The second coordination acknowledged by Shaw (2000) was formulated information sharing, such as companies providing suppliers with demand factors. Lastly, Shaw (2000) recognised modelled collaboration such as supply-chain partners which share operational models to enable a real-time view. Emergency cases when handling both in- and out-patients depend on the information sharing systems, and health information technology must be used appropriately (Inokuchi *et al.*, 2013).

2.3.1.2   Perspectives on Information Sharing

Information sharing activities involves two parties sharing data. Regarding collaboration, information sharing behaviour is identified as a process whereby the information provider agrees to work together towards achieving defined goals and objectives (Hersberger *et al.*, 2005). Information sharing is also utilised in supply chains. The level of knowledge in this sector can be measured using a series of elements, such as the degree

of detail, the types of information being shared and the distance and width of information sharing, among others (Levy & Ramim, 2016).

In the practice of the exchange of information, certain points must be followed. It is vital to share after having obtained consent where applicable. Complying with the Data Protection Act (1998) (DPA) should not hinder individuals in their sharing information. However, it is necessary to ensure that personal details are shared in the right manner. Record keeping is also essential in information sharing. Consequently, if one decides to exchange information, then they should record it, noting the particular individuals as well as the reasons. The security of information, as previously mentioned, should also be maintained efficiently (Wu *et al.*, 2014).

Valuable practices in information sharing are vital to organisations as well. Individual cultural and organisational elements should be observed to ensure that good practice in information sharing is supported and promoted (Iacob *et al.*, 2014). Experts are tasked with comprehending the position of their company and committing to the practice of information sharing to constantly improve it. Additionally, they should be confident in supporting their organisation, especially in sectors where they have employed their professional judgment and shared information in a professional way (Perrin *et al.*, 2015). For specialists in an organisation to have confidence in applying the guidance in information sharing, their employers should establish certain concepts. One of these is promoting a culture that maintains the practice of information sharing between, and even within, firms. This includes having active mechanisms for the identification and tenacity of prospective matters and even prospects for insightful practice (Levy & Ramim, 2016).

The employers should also establish clear systems, procedures, and standards that ensure information is safe to share.

Information sharing behaviour is the entire process of transferring information, including data-seeking and information-providing behaviour. The central concern is how the parties collaborate (Hersberger *et al.*, 2005). The information sharing can be classified according to whether or not the sharing has an objective. Information sharing activity based on a common purpose means the two organisations or individuals have common goals. The two parties are focused towards achieving the goals via seeking, providing and sharing information (Bjurling & Hansen, 2010). From a collaborative perspective, information sharing can be categorised into three levels. The first level involves sharing between actors by transferring and exchanging data between them. However, the two parties or organisations may not have the intention of achieving a common goal or objective through information sharing (Hersberger *et al.*, 2005).

The second level is the data seeking, where the main reasons why information users seek for data has remained a controversial debate among many researchers. Studies and literature reviews have been carried out which focus on the reasons why people seek information. Finally, studies of information-providing behaviour have found that the information provider's behaviour is the receiver's (Hersberger *et al.*, 2005). These studies were based on social exchange theory, which views that information sharing is motivated by a rational personal-interest and interdependence. The sender's behaviour is not solicited by the information need of the receiver. Without the internal motivation of the sender, there is no information sharing process. Attitudes in information sharing are essential and determine its success. Efficient information sharing is a collective

commitment based on four major beliefs: organisational commitment, organisational instrumentality, information self-efficacy and connectivity efficacy (Baggs & Schmitt, 1988). These will now be considered in turn.

Organisational commitment is related to the identification and involvement of different departments of the organisation into management and operational activities. Connective effectiveness is an expectation which ensures that information in the database reaches members of the society collectively (Huang *et al.*, 2003). Organisational instrumentality is essential in enabling successful collective information sharing within institutions. The collective of information sharing should be based on the organisational gains. Information self-efficacy is a self-perception value of the participant's contribution towards information sharing (Hersberger *et al.*, 2005).

In light of these literatures, research indicates that information sharing should focus on organisational commitment. The expected outcomes of the information sharing depend on the determination of the parties (Peterson, 2005). The information sharing between the receivers and senders may be motivated by economic, social, rational interest or psychological reasons. Studies have affirmed that information sharing in organisations and institutions is necessary and aims at solving problems in the society. The participants in organisations share information to acquire mutual benefits based on the individual interest. Talja (2006) takes note that information sharing can be a two-way process between seniors and juniors. In the police and security forces, information is shared with different departments and seniors (Lewandowski & Nestel, 2016).

Information sharing has had a great influence in addressing complex social and economic problems affecting human beings. Information sharing enables nations to

address transnational problems. Through new cooperation and collaboration enabled by information technology, new governments have been formed over the past decades. Development and collaborative governance hold the future of public administration, linking management to the use of information technology that supports the coordination of the networks of organisations (Maguire & Katz, 2002).

The mounting provision for cross-boundary cooperation and data sharing surpasses political prejudice: information sharing goes beyond political ideologies and institutional relationships to enhance more understanding in the public values. Information sharing is helpful in meeting government priorities, fighting crime, solving health problems, monitoring border security and safety (Wilson, 2010). Collaborative governance is a vital concept that promotes information sharing and understanding the society. Technology advancement in networks, databases, and intelligence provides technical support for information sharing when dealing with social problems (McGarrell *et al.*, 2007). Global issues have led to the rise of information sharing. Increased surveillance leads to early detection and prevention of global problems such as terrorism, piracy, drug trafficking and health-related problems. Information sharing promotes international coordination and cooperation among the nations.

It is necessary to understand how information is being shared collaboratively between organisations and government institutions in solving complex public problems. In the health sector, proper information sharing systems have enabled a rapid response to be made during emergencies (Inokuchi *et al.*, 2013). Public administrators, including both private security companies and police departments, play a vital role in providing public services to all citizens. The administrators must understand the issues in the society in

the context of information sharing. The community should be given platforms to share their views and opinions regarding matters affecting them (Pelfrey, 2007). All the participants must understand the need and importance of information sharing.

2.3.2 Information Sharing in Policing

Wyllie (2009) held policing agencies to be "antagonistic and mutually exclusive" (p.1). In policing, the subject of information sharing is viewed as one in a broad range of collaborative practices. In scholastic studies, information sharing in policing has been categorised into various types, as identified by Talja (2006), Strategic information is one of them, which depicts the exchange of information as a sensible method of making the most out of effectiveness in a research group. In policing, investigators from different jurisdictions may share information gathered in the field to better resolve security concerns, such as information on terrorist watch lists.

Information sharing is based upon a target the method of communication. It can be classified in various ways according to whether it is formal or informal; spontaneous or systematic responses or volunteered information; and the information content (LeBeuf & Parè, 2005). Talja (2006) defined information super-sharing as a conscious strategy that has been adopted in pursuit of productivity in longitudinal project environments. Unsworth (2014) noted information sharing to be context dependent and critical for both internal and external policing functions. Information has taken a significant place within police activities, as they seek to reduce the level of crimes and incidents while increasing the level of security and safety. Premises overseen by security guards can be identified as significant sources of a huge amount of information that can help the police to do their work more efficiently to protect against any threats.

There are different types of sharing within the policing activities. The first is paradigmatic sharing, where there is the establishment of a new and distinct research methodology or section within or across various disciplines. In policing, this may involve the formation of a multi-jurisdictional taskforce to tackle a specific issue, which is especially important when crimes extend further than the jurisdiction of one law enforcement agency. The second is instructive sharing, where information is exchanged from a higher authority to a subordinate entity in the chain of command. In police work, the instruction of field agents on what to do while in the field falls under this category. The final type of sharing is social sharing, which portrays the sharing of information as a form of community-building activity. This connotes more of the information-gathering aspect of police information in which the public reports violence and suspicious behaviour for the police to act on.

Addressing the issue of information sharing in policing in Canada, Perrin *et al.* (2015) suggest that a sort of revolution in information sharing was prompted by the isolationism with which agencies stored their information. Information isolation has the double disadvantage of raising administrative costs while not resulting in a direct improvement in the security situation. The Privacy Act allowed agencies to use information in a manner consistent with their purpose of collecting it while giving them greater allowance to expand the scope of their information requirements. This phenomenon created a ballooning effect on the information demand, which in turn increased the amount of information held by law enforcement agencies, creating an even healthier capacity for sharing. Some of the factors that make information sharing in Canada more complex than other jurisdictions include the splitting of jurisdictions between the federal and provincial

government levels, the border flow between Canada and the United States, and the allowance of foreign entity bidding for Canadian government projects.

As an example, the E311 Data Matching programme used in Canada is one of the most complex data sharing architectures, with information coming from diverse sectors, including customs, trade, employment statistics, and financial departments, among others (Perrin *et al.*, 2015). These authors further pointed out that security is quite fundamental when data issues are involved. Best practice protocols and accepted standards have been proposed as a requirement for all the projects to be undertaken. Regarding the security of data, it is vital for all the staff to be trained and sanctions applied for those who do not follow the required procedures. Furthermore, regular reporting on all the security audits should be contained in the plans for the project management (Liao *et al.*, 2016).

Information sharing systems are effective when the storage, management, capture and sharing of information are safe, secure and sustainable. Police departments depend highly on sharing information with all stakeholders. Private security companies have many guards at various locations, and they deal with all groups in society. This means that they must share massive amounts of information easily. Such information sharing, which is mainly accomplished through professional information sharing systems, makes police work much more effective. Although both the police and private security companies aim to curb criminal activities and to protect people and property, it is the relationship and information sharing between them that defines their effectiveness. Without sharing information that can enhance security, collaboration will not come easily; thus, the two groups may clash when attending to security matters.

Community participation in combating and reducing crime is vital through information sharing (Huang *et al.*, 2003; Shah *et al.*, 2009). Crime is one of the major concerns affecting the society and especially urban residents. Crime scenes and experience have led to anxiety feelings and fear among the affected individuals (Lewis & Lewis, 2012). People who have experienced crime scenes usually suffer from psychological problems caused by horror, distress and heart attack. Research indicates that crime causes psychological well-being among members of the community.

A study conducted by Bao and Bouthillier (2017) established that information sharing and specialised enforcement partnerships were among the most common forms of associations in policing collaborative efforts. While associations involved both adult and juvenile probation, it is important to note that not all information can be shared in police activities (Lewandowski & Nestel, 2016). Certain types of data which may be shared between the correction agencies and police include social networking and gang affiliation information, reports on criminal history, registration data on the sex offender, and data relating to the block and neighbourhood level as well (VanderSloot *et al.*, 2016).

Police usually encounter multiple emergencies and problems that need an immediate response (Xiaowen & France, 2002). Information sharing in police activities enhances efficiency in their activities. The police and private security are always faced with several barriers affecting information sharing. The sharing of information can be hindered by a lack of cooperation among different stakeholders, such as individual security departments, the police, and the public. Lack of suitable technology and IT experts in the police force further hinders the effectiveness of information sharing. Information sharing is vital for any successful completion of projects and tasks. There is a need for

collaboration among stakeholders through information sharing. Most disasters and accidents, including criminal cases, are made worse by a lack of timely and accurate information sharing (Xiaowen & France, 2002).

Information sharing departments and intelligence in the police force helps to prevent or reduce crime in the society. A proper standard of information is vital and essential in enhancing the efficiency of the police force. In ensuring compliances with legislation, the police and private security agencies should share critical data with the society. Through information sharing, intervention and prevention of criminal cases are efficiently managed (Lewis & Lewis, 2012). The public should have confidence in the police, and personal information should be kept safe and secure. The police should make sure the people get appropriate information. Information management and sharing in the police help to protect the people and property, preserve police orders, prevent criminal offences and detect them when they occur. Besides, accurate information sharing enables effective police responsibility by the standard and statute laws (Xiaowen & France, 2002). On the other hand Kitchen & Rygiel (2014), discusses the sharing of information within the police, it fails to discuss how the police share the information within various departments. Also fails to examine the existence of a clustering mechanism for the information shared between the police to ensure that the different security needs of the society are responded to effectively.

2.3.2.1 Information Sharing Challenges and Activities

Communication has been found to be one of the major challenge affecting police activities within the society during law enforcement. Police should communicate with their colleagues, different departments, and ranks. The police should be able to share vital

information with the local community members. According to Heverin (2011), the police in the United States use Twitter to communicate and share critical information among the local community and to publicise crime and other criminal-related data. The police utilise the media to disseminate vital information with the media and public.

In combating crime and drug abuse within the society, the police depend on information from the public. Members of the society alert them and private security agencies about criminal activities within the community such as robbery, rape, and drug abuse (Lewandowski & Nestel, 2016). Many youths are drug addicts and spend much of their time taking drugs. Information sharing enables the police to trace and disseminate drug harlots within the society. The advancement of technology in communication has enhanced information sharing greatly. Twitter and Facebook are two of the most used social media in the community to share information with the police (Carter, 2008).

Collaboration between the citizens and police is essential in minimising and combating crime and accidents. Through information sharing in police activities, cases of fire outbreak and robbery are dealt with by an emergency response. During crisis, information sharing is normally done cooperatively to solve the problems and achieve common goals between the participants (Bjurling & Hansen, 2010). The police respond quickly to the scenes to prevent further damage and death. Law enforcement agencies require adequate information and technology to support police activities and operations. The police and private organisations in the security sector share a considerable amount of information, including receiving emergency calls from the public (Lewandowski & Nestel, 2016). The police are expected to respond swiftly during an emergency without any delay. Many crimes, such as murder and robbery, happen at night and partly during

the daytime. The police have the responsibility for responding to the cases to solve the problem at the scene by arresting the offenders (Carter, 2008).

Liu and Hu (2005) stated that the effectiveness of the police/public interface (PPI) depends on an established scope for e-policing services that consists of an interconnection between legacy systems that will support the vision. The network applications strategy consists of the development of an e-policing corporate strategy, a network migration strategy and the established long-term integration and specification of interoperability requirements. Weir and Bangs (2007) confirmed that the use of a Geographic Information Service (GIS) is widespread in the United Kingdom; when supported by information sharing, intelligence-based processes and problem solving, the GIS enables mapping and crime analysis to drive successful programme deliveries.

Police officers need accurate information to present before the court. The collection of information depends on public participation. The public plays a vital role in any investigation and delivers crucial information to the public. The American law enforcement remains among the most decentralised systems incorporating the public. The September 11 2001 attack in the U.S. by terrorists highlighted the necessity for cooperation and data sharing among the police, private security agencies and members of the public (Brown, 2007). The American police localised their operation and embraced the use of private security agencies to combat terrorism and other criminal cases. Local police and organisations need to communicate vital information related to crime and threats to the public. Whenever suspects cross the jurisdiction lines, it is necessary and vital to disseminate information (Xiaowen & France, 2002).

Police officers play an essential role in seeking information to avert crimes, and respond to unlawful acts. Through information dissemination, the police can get and share crucial data concerning missing individuals and criminal activities. Law enforcement officers should have access to crime data from all regions. The police should share significant criminal data between departments and intelligence officers (Bjurling & Hansen, 2010). In addition, information integration and shared knowledge supports the agencies in defining and solving problems jointly; in the coordination of policy, service, and programme; and in improvements to information content and the information technology infrastructure (Dawes *et al.*, 2009).

The United States drove American policing into a new era by recognising the collaborative role of the public and police in combating and reducing crime. The perception of the government and police towards private security used to be detrimental until the terrorist attack (Kettl, 2007). The American people and the whole world realised that the society is living in the days of terror. The emergence of policing and collaboration with the community members came to reality after the September 11 attack (Stewart & Morris, 2009). According to Willard (2007), policing in the U.S. considered homeland security agency.

The attack led to amendments in the American law enforcement by changing the roles and responsibilities of the police and security forces (DeLone, 2007). Former United States President Bush affirmed war on radicalism by stating that countering and investigation in terrorist activities should be done by all law enforcement agencies, including intelligence officers, police and private security (Henry, 2002). The discourse on the role of the police and private security was considered a matter of national concern.

2.3.2.2　Information Sharing Practices between Police and Communities

Homeland security and police were integrated through information sharing to counteract terrorism. Community policing reforms through information sharing has contributed positively towards information sharing in the police which has reduced and controlled crime, combatted terrorism, piracy and drug trafficking (Kettl, 2007). Subsequently, the reform in policing was as a result of the community era period incorporating members of the society. According to Moore and Oliver (2007), American policing entered into force after September 11 with the recognition of homeland security. These authors viewed a new era in policing, one aimed at controlling crime through effective intelligence between private security agencies and the police. Oliver further contended that organisational design should be more decentralised by including both internal and external information sharing (Lyons, 2002).

The private security companies relate well within society, which encourages members of a society to share information, which the companies relay to the police. This enables the police to respond to the security needs of the society, hence enhance societal security (Kitchen & Rygiel, 2014). The security services also responded to emergency cases with the support of the police. The success of information sharing between the police, private security and public depends on cooperation. Research conducted by Foster and Cordner (2005) found that state agencies rely much on information sharing in executing their jurisdiction.　The identification of terrorist suspects recognised the role played by community participation in handling terrorism threats (Lyons, 2002).

Zhao and White (2012) consider that collaborative information sharing is critical in policing and fighting cybercrime. Cyberspace has revolutionised many aspects of human

life, and there is a need for community reliance. Many companies and organisations, including government security agencies, have developed the National Cyber Incident response to deal with cybersecurity (Zhao & White, 2012). The community entity was found to comprise many factors necessary in ten fights against cybercrime. The community is composed of both the public and private entities, including health, education, security, environment and other crucial factors. Effective security and safety requires the allotment of accurate information and collaboration. Information sharing in the policing needs the integration of many elements (Wrobleski & Hess, 2003).

Information distribution helps to detect possible crime occurrences by presenting essential data related to crime. Information sharing expedites emergency preparedness and the timely distribution of data regarding both natural and man-made phenomena. Through information sharing, the public can correlate well with the police and share their opinions on policing. Information sharing in cybersecurity is categorised into internal based information and external source information, with numerous challenges, especially during disasters (Bharosa *et al.*, 2009). Internal based information is the information and data originating from organisations into the society. Information sharing in the police may come from police departments, who pass the information to the community members. External source information comprises information and data that come from outside sources of the society into organisations. Disaster management requires effective information sharing between different stakeholders (Bharosa *et al.*, 2009).

Furthermore, the data given to police departments may come from both the state and federal government, the corporate world and businesses. People typically report cases and crime-related problems to police departments with the aim of getting assistance and

rapid response in the case of an emergency or disaster outbreak (Bharosa *et al.*, 2009). The police are expected to swiftly respond to the concerns of the public. Cybercrime-related information sharing is divided into: routine information sharing that includes primary and general data shared amid stable states. Obstacles in information sharing during disaster management must be considered by all the stakeholders (Bharosa *et al.*, 2009). The information is inclusive of data relating to situation awareness and vigilance. In addition, regular information includes cases related to vulnerabilities, natural warnings, and possible extortions. Incident-explicit information sharing: these are data related to the particular event during detection. The incident information sharing may include cyber threats, accidents, fire, risk assessments, and others (Bharosa *et al.*, 2009).

Information in policing is vital and helps in prevention and protection by helping to ensure security and safety. Information sharing in policing prevents crime and other prohibited activities such as terrorism, cybercrime, piracy, drug trafficking and abuse. To have routine information sharing from community members is vital. The information helps in protection and prevention through collaboration. Collaborative information sharing in the society assists in detecting an early indication of criminal activities and other life-threatening events (Kemp, 2003). Collaborations between private security agencies, the police, organisations, and other stakeholders in identifying terrorism and threats have been successful. Coordinated attacks and robbery can be prevented via data sharing, whereby participants share information on data situation analysis, security threats, and vulnerabilities. Information from external sources provides warnings from federal government, organisations, and the community (Stewart, 2011). Information sharing in the police has been effective and embraced by many nations in securing the safety of the people during disaster outbreaks (Bharosa *et al.*, 2009).

The detection of crime is essential and can only come about through information sharing, which can aid in its detection at an early stage. Whenever prevention and protection fail, collaborative information sharing is established to detect any malicious and unauthorised activities. The sharing should be done effectively (Hersberger *et al.*, 2005) and the information relating to incidents should include the time, date and place. Data from external sources may also assist in detecting different threats and incidents.

Information sharing is vital in analysing the operational activities of the police and should include the scope, severity, and impact of the crime. Information from the police and private security agencies should be accurate with no exaggeration (Hersberger *et al.*, 2005). Understatement in information sharing has a substantial effect on the receivers. Both routine and information sharing requires specific information. Critical information must be shared between the stakeholders, as in the homeland security agency (Kemp, 2003). In the security sector, the police must give authentic public information to maintain security and safety. Information from various external and internal sources is vital in incident analysis.

The rapid response towards calamities and related criminal cases is possible through accurate information sharing (Bharosa *et al.*, 2009). Information sharing enhances making a quick response during emergencies. Through timely information sharing, achieving a rapid response is vital, especially in emergency cases. Participation between the police and public is necessary and helps in response. For instance, information sharing between the public and police during a fire outbreak may lead to a quick response, which in turn saves lives and property. Information sharing can resolve various challenges associated with making an immediate response. Response evaluation is essential to assert

the effectiveness of information sharing (Bharosa *et al.*, 2009). Figure 2.1 shows information sharing in a cyber-incident rapid response phase of a Public.
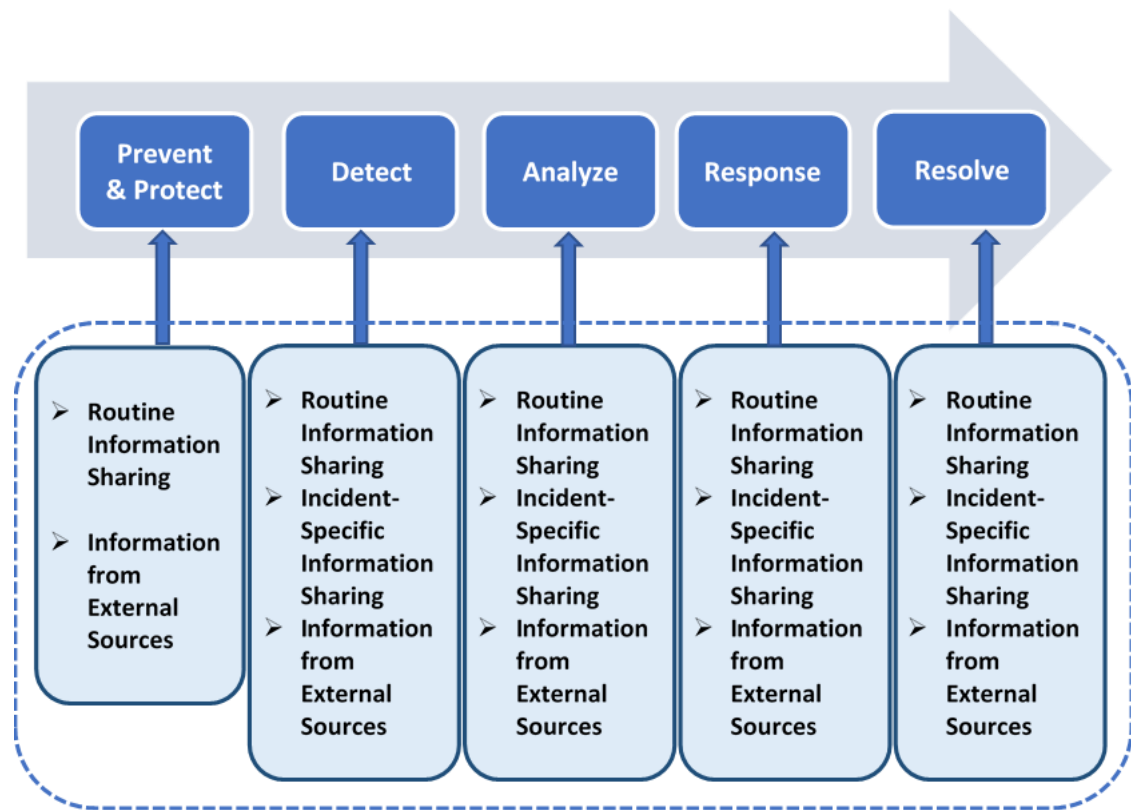
Figure 2.1. Information sharing view (Zhao & White, 2012)

The desired outcome of the information sharing must be established. Information sharing aims at solving people's problems, such as crime, health, environmental conservation and climate change. A lack of appropriate information or false information may cause severe problems. The timely sharing of information has positive results and should be embraced at all levels. According to Carter (2015) supported that partnerships are vital to successful law enforcement agency information sharing programmes in that intelligence is used to prevent threats of crime, health epidemics, and natural disasters.

Cordner & Scarborough (2010) recommended regular meetings and a tear line, or need to share, approach to information system development and deployment to improve information sharing between law enforcement agencies.

2.4 Technologies Used in Information Sharing in Policing

Police departments use various techniques in information sharing to combat crime and other related criminal offences, such as terrorism, cybercrime, piracy and drug trafficking (Lewis & Lewis, 2012). The advancement of technology has enabled different police forces to share vital information as quickly as possible. There are many technologies used by the police to share information, such as the Geographical Information System. GIS has been substantially used by the police to find important data. Among the technologies used in information sharing are Artificial Intelligence Software (AIS) and the Crime Similarity System (CSS). GIS is used by the police to share geographical information regarding crime (Colvin & Goh, 2005). It can capture a wider area and collect detailed data, which are shred among the various organisations. Chan (2001) declares that technology has influenced the activities of the police and broadened their understanding and assisted them in their work. AIS and CSS have been used for many years to store and share socio-economic criminal-related profiles. GIS is used to map crime and share the data among police departments to prevent and combat crime (McEwen & Weisburd, 2011).

Technology supports policing in many ways, such as providing a database system whereby criminal data and geographical information can be stored. There is an increased intelligence level among the police. The police can use mobile technologies such as the Mobile Data Terminal (MDT) installed in a police car to capture and share information during patrols. There are several mobile data devices used by the police to collect and

share information, such as MDT. The tools are essential in pro-active data management within the police. CSS has been widely used in data sharing as compared with a conventional database (Lewis & Lewis, 2012). Many studies of police-community collaboration have shown that information sharing technologies have greatly influenced security and safety. Similarly, Leidner and Jarvenpaa (1995) observe that information sharing technology has improved learning management in schools as well.

Traditionally, governments used to share information with the public through news via media channels such as newspapers, televisions, and radios. However, the people could not respond back to the agencies directly due to the lack of social platforms (Jansen *et al.,* 2009). This changed for the better as technology and innovation led to the development of social media podiums such as Facebook, LinkedIn, Twitter, Instagram, and YouTube (Zhao & Rosson, 2009). Social media platforms are now of great benefit in information sharing between the government and public. Sharing information with the public and getting back feedback used to be a significant problem; the government could not receive back information from the citizens, and their opinions could not be incorporated in leadership. Social media tools are used as communication models between the police and the society. The social platforms also permit non-users to access and view available tweets (Bertelsen *et al.*, 2013; Jansen *et al.*, 2009).

The telephone remains the most common technology used to communicate between police personnel (Lindsay *et al.*, 2011). The police use mobile telephones and radios to communicate among themselves and various departments. Telephone calls are effective during communication provided the internet is available (Lindsay *et al.*, 2011). With the advancement in technology, information sharing using the telephone is based on wireless

connection via the 4G network (Lindsay *et al.,* 2011). Most police forces depend on emergency calls from the public. The police take the criminal data using computers which is stored in various machines and can be shared via emails. Mobile phones and radios used by the police have been improved and can be used to make calls from any location. However, face-to-face communication with the public is still done, though supported by recording devices, which are used to record all the information collected from the public for evidence (Lindsay *et al.,* 2011).

Biometric technologies are used by the police to collect useful information. The data collected through mobile fingerprint readers are vital during the investigation (Lindsay *et al*., 2011). The police can share the biometric data using various devices. DNA evidence is collected and shared using biometric devices. The ability of police forces to share information relies on the effective transmission of information between the police and public. Camera surveillance is used to capture data which are transmitted to the police departments (Lindsay *et al*., 2011). Video surveillance and computer-aided systems are embraced by the police. Integrated databases used in police departments have crucial information which may be private and confidential, or may be shared by police departments and officers (Lindsay *et al.,* 2011).

Twitter users use the platform for various reasons, such as sharing ideas, opinions, music, video clips and other crucial information, besides being enjoyed for social interaction by many users. Zhao and Rosson (2009) affirm that Twitter users mostly use it for interacting with friends, relatives, families, and workmates by collecting and sharing expedient information, sharing opinions and thoughts. Jansen *et al.* (2009) ascertained

the importance information sharing has in the organisation; companies can share essential data among employees, customers, and stakeholders (Bullen & Bennett, 1990).

Twitter has been used to share information in various police sections, especially in the U.S. However, the kind of information shared is necessary and determines the technology used (Boyd *et al.,* 2010). Twitter is the leading social media technology used by the public to share information. Its users can choose who to follow and unfollow during the social interaction (Bullen & Bennett, 1990). During crisis and disasters, Twitter is used to share product information to citizens. It has developed some useful features, such as retweeting, replying and hashtags. Retweeting involves the transmission of tweets to the senders and may also be used to share exciting information (Boyd *et al*., 2010). Table 2.1 shows a range of categories of Twitter use in the police in order to share information.

Table 2.1. A range of categories of Twitter use in police department (Heverin & Lisl, 2012)

Category	Description
Crime/incident information	Reporting crime or incident; providing updates about a crime or incident
Department information	Sending information about the police department
Event information	Informing others about upcoming or planned event
Traffic information	Reporting traffic problems, road closures, and parking for major events
Prevention information	Offering safety tips and awareness
Person identification	Distributing suspect or missing person information or requesting help in identifying suspect or missing person
Reply/Mention	Replying to other Twitter users publicly on Twitter or mentioning other Twitter users' usernames
Retweet	Retransmitting word for word of other twitters' messages
Data	Providing statistics or data
Other	Unknown, tweet is only a URL, URL does not work, test messages

Conventionally, police departments used to share information with the public via the media. However, police forces used to have difficulty to get feedback from the audience. The security departments have been working with the media to share vital information with the citizens by assuring the public maximum security and safety (Bullen & Bennett, 1990). As society becomes more integrated and globalisation takes control of the world,

the information sharing that occurs between the police and public is essential to maintaining law and order (Lehnhar, 2009). Police departments are increasingly embracing the public communication in law enforcement activities. The police can have a personal relationship with the public, leading to effective law enforcement. The social media promote transparency by confirming information to the government and security agencies (Grudin, 2005).

Technological advancements in information sharing, including Twitter, have created opportunities in police force departments by allowing direct communication between the public and the law enforcements (Heverin, 2011). Social media platforms have enhanced openness and provide opportunities for the social relationship between the police and the public. They allow the police to share critical information, such as crime investigations, with the public. Tolbert and Mossberger (2006) support the use of information sharing between the police and public by arguing that information technology data sharing makes governments more responsive, transparent and accessible. Useful information sharing between community members and the society increases trust and makes government agencies active. The active participation of the police with the public improves mutual satisfaction with the security forces (Lehnhar, 2009). However, the police do not always have an interest in sharing information with the public, which creates barriers to data dissemination.

Police stations are essential in any given society for maintaining law and order. Desktop application management systems play a vital role in coordinating information between the police and public, as argued by Zhao and Rosson (2009). According to the research carried out by Abdul *et al*. (2009), effective management of information is

necessary for maintaining law and order. The security software has been protected from unauthorised access to prevent data loss and any information compromise. Different components of the software are encrypted with MySQL and developed using Java. Information security is vital in police departments and should be efficiently managed using the latest developed software.

Cloud-based software and police data information sharing software are used to share vital information; the latter facilitates different departments in the police sharing crucial information. The shared data improve the decision-making process between the police and various agencies (Boehm, 2011). The Canadian Police Department has also adopted information technology in the process of law enforcement. Supported by the Federal Government of Canada, the department has unveiled an initiative for promoting and simplifying assimilated information in the police force which involves the immigration enforcement agencies, the correctional facilities, the judiciary, and members of parole boards (Sanders & Henderson, 2013). The integration of information has been accomplished through assimilating tools of technology, although the process has been pointed out to be tougher for the police agencies in various jurisdictions across Canada (Perrin *et al.*, 2015).

Sanders (2014) has highlighted that in the Canadian police, information is shared to enhance efficiency. Effectiveness is viewed to be the vital element to consider in information sharing, whereby it assists the entire Police Department to make informed decisions. The type of information shared is usually decided by the individual police officers no formal process is utilised. However, individuality has been identified as a feature among the cultures of the police in Canada. The significance of the information is

one of the factors used to determine if sharing will be conducted, in that critical information with the potential to affect multiple departments and a large section of the population receives greater sharing privileges than less impactful information (Takahagi *et al.*, 2015).

2.5   Information Sharing Systems Analysis in Groupware Time-Space Matrix

Groupware is a type of hardware and software technology used in assisting interacting groups to interact efficiently. The software is designed to support group working with cooperative requirements in mind (Clearence & Wainer, 2011). Groupware is classified based on when and where participants are working, as well as the intended function in the cooperative work. Computer supported cooperative work (CSCW) is used to show how members of a group work and operate (Kraemer & King, 1988). It is also used to demonstrate how technology is used in enhancing and promoting interaction and collaboration among group members (Clearence & Wainer, 2011).

Groupware comes in various shapes and styles, performing different and unique activities. Information senders may not get an immediate reply. The system should be distinguished from Group Decision Systems, which are used in face-to-face electronic meeting technology, and are also known as same time and same place technology (Clearence & Wainer, 2011). However, both systems incorporate presentation technology, computation technology, and group process technology.

The time-space matrix is used to communicate with different people at the same time or a different time. All groupware systems are protected from authorised accessibility,

hindering and blocking strange users. Groupware is also used in social interaction in an organisation. Groupware technology has integrated both time and space with the emergence of CSCW (Greenberg & Roseman, 1998). The typical space and time matrix has four quadrants that allow information sharing. Groupware information sharing can be used to share accurate information within the shortest time possible.

The police can interact with the public in real time through the time-space matrix physically. Conferences can be convened through embedded computers and provide public displays. Different times may involve participants cooperating via team rooms which enable group displays. Police officers can effectively share important information through the time matrix. The communication channel is fast and efficient, providing security and safety. Further, through distribution in real time, there are numerous chat systems, and collaborative aware groupware. Video conferencing in the police enables the actual scenario to be viewed without alteration and the police can stream live video. Effective communication in the matrix is essential and enables the police to share criminal and investigative data.

Another type of groupware is known as video conferencing, which allows members from various locations to view and hear from one another at the same time. The groupware systems are also known as different place collaboration. The last groupware type is known as a workflow. The workflow management system is a type of network control system that assists in analysing, coordinating and executing the business process. The workflow management tool has two systems, namely, the modelling subsystem and the enactment subsystem.

Organisations use the time-space matrix during the problem-solving and decision-making processes. Participants can contribute to the discussion from different places and times. According to Mokhtari *et al.* (2015), technologies necessity supports time and space restraints in the situation where individuals collaborating on a common task cannot be assembled in the same place or cannot share information in real time. The police can use emails to interact with their bosses, security stakeholders and the public. Emails permit live messaging and video chats through the conference. The police can do video conferencing with other police officers or the same public time and different space. Similarly, emails can also be sent at different times and places effectively. Figure 2.2, adapted from Mokhtari *et al.* (2015), shows the time-space matrix with technologies.

Space

	Same Place	**Different Place**
Same time	*Face to face interactions* • Conference tables with embedded computers • Public displays • Dedicated tools for e.g., voting and brainstorming	*Ongoing tasks* • Team rooms • Group displays • Shift work groupware • Project management
Different Time	*Distributed real time interactions* • Chat systems • Transparent sharing of single user applications • Collaboration-aware groupware • Video conferencing • Media spaces	*Communication and coordination* • Unstructured or semi-structured electronic mail • Electronic bulletin boards • Asynchronous conferencing • List services • Workflow systems • Schedulers • Collaborative hypertext

*(left axis label: **Time**)*

Figure 2.2. Time-space matrix (adapted from Mokhtari *et al.*, 2015)

The system permits administrative managers and experts to hypothesise possible models of workflow amongst the team members. The ideal has been entrenched in network systems driving the working subsystem. The subsystem customs the exemplary in coordinating tasks execution by ensuring various members or participants in different workstation are connected to a network (Clearence & Wainer, 2011). The system initiates multiple tasks in a given correct order and keeps track of completed tasks.

The time-space matrix communication system can be used to transfer suitable information to various operators at different work required. The model assists during the execution of tasks, sending reminders to users by informing them of submission deadlines (Clearence & Wainer, 2011). The system automatically operates without many tasks, making its management easier. The groupware makes the management of groups efficient by allowing team members to meet online at the same time, place or different times. The primary objective of the groupware models is to allow efficient coordination, communication, and collaboration among members of the same group. Team building and management have been made easy through groupware technology (Grudin, 2005).

Groupware technology assists groups in their daily activities. Groups can be seen as collaborating communities aimed at achieving specific goals in an organisation, institution or company. The group may be as small as possible with only two people, or vast and include all the citizens of a country. Group members are generally committed to achieving defined goals and objectives (Clearence & Wainer, 2011). The members of the group are bonded together by common goals, preferences, knowledge, and agenda. For instance, a political party may be connected throughout the country through one system. The political party members share the same goals, values, philosophy, and ideology. Similarly,

the police and public may collaborate and agree to cooperate as a team towards ensuring law and order. All the citizens in a nation may participate in electronic voter registration and voting. However, some groups are amorphous, and members may not have the same goals and objective (Clearence & Wainer, 2011).

Groupware technology normally operates electronically through the internet, which the users should be able to access. However, some systems are developed in a way that means they do not require the internet (Bannon & Schmidt, 1991). The group members are usually individuals from corporations, organisations and community members. Whenever one thinks of groupware technology, the first concept that comes into mind is an electronic device or video conferencing. For instance, a distinct manuscript editor has an augment button on the automated email. It is necessary to identify and use specific groupware (Clearence & Wainer, 2011).

Some groupware is more efficient compared to others during operations, depending on the functionality. Conventionally, ordinary electronic mails are not valuable compared to advanced electronic mails which filter, sort different emails in various mailboxes and involve other multi-media. Filtering of the mail is necessary and helps in preventing information overload (Bannon & Schmidt, 1991). Sorting emails assists in the categorisation of various messages into unique conversations by providing the context of the message. Multimedia encourage a group spirit by embracing and emphasising a similar social background. Some technological groupware models' spectrum models are high and incorporate powerful and appropriate aids in groupware. However, some are a low spectrum and provide weak and inappropriate aids in group work. Ordinary emails

have been found to be much lower on the spectrum compared to enhanced emails (Clearence & Wainer, 2011).

It is vital to recognise the magnitude of the problems and developers should understand the prospective users at workplaces. Analysis of tasks, and evaluation design in groupware is one of the challenges faced by multi-user applications as compared to single-user ones (Carasik & Grantham, 1988). An individual understanding in a certain word computer is not influenced by background and characters in other users. Groupware is used to integrate users with different abilities and tasks. Furthermore, it should be possible to shift roles, responsibilities, and preferences. Evaluation and analysis may take longer and groupware supporting multi-users makes it more difficult (Grudin, 2005). The lack of enough IT personnel in the Police Department may affect the use of groupware in technology. However, the police can use the system in combating cases of crime.

The decision-making process is necessary in any given organisation. However, the uses of groupware in the decision-making process have enhanced the process with some little challenges. Decision-makers rely on informed intuition and managers having the right perception find it easy compared to those with poor intuition using CSCW (Grudin, 2005). Besides, decision-makers rely on the provided information and alternatives. Right intuitions in for all groupware multi-users are challenging to establish. The police can obtain the opinions of the public through groupware technology. In addition, some developed nations use the groupware technology to share and discuss critical issues surrounding security and safety with the public (Bannon & Schmidt, 1991).

2.6   Chapter Summary

The chapter has reviewed some different approaches used in information sharing in police work, as well as the literature on collaboration and information sharing in organisations and policing. It has highlighted the necessity for collaboration between the police, the private security agencies and the public, as well as other stakeholders in Law and order enforcement. Collaboration assists the police during their work and investigations, preventing and combating crimes and making a rapid response to emergency cases.

Information sharing in organisations enhances production and performance. Technology advancement has played a vital role in information sharing and has promoted collaboration between different stakeholders. Social media platforms and the internet have made it easier for the police, security agencies and the public to work together to combat crime and social problems. It is imperative to incorporate public participation to achieve adequate security and safety. In this, the chapter has discussed the importance of the time-space matrix communication system.

Having reviewed in this chapter how information is shared between members of the UAE Police Department and the security agencies, the next chapter looks at the theories that inform this study of how the information is shared and how this can be improved.

Chapter 3: THEORETICAL FOUNDATIONS

3.1   Chapter Overview

Chapter 2 reviewed the literature relevant to information sharing in Policing and collaboration between the users of the system. This chapter presents and develops the two principal theories informing the investigation of these topics. The first is the Organisational Semiotics and the second is Activity Theory, which are used to understand the information and to develop how it is shared among the organisations under study. In addition, it is necessary to take into account some related theories.

A conceptual framework for the study was developed on the theoretical foundation of the Activity Theory and the semiotics perspective, which focuses on (1) the framework based on the Activity Theory; (2) the matrix for the analysis information sharing; (3) information artefacts; and (4) the Information Requirement Set. A detailed examination of the theoretical foundation is undertaken by evaluating the theoretical and philosophical underpinnings of the two main theories just mentioned. Further, their overall influence in the research field is assessed, which will be helpful in understanding the activities of information sharing in the UAE Police Department.

3.2   Related Theories

Garner *et al*. (2009) view theories as simply models, or frameworks developed for observing and understanding various phenomena. Taking a different perspective, Burke (2003) held that theories are simply generalised statements that are meant to explain and assert a connection between two or more phenomena. They can be seen as a generalised explanatory principle to be followed in explaining a phenomenon. Furthermore, Carter

and Caroline (2005) argued that theories can be regarded as a system of interconnected ideas and abstractions that are meant to organise as well as condense knowledge about a specific phenomenon. They were used in this study to organise and condense knowledge during the data analysis process, which was fundamental in making reliable inferences and discussions.

Theories have been used continually in academic and empirical research studies. Today, they still play a crucial role in the development and undertaking of a research study. The importance of theories in research includes their role in shaping what the researcher sees and how it is seen and interpreted. As explained by Brett and Drasgow (2002), theories allow researchers to make important links between the theoretical and the empirical, the abstract and the concrete, as well as observational statements and thought statements, which are all useful in interpreting and understating the phenomenon under study. These considerations are essential in studying the current approaches and practices of information sharing in the UAE Police Department.

Theories were used in this study to explain how various variables associated with information sharing relate with each other, specifically to provide a clear understanding of the information sharing strategies used in the UAE Police Department. They also influenced how the researcher organised ideas relating to information sharing, information systems, strategies and approaches that can be used in the Police Department. They served the additional purpose of providing a clear meaning to various facts relating to information sharing between the police and PSCs, as well as clarifying the researcher's understanding of issues associated with this matter.

The information sharing for this kind of issues or problem and in order to address this the special theories around the analysis and social technical system are relevant and here the potential candidate. Institutional theory has ascended to importance as a common and useful description for both individual and organisational action. It is a helpful theory that has been contrasted with a number of other methods. Although its possibility has positively been expanded, institutional theory has frequently been criticised as mainly being used to explain the relationships and the existing practices of phenomena. We consider that this emphasis did slight to tap the full influence or potential of institutional theory (Dacin, et al., 2002).We find, for instance, that institutions change time by time, are not uniformly been taken however, it could related in regulative which can clarify the rules and laws, normative and cognitive research.

Agency Theory, as it can be applied in a general way to decisions and activities in an organisation. Its basic idea is that an "agent" accepts to undertake a task on behalf of the "principal", thereby becoming accountable to the principal. Agency Theory primarily aims at addressing various problems that may arise in a business because of the differences between the goals and desires of the principal and an agent. Such a situation often arises for two reasons: first, the principal is unaware of the agent's actions and second, resource limits prohibit the principal from acquiring the information.

The theory is sometimes expressed in the form of the "Principal–Agency Theory". Agency Theory is generally centred on an agent, who is a person or entity that is able to make a decision on another entity or person, that is, the principal. Its decision directly influences and affects the principal. Sometimes, the agent might be motivated to make

decisions based on his or her own best interest, thereby creating a dilemma because it might be against the principal's desire or interest.

The origin of Agency Theory can be traced back to the early 1960s. It directly resulted from the attempts by economists to explore risk sharing among groups as well as individuals in businesses. The broadening of the risk sharing literature led to the development of the agency sharing, by including the concept of an agency problem, which is considered to arise when the parties involved have different goals and interests. The division of labour is another important contributing factor to the agency problem (Eisenhardt, 1989; Shapiro, 2005).

Within the context of this research, Agency Theory makes an important contribution to the treatment of information sharing: information is regarded as a commodity, which enhances its sharing. In Agency Theory, information has a cost and can be purchased, a feature enabling it to be shared. It can enhance important processes such as budgeting and managerial supervision by providing the necessary information (Eisenhardt, 1989).

Mahaney and Lederer (2003) have discussed how norm-based Agency Theory, when applied to an IS, can provide a tool for modelling and analysing business processes. The process also enhances information sharing in the business environment by guiding the analysis, identification, and grouping of actors who share a common responsibility and tasks. In this context, Agency Theory provides a monitoring role that directly enhances information sharing (Miller, 2002). However, while agency theory provides a way of characterise the relationship between actors, it is not practical in designing the framework for developing an information sharing systems. Therefore, the Activity Theory been used as discussed in the following section.

3.3   Semiotics Perspective

Semiotics refers to the study of making meanings of the sign processes and communications. The focus of semiotics is the exploration of the study of symbols and signs as an essential element of communication. In the semiotics perspective, an attempt is made to study every cultural phenomenon as a set of communication systems or agents. In addition, in life science, the semiotics perspective attempts to determine how individuals make predictions as well as adapt to their semiotic environment. In general, as explained by many authors, such as Harvey and Evans (2001), the semiotics perspective uses sign systems as the object of study.

It is concerned about the understanding of knowledge, objectivity of meaning, definition of meaning, and a number of epistemological questions that relate to the general learning process and activities. Beynon-Davies (2009) added that the semiotics perspective also considers the dimensions of sign processes associated with learning and activity. Furthermore, it takes into account the contributions of various aspects of semiotics in the general learning process.

Alternatively, the semiotics perspective can be considered as a study of sign systems in learning, especially with respect to its relationship to social structure. In other words, its primary focus is to study the meaning of sign systems in its most general sense to make proper meanings. Representations and signs are recognized to be essential in the learning process and the entire social system. The social system involves working with various signs and representations. For example, facts can be represented by means of indices, symbols, and their relations, among other options.

The semiotics perspective is a subset of the field of semiotics, which is focused on studying sign systems, signs, and sign processes. It puts more emphasis on the use of Peirce's theory of communications, in which he postulates that signs are communicated by an addresser agency and act within their own semiotic agency (Baskerville, 2010). The signing process serves the primary purpose of communicating the addresser's message.

There are many different branches of semiotics. Charles Pierce proposed one approach between 1931 and 1935; he later developed it in 1938. This approach uses logical components to describe the study of sign systems (Price & Shanks, 2005). He argued that the sign's actual presentation should indicate the intended meaning as well as the received meaning. The first element deals with the interpretation of the phenomenon being represented while the latter deals with the effect of the interpretation on the actions taken by the interpreter (Price & Shanks, 2005).

As noted by Price and Shanks (2005), Morris elaborated the relationship between these aspects of the sign as syntactic, semantic, and pragmatic. The syntactic deals with sign representations while the semantic deals with representations and the pragmatic deals with how it is represented and interpreted, which all inclusively pertain to the form, meaning, and use of signs (Burton-Jones & Hubona, 2005).

The semiotics perspective postulates that the general sociolinguistic context of the interpreter determines how he or she undertakes the actual interpretation of the sign. The sociolinguistic context under consideration includes two elements, namely linguistic norms and societal norms. Liu *et al.* (2002) took note that the individual's circumstances such as their knowledge and personal experience also determine how they make the

actual interpretation. Within this context, the semiotics perspective can be applied to enhance the formal definition and procedures of information sharing.

An important aspect of the semiotics perspective that can be used in information sharing is the classification of signs. In this perspective, signs and sign systems are classified with respect to how they are transmitted. The approach is essential and is becoming more powerful in the era of information sharing. In an information system, codes are used to carry and convey the meaning. The transmission process may include letters, sounds, body movements, emotions, attitudes, and so on. In information sharing, the community can agree to coin a word to convey the meaning of the sign being referred to.

As pointed out by Barron *et al*. (1999) and others, both the input and output in computer-based information sharing require the representation, storage, and processing of signs. Both the users and the computers need to have these three essential elements. The semiotics perspective becomes useful by providing a platform for the appropriate representation, storage, and processing of signs. Information sharing cannot take place effectively if such conditions are not met. The theory and principles of semiotics can then be applied to characters, words, sentences, and messages, and other symbols used in the sign in order to aid information sharing.

The semiotics perspective is more concerned about the properties of things used as signs and how they can convey the information appropriately (Barron *et al*., 1999). Their properties remain unchanged in the entire process and become essential in the representation and interpretation of the sign system. Analysis of the properties of signs, as aided by the semiotics perspective, is an essential contributing factor to the overall

understanding of information and information sharing. It is potentially useful in laying down criteria for the differentiation and categorisation of information.

The semiotics perspective is used in information sharing to provide a useful platform upon which signs can be properly interpreted. It can actively provide the useful social level upon which signs can be understood and interpreted for the sake of enhancing information sharing, analysis, and interpretation. This is possible because the semiotics perspective would bring into the information analysis various social norms, such as acceptable ways of behaving, and sets of values, as well as a shared reality model. It would enable us to define the form of social reality when it comes to information sharing.

The semiotics perspective has a number of features that are most appropriate for information systems, which lie at the centre of the present study. Barron *et al.* (1999) listed them to include "the application domain, action complexity, social consequence, acquisition complexity, acquisition scope, input usability, output usability, justification, real-world relationship, and representation." Some of these features are established through the social setting.

The application domain is to determine the scope, actual perlocutionary effects, and the boundary of the information system. It becomes very useful when discussing information sharing and analysis. It sets platforms that enable the information system to support activities and tasks, and solve problems, as well as make changes. The spectrum of an application domain can be set in many ways, which further enhances its information sharing capability.

When it comes to information sharing, many different social consequences may occur because of perlocutionary acts by users of the information system. The semiotics

perspective can be used to deal with these social consequences. They can range from issues related to strategies and tactics to operations. The semiotics perspective embeds elements of social norms that enable the handling of these problems when sharing information or using information systems.

Another essential feature of the semiotics perspective is its capability to deal with the complex nature of acquiring information. It is more concerned about the nature of processing that is required to obtain as well as share information. This characteristic is potentially applicable to the information sharing process. It determines the degree of knowledge as well as skills necessary for effective information sharing and analysis.

The theory of semiotics provides a basis for understanding the transmission and representation of information, as well as its meaning. This characteristic enables it to play a central role in studying the nature of information systems, especially when it comes to sharing, interpretation, and analysis. In the modern era, information has become more virtualized, which makes the representation and understanding of meanings and signs essential (Mingers & Willcocks, 2014). In view of these capabilities, a semiotics framework can be developed to help analyse the complex interactions in the information systems by considering the personal, social, and material aspects.

3.4   Organisational Semiotics

Stamper *et al.* (2000) define it to be the study of how an organisation can use various methods and concepts of semiotics. It examines the characteristics, nature, and features of information and attempts to determine how best it can be used within the context of business domains and organised activities, that is, the organisation (Liu, 2000). In an organisational semiotics, an organisation is treated as a system where the information is

created, processed, distributed, used and stored. This approach is clearly and directly relevant to the present study of how information is shared in the Police Department.

Semiotics is defined as the doctrine of signs: in this case, sign mediation processes are used to formulate the signs. This process is known as semiosis (Stamper *et al.,* 2000). The development of the concept of organisational semiotics directly benefited from various semiotics research studies. Stamper was the first to introduce the concept (Stamper, 1973). He used Peirce's work on semiotics to develop the concept, which was later adapted by Nake (2002) to include and define data, information, and knowledge.

Ronald Stamper introduced and started working on the concept of organisational semiotics around 1973. At that time, he relied on the collective work of researchers who came from different backgrounds: they all worked together on both practical and theoretical issues relating to technical and organisational problems (Nake, 2002). During his extensive interactions with industry users, Stamper saw the need for developing an effective theory that could relate information as a resource. He was motivated to work on this idea, which later led to the development of organisational semiotics.

During the early stages, and working with his team, Stamper introduced a number of concepts that would later play important roles in the development of organisational semiotics. Some of the important concepts he introduced include social norms, the semiotic ladder, social affordance, actualism, the information field, and ontological dependency (Gazendam & Liu, 2006). In the concept of semiotics, an organisation is understood in terms of signs as well as how certain actions are undertaken through various norms. Furthermore, it considers an organisation as a structure of social norms.

The importance of using organisational semiotics is that it defines the aspect of the information based on actions. Secondly, it treats information as a resource, which has made it essential in modern-day research studies. The approach also empowers information and creates avenues for more opportunities for exploiting information sharing. The fact that the concept of organisational semiotics considers information as a social norm and social affordance clearly indicates that it can be shared within the community over time.

3.5   The Organisational Onion

Another important feature of organisational semiotics is that it considers norms as knowledge or information in the organisation. Practical experiences of human agents within each organisation are used to develop norms. In organisational semiotics, norms have prescriptive and directive functions, thereby guiding the actions and best course to be taken. An organisational "onion" can be used in the analysis of the norms of an organisation. Stamper was the first person to propose this approach (Stamper, 1992). An organisational onion is simply a diagram or chart that uses a few circles to show layers of a complete system, as shown in Figure 3.1.

INFORMAL IS
The PSCRD and PSCs' society's culture and values reflected as norms and beliefs of behaviour that police officers and security guards follow when interacting with sharing information and incidents.

FORMAL IS
PSCRD and PSCs' procedures, polices, legislations and regulations.

TECHNICAL IS
Method of sharing info. e.g.
Phone calls
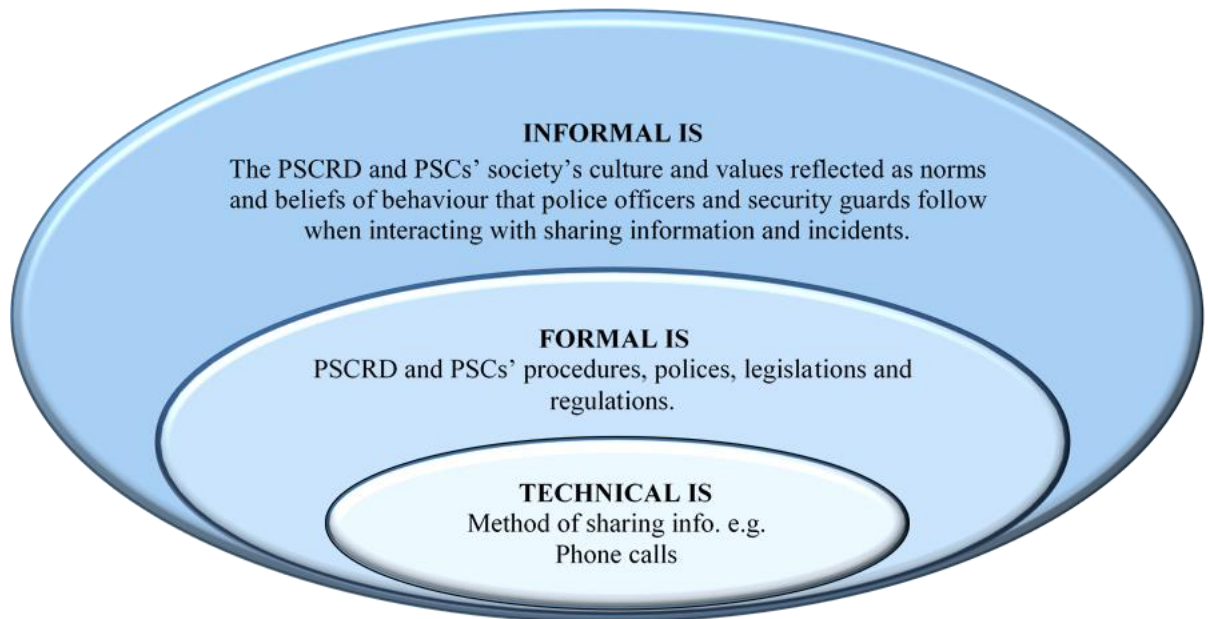
Figure 3.1. The organisational onion (Stamper,1992)

The initial organisational onion proposed by Stamper consists of three layers, namely the informal, the formal, and the technical layer. The informal layer consists of all the pieces of information relating to the organisation's culture, values, as well as customs, all of which are reflected in habits, beliefs, and patterns followed by the members of the firm. They consist of norms that form part of the wider organisation's culture. Stamper *et al.* (2000) considered that these norms and habits are applied informally in the organisation. The second is the formal layer: it consists of rules and bureaucracy that are being followed by the organisation's members in performing their daily activities. The last is the technical layer, which captures and automates the formal and informal layers. With this perspective, the technical layer becomes the core of information sharing. However, information can be shared at the informal and formal layers, as well as the technical. For effective information sharing, all three layers must be integrated together.

3.6   Norms and Information

In an organisation such as a police department, its members follow patterns of behaviour which are influenced both by the regulations and policies of the organisation, and by the expectations and understandings that the individuals have acquired through being part of their particular society and social groups. One important concept that helps us to understand such patterns of behaviour is that of the social norm.

A social norm can be defined as an informal understanding governing how people are expected to behave in a society or group. Stamper *et al.* (2000) defined a norm as "a generalised disposition to the world shared by members of a community" (p. 15). Apart from the larger society, smaller groups such as offices, teams and police forces, among many others, may also be affected by norms. Lilley *et al*. (2004) stated that social norms are regarded as an acceptable way of conduct in a group, organisation, or society. Norms may include elements such as values, traditions, and customs, which can make them be viewed as cultural products.

Generally, social norms play an essential role in guiding the behaviour of a certain group in a certain environment or situation. There are two dimensions of social norms: (1) the extent to which the group approves a given behaviour; and (2) the level to which a given behaviour is exhibited by the group. The use of these dimensions in a normative message can end up altering the norm and subsequently the general behaviour of a group or organisation (Mingers & Willcocks, 2014).

The concept of social norms can be extended to help understand behaviours and interactions within an organisation such as a police department. Using the concept, an organisation can be understood using both legal and cultural norms that are responsible

for regulating people's behaviours. In an organisation, people are able to get along and work together because they share information and knowledge about acceptable, desirable, and exemplary behaviours. The shared knowledge exists in all kinds of organisations (Volkoff *et al.,* 2007). In essence, social norms enhance the sharing of information in an organisation.

In an organisation, social norms can be considered as forces that directly and indirectly define how group members behave or think (Leonardi & Barley, 2008). They directly determine the kind of information needed in an organisation and also set out criteria for sharing it. All knowledge consists of certain norms and attitudes. Unlike attitudes, norms have conditions that need to be fulfilled. Thus, an organisation builds its knowledge of what should be done: it forms part of the behavioural norm. An organisation also builds its knowledge of how people should judge things and their happenings: these two form part of evaluative and cognitive norms (Mingers & Willcocks, 2014).

In regard to the present research, social norms can affect the recording and sharing of information in many ways. For instance, they may specify the starting time, starting authority, finishing authority, and the finishing time during the information sharing process. In a similar manner, social norms can affect how information is understood, perceived, and shared. The meaning and message conveyed by an item of information can be construed differently if it is interpreted within a different set of social norms. It is also essential to consider the fact that social norms are valid only in a specified community and in a specified limited period. They can also affect the way the information is understood and shared.

In describing an organisation or analysing information sharing, social norms enable the person to distinguish between the substantive cores and rules. The ability also affects how the information is analysed and shared. Social norms determine how control is exercised in the process of analysing and/or sharing information (Moll *et al.*, 2005). The controls exercised determine how the information is understood, perceived, and shared among the people involved in the process.

In order to be effective in decision-making and operations, an organisation needs to depend on quality information. However, the quality of the information and how it is understood is directly influenced by the already-established social norms in the organisation. Every member of the organisation would interpret and share information within the confines of the existing social norms. As pointed out by Price and Shanks (2005), there is no agreement on how information quality should be defined in terms of its criteria and categories. Norms influence the information quality by allowing the use of non-theoretical approaches that consider both objective and subjective perspectives.

Price and Shanks (2005) further examined how, at the pragmatic level, the process of interpreting information depends on how the person understands and uses norms. The general sociolinguistic context of the person, such as linguistic and societal norms, will determine how the information is interpreted, analysed, and shared. Norms also control individual circumstances such as personal knowledge and experience, which determines how the person interprets the information. Essentially, norms are applied to the formal definition of information quality.

Signs are crucial aspects of information sharing, interpretation, and analysis. Signs help greatly in understanding and interpreting the information as well as sharing it. Barron *et*

al. (1999) argued that in information interpretation and sharing, signs can only be fully understood when regarded within the potential context of social norms and consequences. They convey the existing social constructs. At the social level, norms come in handy in determining appropriate ways of behaving, following sets of values, and creating shared models of reality, all of which are useful in the processes of interpreting and sharing information.

Norms have perlocutionary effects that influence the target context when interpreting, sharing, and analysing information. In situations where norms about real-world objects are well-defined and established, experiences, knowledge, ways of behaving, values and culture become stable and are mapped from a statement into the real-world objects. Their meanings also become stable. The process creates stability in how the information is understood, shared, and analysed in the real world (Barron *et al.*, 1999).

In a normatively regulated information sharing context, actors generally agree on the behaviours and approaches that are deemed valid in the group. Such approaches meet the expectations of the group. Norms have a binding force that determines the extent to which actors can agree on the validity of the information sharing techniques and criteria to be used. Price and Shanks (2005) contended that any such technique and approach agreed to be valid becomes part of the group and is binding to all members. The process leads to the establishment of a binding system of norms that determines how information is understood, shared, and analysed by the group members.

When communicating, passing, analysing, or sharing information, people tend to have an expectation with respect to appearance, behaviour, and personality, all of which are embedded within the confines of the established social norms. In particular, norms,

directly and indirectly, inform the system of meanings portrayed by personality, behaviour, and appearance. Such norms become very influential in the sharing and analysis of information, which are shaped by both the virtual and actual world.

Zammuto *et al.* (2007) claim that social norms often become the first choice of self-representation when sharing information. In such cases, information is often received through the lens of an expectation of appearance and gender. Information is further attached to the likable or persuasive qualities that determine its general acceptance. Price and Shanks (2005) suggested that norms enable the personal and social worlds to interact through the process of semiosis and situation. Such interaction gives the experiences of presence when sharing information.

Norms have conditions that need to be met by the group members. By being "a generalised disposition to the world", when the conditions of a norm are met, it eventually generates propositional attitudes which affect the information, especially how it is shared, understood, and analysed (Stamper *et al.*, 2000). In addition, the propositional attitudes affect the person's behaviours and relations with other members of the group, thereby influencing the information sharing process.

Stamper *et al.* (2000) offered an analysis of the norms in an organisation in terms of logical conditions and consequences. They declared, "Once we know the norms of an organisation, we can deduce its information requirements because every norm has the general shape." In "general shape", Stamper and his colleagues were referring to the "if condition then consequent" (p. 16). In this case, the information required by the norm-subject is determined by the condition. The norm-subject can be an individual, a group, or the entire society, and it is required to obey the condition. On the other hand, the

consequent determines the generation of information to be used by others. In the consequent part, the generation of information is influenced by the group's norms upon their actions. The norms determine how the information is understood, analysed and shared among the group members.

In an organisation, norms affect information analysis by reflecting and influencing the regularities in its members' behaviour and action patterns. They allow members of the organisation to coordinate their analysis of information in a particular manner. The influence of norms on information sharing and analysis is determined by their ability to govern the thinking, behaviour, and perception of the group members. Norms exist in all kinds of societies, organisations, and groups. Stamper *et al.* (2000) go so far as to claim that norms provide the solution to most organisational problems. They also play an important role in determining how information is construed, received, perceived, analysed, and shared.

3.7   Activity Theory

The origin of the theory leading to the development of an activity system diagram stems from the seminal work of Vygotsky (1978), being later expanded and developed by Engeström (1990). Central to this study is the Activity Theory, which Kuutti (1996) defined as "a philosophical and cross-disciplinary framework for studying different forms of human practices as development processes, both individual and social levels interlinked at the same time" (p.7). As it provides a framework for analysing various human activities at both the individual and social levels, it provides a core framework for the present study, which focuses on activities relating to information sharing. It is

therefore necessary to consider it in some detail. Also the Activity Theory is more analytical and more descriptive is kind a better theory to use.

Chen et al. (2013) explain that the theory assumes that all the activities of a human being are directed towards a specific object and that artefacts mediate them. These authors go on to elaborate that all human activities are considered to be socially constituted within the surrounding environment. Bertelsen and Bodker (2003) expressed the same opinions. In the context of this theory, an activity is understood as the structure that collates and extends various sub-activities from its core.

According to Widen-Wulff and Davenport (2007), "An Activity Theory is an approach to understanding learning that presents the individual and social dimensions of process as inseparably coupled" (p. 3). The process thus becomes inseparable from these elements. Both the objects and subjects co-define each other mutually in the transformation process. Widen-Wulff and Davenport (2007) added that the transformation process is continual and mediated by rules and roles that keep on evolving by shifting communities and social groupings. In this process, the activity system may consist of many different levels of work.

Thus, the Activity Theory offers a systematic multi-dimensional framework for analysis. The framework becomes very useful in guiding both the interpretation and the observation process. Widen-Wulff and Davenport (2007) suggest that the theory attempts to implant studies in a wide range of organisational frameworks, thereby allowing proper assessment and observation of the processes and intersection behaviour over time, and across various organisational activities. The Activity Theory also brings an

understanding of information sharing into perspective when the framework is applied to the observable activities.

The Activity Theory offers a framework and descriptive tool for analysing a system. It postulates that people are more socio-culturally embedded and that there exists a hierarchical motivation of human actions based on the level of activities (Kaptelinin & Nardi, 2012). Rather than being a predictive theory, Activity Theory is actually more a descriptive meta-analysis. It considers the entire work (activity) system beyond just one user or actor. Principally, it attempts to account for the environment, culture, motivation, the role of artefacts, and the history of the person, along with the complexity of real-life actions, among other factors. The activities considered are goal-directed actions (Boer et al., 2002; Kuutti, 1996).

The Activity Theory was developed by Robert J. Havighurst during the early 1920s and has remained very useful even today. Havighurst developed this theory to provide a direct response to the disengagement theory of aging, which suggested that the elderly naturally disengage from the society upon the realisation that they are nearing their time of death. It specifies that activities and their components are not static. The theory embeds both historical and developmental ideas and the constructive role of humanity in the development of scientific thinking. The development of activities is neither linear nor straightforward, which creates an implication of each activity having its own history.

In this theory, an activity is treated as the basic and most essential unit for analysis. It enables each human action to be taken as the basic unit of analysis. In this regard, the relation between the various elements of an activity is mediated instead of being directed. An activity provides an organised form of directing the object that is used to distinguish

each activity. The existence of an activity is motivated by the process that transforms an object into an outcome (Daniels et al., 2013), who elaborated, An object can be a material thing, but it can also be less tangible (like a plan) or totally intangible (like a common idea) as long as it can be shared for manipulation and transformation by the participants of the activity.

During the entire activity process, both the object and the motive can undergo various changes. They may enable the self-revelation of the object and their motives in the process of doing things. The introduction of an intermediate, a third term, creates the process of mediation. The tool is used to mediate the relationship between the object and the actor, which the historical development is condensed to; the tool is both limiting and enabling. Its main role is to empower the subject in the transformation process. It also restricts the interaction between the interactions to be achieved only from a particular instrument.

3.8 Activity Theory and Information Sharing

Activity Theory has classified collaborative activities in information sharing into three levels, namely, coordinated, co-operative and constructive action (Hersberger *et al.*, 2005). Coordinated activity is a situation whereby various actors work towards a common objective without relating the similar goal but restrain to their businesses. Constructive activity focuses on the reconceptualisation and reconstruction of common object jointly. The constructive restructure organisation and interaction towards the shared object. Collaborative information sharing behaviour asserts that different actors may work together in various activities through effective information sharing (Lewandowski & Nestel, 2016). The teams work towards a shared purpose and may not share the common objective in the objected activity.

It is clearly appropriate to apply the Activity Theory in the development of the framework for understanding the sharing of information in the Police Department, as this process involves a number of well-defined activities which can be easily identified. Following the emergence of the information age and the importance that has been placed on it within the organisational setting, it becomes a critical theory of interest in this regard. As pointed out by Boer *et al.*, (2002), the need and importance of information sharing within an organisation is generally accepted and agreed upon.

The Activity Theory can be effectively used to build the framework for analysing information sharing, especially when the activities involved within the analysis. It provides an effective way of using knowledge and information to describe the setting of an organisation within its confines. Chen *et al.* (2013) proposed that this approach would enable the organisational setting for knowledge sharing to be described within its mediation of language, the division of labour, social rules, and emergent object activity. Furthermore, this approach would enable tensions to be used as reference points for the study of information sharing, despite being inextricable aspects of the system.

When the Activity Theory approach is adopted to build a framework for analysing information sharing, a systemic analysis would be guaranteed because it stresses the situated nature of the information sharing process. Furthermore, as highlighted by Boer *et al.* (2002), it explicitly takes into consideration the temporal interconnectedness and emphasises the processual character of knowledge sharing.

The Activity Theory can be used to conceptualise the information sharing process in many ways. The way it is conceptualised would depend on the researcher's perspective of information or knowledge (Boland & Tenkasi, 1995). Several different kinds of

epistemological perspectives on information sharing can be taken by practitioners and scholars to develop a conceptual framework. For instance, information can be perceived as an object, which leads to it being defined as 'a true belief.' When this perspective is used, an assumption of the codification and separation of information, especially from the minds of people, is made (Wasko & Faraj, 2000). When this approach is adopted, information sharing can be conceptualised as 'transferring knowledge-objects.'

A second perspective that can be adopted in building the conceptual framework for analysing information sharing using the Activity Theory is based on the view that information can reside only in people's minds. This perspective defines information as "that which is known." Polanyi (2015) held that people have the ability to know and convert the information they have into actions. This process is aided by the act of thinking, which transforms information into knowledge (Boer *et al.*, 2002). When this perspective is adopted, then information sharing can be considered as the process that leads to the exchange of information in order to yield knowledge.

A third perspective that can be used in building a framework for analysing information sharing assumes information to be 'the social practice of knowing.' In this perspective, it is assumed that information is embedded in a community. Consequently, it is not embedded in just one individual, so such a perspective makes the availability of information to the individual to be highly dependent on the context (Wenger, 1998). Furthermore, this perspective highly emphasizes and promotes the power of deductive logic.

3.9 Activity System

In 1987, Engeström conceptualised a systemic model for an active system, which later became known as an activity system diagram. In the original Engeström's model, the diagram consisted of reciprocal relationships between object, subject, and the community. The activity system diagram expresses an activity as "a systemic whole in the sense that all elements have a relationship to other elements, but all those connections have not been presented in the picture because of the sake of clarity" (Engeström, 2000). Figure 3.2 depicts an Activity Theory-based model.
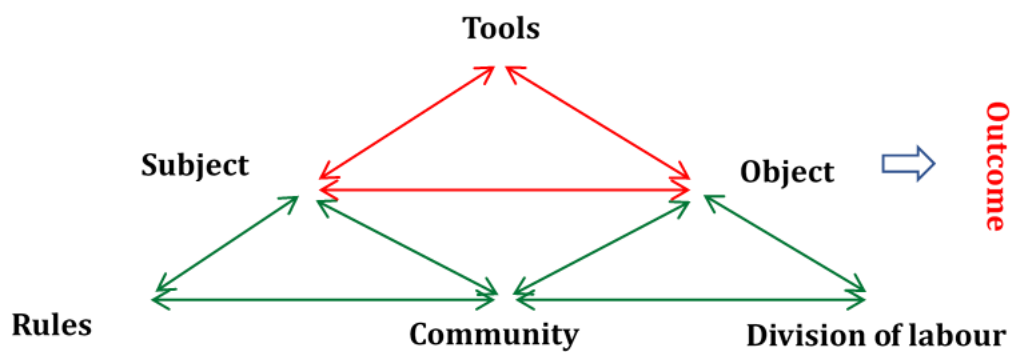
Figure 3.2. An Activity Theory-based Model (Engeström, 2000)

The basic structure of an activity system diagram consists of three mutual relationships between object, subject, and community. The structure portrays an activity as a systemic whole because every element has a relationship with all the other elements in the model. The primary function of the tool is to mediate how the object and the subject relate to each other while the rules mediate how the community and the subject relate. On the

other hand, the division of labour serves a primary function of mediating how the community and the object relate (Kuutti, 1996).

Guo *et al*. (2017) noted how instruments are integrated into a single base in the activity diagram. They are useful in providing different interfaces to different categories of users in the group. On the other hand, the community provides a social context upon which all actors are able to be involved in the activity system. Likewise, rules or laws are simply conventions and guidelines used for regulating activities in the system. Different actors in the system use rules to know the relevant information to be applied. To complete this brief account, Guo *et al*. (2017, p.35) defined labour division simply as "the social hierarchical structure of activity among actors in the activity system." Its primary purpose is to provide prescribed social contact information, which is used for dealing with other elements of the activity (Boer *et al.,* 2002).

In the activity system, some goal-oriented actors, known as the subject, are always used to conduct the activity. Guo *et al*. (2017) highlighted that such activities are always directed towards an object or outcome. Anything that can be used in the transformation process can act as a tool. However, rules are explicit and implicit norms, and social relations, and conventions within the community. On the other hand, a division of labour can be both an implicit and explicit organisation with the community. Through an activity, this diagram provides a meaningful context for understanding individual actions.

In an activity diagram, objects are heterogeneous in nature; the diagram expresses the translation of an object as the primary source of motivation. Widen-Wulff and Davenport (2007) elaborated that objects are shared by participants in the activity diagram. On the other hand, rules mediate how the community and subject relate to each other while the

division of labour mediates how the object and the community relate to each other. During the process, each activity is linked to an object, which is supposed to be translated into an outcome over time. The short-term processes produce actions that must be accounted for. In the working of the system, each activity consists of chains of actions: the significance of each chain of action might vary for different activities. The sharing process is achieved with the help of the division of labour, which emerges from pragmatic judgement about the capability of each member in terms of their expertise and physical proximity (Widen-Wulff & Davenport, 2007).

3.10 Aspects of the Activity Theory

As depicted in Figure 3.2, an activity is considered to consist of six main elements, namely the community, tool, object, subject, rules, and the division of labour. Each of these elements is interrelated and integrated into the activity system, working collectively to yield the outcome through the transformation process. In addition, they can help support information sharing in many ways. The activity system offers a process through which a relationship can be established. The following subsections deal with each of these six elements in turn (Boer *et al.,* 2002; Engeström, 2000).

3.10.1   Tool

In an activity system, the tool sets out and mediates how the subject and the object of the activity relate to each other. The process sets out the historical development upon which the relationship is anchored. At the same time, the tool plays an important enabling and limiting role in the activity system. This essential role extends to empowering the subject

in the transformation process to build it. It directly restricts the interactions in the activity system to come from only a particular direction.

By limiting the interaction to come from a particular direction, the tool plays an important role in the information sharing. Therefore, it can be used in the sharing to determine and influence how the information would be shared in the activity system. It also enhances the information sharing by enabling the process to proceed successfully.

3.10.2   Object

Basically, in the Activity Theory, the object refers to the raw material that the activity is directed to. In essence, it is the set of space that moulds and transforms an activity into the required outcome (Engeström, 2000). The working of an object is aided or supported with the help of various mediating artefacts (Boer *et al.*, 2002). In the activity, an object can be partly emergent or partly given. The object helps in supporting information sharing when it is shared with all other members. This would be made possible by the use of the formal and informal division of labour. When an object is shared with other group members, it eventually validates claims, thereby aiding information sharing in the system. The role that can be played by the object in information sharing is to provide specific understanding of information behaviour in the system. This way, it would directly articulate the role of information sharing (Widen-Wulff & Davenport, 2007).

3.10.3   Subject

The subject is the sub-group or individual chosen to act as a point of view in the analysis process. To act as the point of view, the subject must participate in the activity being investigated. For instance, a researcher who participates in the investigation can act as

the subject. The subject can also be used to enhance information sharing by directly relating to the community. It uses the set of rules to relate directly to the community.

3.10.4   Rules

This element consists of social rules, guidelines, or laws. Boer *et al.* (2002) state it refers to both implicit and explicit regulations, interventions, and norms that are designed to constrain various actions and interactions within the activity system. Another significant role of rules is to organise the relationship between the subject and other actors in the activity system. This is done by the use of collective traditions, norms, rituals, and prescribed values. Rules and roles constitute the practice of the community.

This element of the Activity Theory can assist in information sharing through the practice of community that it unveils. The community practices become the standard procedures shared across the activity system. The element can be used to share information relating to the extent to which the subject has internalized the rules. It can also share information relating to the extent to which rules take into account the interests of the subject.

3.10.5   Division of labour

This element in the Activity Theory refers to the division of power and status and the horizontal division of tasks among the various actors who are involved in the process. It provides and establishes the social hierarchical structure within the activity system, which enables the division of activities within the system to various actors. By creating the division of activities, this element directly helps in the information sharing because all the actors have to communicate with each other. The division of labour also provides the

social contact information, which enhances information sharing within the system. For instance, it can share information on the number of actors involved, the tasks executed in the group, which group executed the task, and so on.

3.10.6   Community

The community is sometimes referred to as the actors involved, and consists of multiple sub-groups and individuals who share a common object of the activity. Here, the community constructs themselves as distinctly from others as possible. The community can share information about the wider social context because it relates to all the actors in the activity system. All the actors are involved and can share the information as desired. In essence, it sets out a platform for the community network in the activity system, thereby connecting everyone involved.

3.11 Conceptual Framework Based on the Activity Theory

The main focus in this study is the information sharing between departments, organisations and individuals; it is based on several activities that affect the sharing of information effectively. Figure 3.3 illustrates the factors of the framework that take into account the users' needs that impact on improving the information sharing mechanism. The framework contains four main components: the first is the actor (subject); the second is the action (object); the third is the information artefact (outcome); and the last is the purpose (reason for the action). In this approach, there are more than two actors use to share the information based on activities. The emphasis in this model is the analysis of the information sharing between any departments or organisations.

In fact, analysing the information sharing is needed in order to examine the existing system to see whether it needs a development or other requirements. The proposed framework of information sharing analysis sets out to facilitate using the required information accurately and promptly through the right users within the organisation. It is clear the actor plays a key role in any activity because through his actions he will deal with (create, report, record, used, solve and store) the information in a particular way, depending on the purpose of activity. The final result of each activity is the information artefact, which is constructed by the actor as an outcome from his activity to be used by another actor.
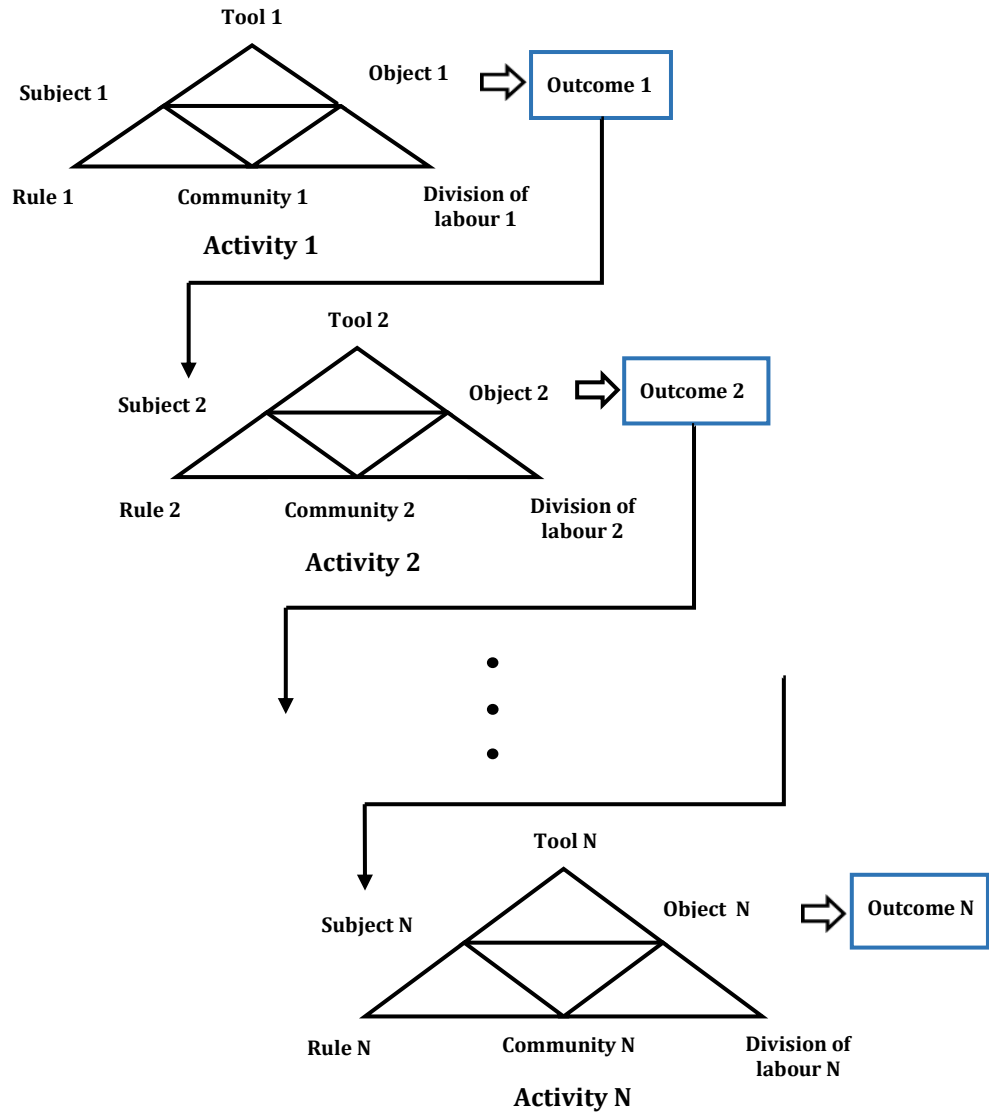
Figure 3.3. Activity Theory-based Information Sharing Analysis Framework (AcTIShAF)

The processes of analysing the information through this diagram started from activity 1. which includes actor 1 is defined as subject 1 in the diagram5.1, and the action here is to create artefact 1, which is represented as outcome 1 through the information captured which is represented as object 1. Outcome 1 is then used by subject 2 to create artefact 2 in activity 2, to be used by actor 3 in the next activity, and so on, until reaching the end of the necessary activities to solve the problem and arrive at the best result of the process.

3.11.1   Information Artefact for Action Network Analysis
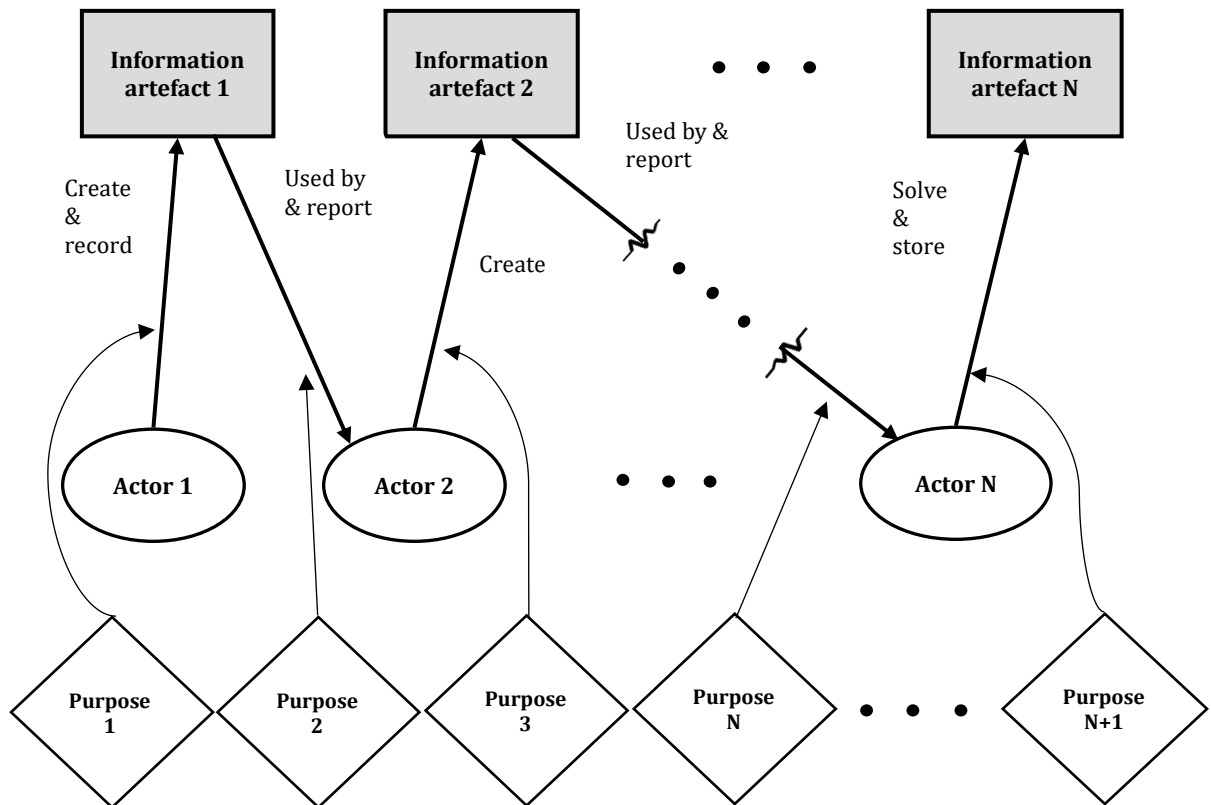
Figure 3.4. Information Artefacts for Action Network Analysis (IAANA)

The information artefacts of this study are represented in the Activity Theory-based model, which is proposed to design a means of systematic information sharing and to analyse the information sharing mechanism. Basically, the information artefacts focus on the outcomes from each activity. Figure 3.3 elaborates on the actors involved, the actions for the information sharing and the purposes for each action. Figure 3.4 depicts the Information Artefacts for Action Network Analysis (IAANA), which shows the action for each artefact.

The action network of information artefacts is articulating the relationship between the artefacts and subjects (actors) through the actions, where the possible actions form a set consisting of (creates, records, reports, used by, solves and stores the information). The diagram of information artefacts for action network analysis in Figure 3.4 is generated from Figure 3.3 and represents the actions, actors, information artefacts, and purposes associated with each activity.

The information artefacts are represented as an outcome and the actors defined as subjects, as in Figure 3.3, with the arrows between both components indicating the actor's actions; this simply shows the different actions involved in sharing the information, which are creating it, recording it, reporting it, it being used by, using it to solve, and storing it. The purpose of each action or activity is explained in the rhombuses at the bottom in Figure 3.4 as components to support designing an information sharing system. The information artefact 1 is created, recorded and reported by actor 1, along with the purpose for creating it; and then artefact 1 is used and reported by actor 2, along with the purposes for using it and then creating it. Actor 2 creates an artefact 2 for some reason depending on the requirement for it, and these steps are necessary in relation to the effective sharing of information to the right direction/pathway. Information artefact N-1 is used and solved by actor N; after that actor N stores the information as a final action on the basis of its importance, which can be reused when needed in the future.

Kuutti (1996) brings to notice that, by broad definition, artefacts mediate between actors and objects. He listed the possible categories of artefacts to include articles, reports, computer files, servers, records, and databases, among others. Artefacts also mediate how subjects and objects relate to each other. Artefacts can take several different forms, some

of which are humanly produced. In the context of this research, an artefact can include an information system, which is responsible for producing and sharing accurate, timely, and relevant information. Examples of normative artefacts include computer systems and machines, which may be good or defective in the system (Mingers & Standing, 2016).

Artefacts are responsible for transforming the object in the activity system. Artefacts always have a mediating role, which is their common essential feature. Thus, they enable the mediation of the relationship between elements in the activity system, thereby enhancing the information sharing process. Another interesting feature of artefacts is that they carry with them a particular element of culture, that is, the historical remains of the development. Artefacts can be used in a special way to help in information sharing by controlling the behaviour of various actors (Boer *et al.*, 2002). The process leading to the development of the activity is responsible for creating and translating artefacts.

3.11.2   Information Requirement Set

In regard to analysing the sharing of information between stakeholders, departments, and within the organisation, Table 3.1 provides a framework in the form of a matrix for identifying the actions, actors, information artefacts and purpose. The left column includes each activity. The second column lists the information artefacts which represent the outcome in Figure 3.3. The third column shows the actors, who are represented as subjects in Figure 3.3 and actors in Figure 3.4; they are managing and organising the information in each activity. The fourth column presents the actions, which are a central part of this analysis and involve various actions carried out by the actors, including creates, records, reports, is used by, solves and stores. The final column presents the purpose of each action, as illustrated in Table 3.3.

Table 3.1. Information Requirement Set through Activities (IRSA)

	Information artefacts	Subjects and actions		Purpose
		Actors	**Actions** (Create, used by, record, report and store)	
Activity 1	Outcome 1	**Actor 1** (create, record, report)	outcome 1, used by **Actor 2**	purpose of the actions in activity 1
Activity 2	Outcome 2	**Actor 2** (create, report)	outcome 2, used by **Actor 3**	purpose of the actions in activity 2
. . .	**. . .**	**. . .**	**. . .**	**. . .**
Activity N	Outcome N	**Actor N** (create, record and store)	outcome N, solved & stored (end)	purpose of the actions in activity N

The Information Requirement Set (IRS) can be viewed as a kind of information architecture which the IRS can then treat as the basis of the information architecture. Maderia *et al.* (2010) argued that for pervasive healthcare to be undertaken efficiently, certain requirements should be present to provide the required information for the users. Providing information ensures that there is an increase in efficiency of the pervasive healthcare services to people at any time through the integration of various sectors. Information architecture was defined by Evernden and Evernden (2012) as "a foundation discipline describing the theory, principles, guidelines, standards, conventions and

factors for managing information as a resource. It produces drawings, charts, plans, documents, designs, blueprints and templates, helping everyone make efficient, effective, productive and innovative use of all types of information" (p. 1). However, this definition is broad and does not lead to any concrete artefacts, which makes it difficult to use; therefore, an information requirement set is needed to fit the information sharing with the actual outcome of the IRS, which is the type of information architecture to be provided. Essentially, an IRS is defined as a set of actions, actors, information artefacts, and purposes. The IRS is consisting to treat information architecture matter.

Basically, the categories of the action, actor, information artefact and purpose constitute the components of the Information Requirement Set. The IRS includes four key elements to facilitate the process of analysis of each activity, which requires an actor who creates an information artefact through an action or multi-actions for different purposes, all as a union of the sets in the activities. On the other hand, some cases might have multi-interactions in each activity; as an instance, and the analysis of the Information Requirement Set has various activities. However, this analysis will be carried out with a one-to-one mapping of one actor to one activity, as shown in Table 3.1. This is one limitation of this approach, but it may simplify the process because in this research the focus is on one subject (actor) in a single activity. The analysis approach focuses on the activities, relationship and the several components as a result of the outcome, the specification of the set of the actors of the information items and needs, which are the information requirements for the purpose of an information sharing generic framework. The tuple as Information Requirement Set elements one is accumulated through this each actor but, also it is a union of all the sets in all activities. Essentially, the analysis of the IRS is a union of all the sets in Table 3.1, which is generated from Figures 3.3 and 3.4.

Therefore, each activity becomes an IRS, which then needs to be analysed in terms of the type of interaction to link it to the features and types of tools that can be used to support information sharing.

3.11.3   Potential Conflicts and Inconsistencies among the IRS

In order to formulate an appropriate information requirement component, it is essential to consider first what is needed by the information sharing system. One of the best ways of doing this is to come up with a list of appropriate information requirement components. The brainstorming technique can be used but is governed by three major objectives, namely (1) to determine how the share information, (2) to determine why and where the need to share information, and (3) to determine the problems facing when it comes to information sharing (Gupta, 2011). Based on the objectives listed above, four essential components for the Information Requirement Set have been identified for this study: action, actor, information artefact, and purpose. In brief:

(a) the action is responsible for generating the information and initiating its sharing, such as create, report, record, used by, and store;

(b) the user is responsible for monitoring the sharing and movement of information;

(c) the information artefact is responsible for detecting the complex movement of information and it refers to the outcome of the activity;

(d) the purpose sets up the reason for the information, its target for each action and with whom it should be shared.

This approach focuses on analysing the activities in terms of information sharing and the set of components as a result of the outcome. The specification of the set of the actors

of the information items and needs, which are the required information for the purpose of information sharing generic framework. In the scenarios involved with each activity in terms of sharing information and the associated interaction between the two actors, when several actions are taken, some potential conflicts or inconsistencies may arise:

1) In one scenario concerning activity 1, actor 1 may create a report for actor 2 and in a later activity, actor 2 is supposed to create a report for actor 1, which may create an inconsistency in the action's purpose.

2) When actor 2 in activity 2 shares the information with actor 3 for a specific purpose, but actor 3 then takes a different action from the intended purpose, a conflict may arise from the different understandings of the purpose.

3) In activity 3 actor 3 creates an information artefact about a situation for actor 4 and actor 4 takes an action based on it and finds that the information artefact is not clear enough; this might show conflicts in purpose and artefact.

There are such potential conflicts and inconsistencies in the IRS and there is no systematic way of addressing the conflict as many requirement engineering practices however, it is important to remove any potential inconsistencies and conflict at this stage.

3.11.4   The Information Sharing System Features for the IRS

The activity system triangle can be used to develop a generic framework. To start with, the information sharing needs to be portrayed of information sharing which is taken as the objective of the analysis in the framework. It would also help to understand the type of technology that can be employed to support and improve the information sharing processes. The outcome of the AcTIShA-Framework, based on the IRS, will help to design

an appropriate system or method to facilitate information sharing within organisations. Table 3.2 illustrates the information sharing system features that are devised to fit with the IRS and can be applied systematically to improve the information sharing among organisations and individuals within this approach.

Table 3.2. Mapping the IRS to the information sharing system features.

	Actors		Purpose	Features
	From	**To**		
Activity 1	Actor 1	Actor 2 Actor 3 Actor 4	Ensuring speediness of sharing info.	- Easy to use - Quick delivery - Record info.
	Actor 2 Actor 3	Actor 4	Maintaining Confidentiality	- Easy to use - Quick delivery - Quick response - Record info. - Store info.
Activity 2	Actor 2	Actor A 1	Further details about info. needed	
	Actor 3	Actor 2	Necessary information required.	
. . .	**. . .**	**. . .**	**. . .**	**. . .**
Activity N	Actor 3 Actor 4	Actor 1 Actor 2	- Following up and updating the info. processes - Investigating or enquiring about the information provided.	- Easy sharing - Instant delivery - Remote access.
	Actor 4	Actor 3	Following up and updating about info. processes	- Easy sharing - Instant delivery - Remote access.

This table is designed to link it to the interactions which are required in terms of the features, systems, tools, actors, and purpose. By using an information technology system, users are able to filter information as well as control how it is shared. It also offers beneficial connectivity that enhances the process of information sharing. Technology enhances the user's orientation, which is equally useful in information sharing. As recognised by Churchill and Churchill (2008), using technology in information sharing comes with five affordances, namely the connectivity tool, representational tool, multi-media access tool, capture tool, and analytical tool. They make it quite easy to share information within an organisation and are useful in this regard. Churchill and Churchill (2008) noted that information technology systems can enhance social interactivity, which makes them fit well within the activity system.

Table 3.2 provides clarity on how the actors can interact with the system effectively. This example has three rows and three columns. The first row includes activity 1, the second row activity 2 and final row activity N; they capture how each actor shares information. The columns comprise the following:

1. the actors that communicate in a pair-wise fashion;

2. the purpose, which comprises the intention of the actor's action within the activity;

3. the features, which identify the characteristics of the system used in sharing the information. These elements help in classifying the needs of the information sharing system.

In the following is the table 3.3 which shows the types of systems and tools by using time-space matrix for each activity to share the information based on its features. There

are different activities which required different communication systems and tools depends on the type of the time and space where the information need to be shared.

Table 3.3 Types of systems and tools by using the time-space matrix.

	Time		Space		Type of system and tool
	Synch.	Asynch.	Co-Location	Different	
Type 1	✓		✓		Interaction/ Conference tables with embedded computers/ face to face communication
Type 2	✓			✓	Group displays Social media: e.g. (WhatsApp)
Type 3		✓		✓	Workflow systems/ Electronic bulletin boards
Type 4		✓	✓		Media spaces/ Chat systems

Table 3.3 provides the time-space matrix for the actors to interact with the system by using the suitable method. This table has four rows and three columns. The four rows correspond to presentations of time and space characteristics, these tools present how each activity shares information. The columns contain the following:

1. the time, identifying whether the information sharing is synchronous or asynchronous;

2. the place, identifying whether the actors are in the same place or not;

3. the type of system and tool which support sharing the information and include the technical tools to be used for sharing information.

Importantly for this study, Table 3.3 facilitates analysing how the actor interacts with the system and tool to be used for the specific activity in an effective way.

3.12 Justification for Using Semiotics and the Activity Theory

The design of the questions in the interviews and the analysis of the participants' responses were guided by both semiotics and the Activity Theory. These theories were discussed in detail in Chapter 3. Essentially, both theories provide a useful framework to understand how the information in the UAE Police Department is used and shared. Semiotics is needed to analyse the information itself and its sharing within the PSCRD and PSCs. However, organisational semiotics taken by itself has difficulty in analysing the problem domain, which concerns the collaboration between the information users that takes place. Therefore, to analyse the features of such collaboration, the Activity Theory is needed, for it provides more operational methods of analysing the collaboration through making use of its treatment of tools, rules, division of labour and community.

Furthermore, the reason why these two theories can be used together is because epistemologically they are similar: both take an interpretivist perspective, with neither having a strong grounding in ontology because always argues that the analyse carried are for the Activity Theory can be treated. As their application does not depend on ontology, they fit in well with the research paradigm of this study, namely design science. While the outcome of that can be treated as realist ontology, that is why these two theories are consistent in treating the epistemological questions, particularly because of the use of the

design science perspective. The next section turns to a more specific approach in the use of design science to develop a framework for developing information sharing systems.

3.13 Chapter Summary

This chapter has laid down a detailed theoretical background for this study of information sharing, based on two theories, the Activity Theory and the semiotics perspective. It will be analysed further in Chapter 5 to deal with tackling the research problem. Both the Activity Theory and the semiotics perspective have been critically evaluated on the basis of their theoretical and philosophical underpinnings.

The chapter has subdivided into four sections. The first section assessed the overall importance of theories in empirical research studies like this one. It look at theories in general and how they can help and support the research study. The second section, on related theories, discuss at a general level theories that can influence the research, as well as some details relevant to this about the Activity Theory. Followed by section which examined organisational semiotics and highlights its importance for the present study. It includes a discussion of the organisational onion diagram, and the relevance of the semiotics perspective and social norms to the analysis of information sharing. The third section adds further details about the Activity Theory and considers how it could be used to develop an appropriate theoretical framework for the research.

Now that the theoretical background of information sharing has been considered in this chapter. Finally present`s an overview of the developed Activity Theory conceptual framework devised for studying the topic. The next chapter examines the methodology that was used to carry out the investigation, including its philosophical assumptions.

Chapter 4: RESEARCH METHODOLOGY

4.1 Chapter Overview

This chapter introduces the appropriate research methodology and design for the evaluation of the proposed framework, and thus answering the research questions. The chapter sets out the research paradigm, methods and techniques which will produce the knowledge required. Having set out the theoretical foundations of this study of the information sharing in Chapter 3. The chapter presents and discusses the methodology used.

The approach taken in this research is based on the concept of the Activity Theory, which was used for the development of an appropriate technological system to deal with the sharing of information. The primary techniques for the data collection were in-depth interviews and the focus group, which were employed to evaluate this framework. Finally, the data collected from the interviews were analysed using content analys

4.2 Research Paradigms

Paradigms can be loosely defined as the different approaches to a research study. A paradigm is a set of assumptions or world views about how things are believed to work or happen. As viewed by Creswell (2003), it is "a shared understanding of reality" (p. 134). It can also be considered as a theory or belief system directly guiding how things are done. A paradigm establishes a set of practices to be adopted, which can include different actions and thought patterns. Every research study is governed by a specific paradigm; notable ones include positivism, post-positivism, critical realism, interpretivism, and design science.

Naughton *et al*. (2001) identified three aspects that can be used to characterise paradigms, which are the ontology, epistemology, and methodology. Ontology attempts to identify and define what is real: it provides a view of the nature of reality. Epistemology deals with how to know something. It is concerned with how we relate to the knowledge we have discovered or that is being discovered. Lastly, methodology deals with how we go about knowing things, which involves the process used to find knowledge through research.

Varying views on the nature of research and the kind of knowledge it relates to have been expressed within and across various disciplines, in which research can yield a wide variation in the kinds of knowledge being developed. The use of the research paradigm can assist in reducing or eliminating these variations in understanding and practices. Research paradigms play the role of providing a guideline on how to carry out and make a decision about research studies. For instance, in the study of law, the researcher uses the adversarial paradigm, which may not be applicable in other disciplines (Mertens, 2005).

Mertens (2005) has made the point that a research paradigm has an influence on the way knowledge is studied and interpreted in a particular discipline. The choice of the research paradigm sets down the motivation, expectation, and intent of the research study, and is the first step that leads to the determination of an appropriate methodology, methods, and research design, as well as the literature to be used in the research study.

Over the years, there has been an upsurge in the development of management science methodologies. According to Mingers (2003), the most notable approach has been in the form of a soft or interpretive perspective that is utilised for problem-solving and practical

interventions. Moreover, Terre Blanche and Durrheim (1999) argue that the research process is composed of three main dimensions: methodology, ontology, and epistemology. The development of various techniques of frameworks in the field of management science has been attributed to the changing environments as well as the emergence of new trends that demand the inclusion of advanced systems. A research paradigm provides a set of assumptions that are used in both qualitative and quantitative studies (Saunders *et al.*, 2009). The section seeks to conduct a comparative analysis between various research paradigms, namely, positivist research, interpretitivist research, critical realism, and design science research. In each case, the focus of the study will be to establish the most appropriate method of designing information sharing systems.

4.2.1 Positivism

In the positivism paradigm, extensive emphasis is laid on observation and reason as the basis for understanding human behaviour (Henderson, 2011). Subsequently, true knowledge of a particular scenario rests on the level of experience of the senses. The research data can, therefore, be obtained through observations and experiments (Mingers, 2004). Avison and Elliot (2006) argued that the positivist research presume that reality is objective and can be measured irrespectively of the study tool used. Furthermore, it focuses on evidence of hypotheses, operational or quantifiable measures, also variables such as dependant and independent are used for testing formulated proposals to make conclusions.

4.2.2 Interpretive

Interpretivists consider the adoption of inter-subjective epistemology and ontological belief to the effect that reality is socially constructed. Various scholars including Walsham (1993), Campbell *et al.* (2009), and Reeves and Hedberg (2003) have contributed to the subject, with the latter noting that the paradigm must put analysis in context. Accordingly, the main interest is not based on the generation of new approaches; instead, they judge and refine interpretive theories, which has been evidenced by (Walsham, 1995). According to this view, the world is socially constructed and knowledge is not objective. Furthermore, in interpretive research conclusions are generally subjective, this because of the study assumes that knowledge is formed by its social context. On the other hand, knowledge can be acquired by social construction such as, consciousness, language shared meaning, etc. (Avison and Elliot, 2006). This is in contrast to the positivism paradigm, which believes in value-free and objective research.

4.2.3 Critical Realism

The critical realism paradigm of research is a combination of two different worldviews, namely, critical theory and postmodern scholarship. The works of the critical researchers are based on the assumption that social reality is historically constructed (Mingers *et al.*, 2013). Despite the fact that people consciously strive to alter both their social and economic conditions, the critical realism approach argues that the abilities of such people are limited by such factors as social and economic conditions as well as political domination (O'Mahoney & Vincent, 2014). As such, critical realism combines both the general philosophy of science as well as critical naturalism to determine the link between social and natural worlds.

Mingers and Willcocks (2014) suggest that the critical realism paradigm admits the ontological reality of a variety of different entities as long as they have a causal effect and can be postulated. The primary intention of the critical realism paradigm in regard to research is to understand the world of human experiences, the reality of which it holds that in the world of human experiences, the reality is to be constructed socially (Mertens, 2005). In it, the research participant gives their views on the subject, situation, or phenomenon being studied. Furthermore, a critical realist researcher recognises how the participant's background and experiences affect the study (Creswell, 2003).

The critical realism paradigm is to combine a general philosophy of science with that of social science, which enables it to describe effectively the interface between social worlds and natural science. It is also useful for establishing the order for undertaking a scientific investigation by giving the object a real and manipulable internal mechanism. A further point is that the use of the critical realism paradigm enhances the understanding of science as an ongoing process (Mertens, 2005). The major difference between positivism and critical realism is that whereas the former bases primary decisions on experiments and observations, the latter is concerned with dealing with various limitations that arise during the research process. As such, critical realism recognises the fact that observations are fallible, and are therefore prone to errors.

In this paradigm, the researcher is likely to rely mostly on qualitative methods and techniques, especially for data collection and analysis methods, as in the present study. However, in some cases, critical realist researchers may use mixed methods, which are a combination of both qualitative and quantitative techniques (Neuman, 2000). Essentially, none of the three paradigms so far are suitable as the purpose of this research is to

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generate a new framework for developing information sharing systems; which is not about understanding the phenomena. Therefore, design science paradigm is explored in the next section.

4.2.4 Design Science

Design science research (DSR) can be traced to the engineering and artificial sciences. It is extensively used in providing long-term problem-solving techniques and seeks to attain its objectives through innovation (Gregor & Hevner, 2013). Under this framework, ideas and practices to be integrated into the research process are identified through an extensive analysis (Kuechler & Vaishnavi, 2012). Thereafter, the identified technical capabilities of the system are utilised in the product development phases, including design, implementation, and evaluation. Due to its importance in the development of new products and ensuring the quality of the production process, the design science research paradigm is popular in the engineering and information sciences.

DSR has been adopted in the management of information systems and its usage can be attributed to its acceptance across the field (Gregor & Hevner, 2013). In the information systems field, design science research is utilised in the construction of numerous socio-technical artefacts such as modeling tools, governance strategies, and decision support systems. Moreover, design science research is also extensively used in the construction of information systems change interventions and information system evaluations (Hevner *et al.*, 2004). The importance of design science research is based on its contributions to knowledge and how its concepts are employed in numerous scenarios to improve the quality of outcomes.

The main similarity between critical realism and design science research is that both are utilised in the effective management of information systems. Critical realism provides a framework that promotes the use of multiple methods in understanding the significance of information systems. However, design science research is preferred since it provides the guidelines for the construction of artefacts, and hence supports the standardisation of processes.

4.3 Design Science Paradigm

Design Science Research provides solutions for the problems of information systems, which are related to the stakeholders (Vaishnavi & Kuechler, 2004). Moreover, the DSR is "A research paradigm in which a designer answers questions relevant to human problems via the creation of innovative artefacts, thereby contributing new knowledge to the body of scientific evidence. The designed artefacts are both useful and fundamental in understanding that problem" (Hevner & Chatterjee, 2010, p. 5). Figure 4.1 presents the DSR framework for designing the IS and evaluating the artefacts.
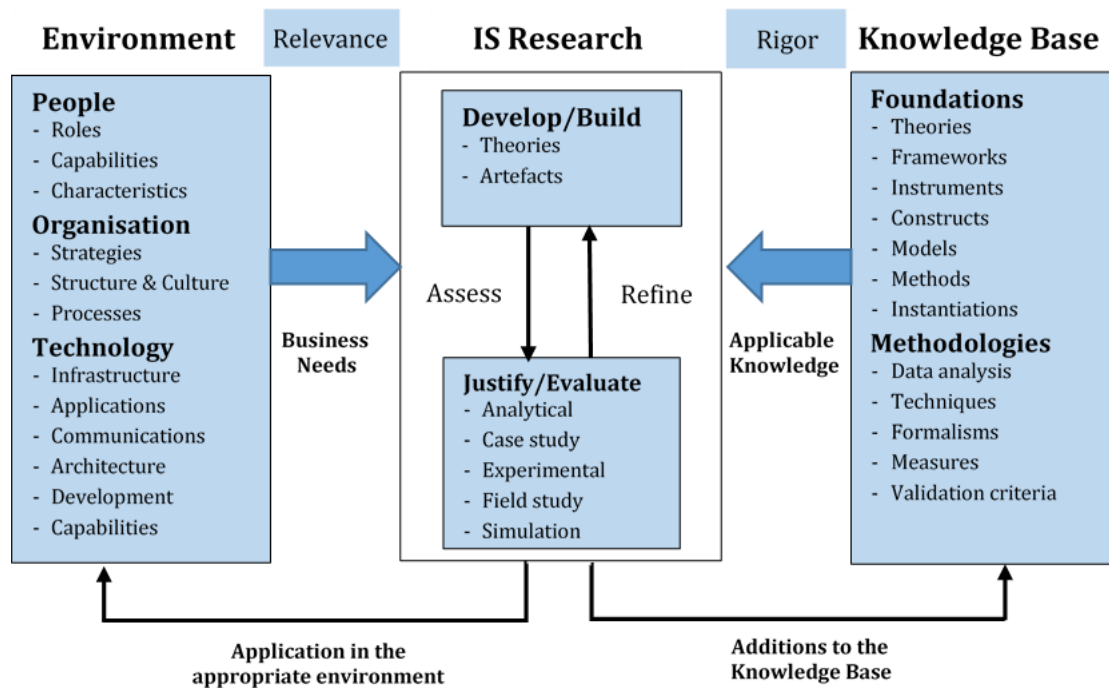
Figure 4.1. Design Science Research framework (Hevner *et al*., 2004)

The rigorous development of a required artefact satisfies a need, meets the standards of quality, contributes the form of information sharing and might be appropriately evaluated (Hevner *et al*., 2004). DSR provides identified guidelines for developing and evaluating a research project. These guidelines address issues by creating and evaluating artefacts to meet the requirements of a business needs (Hevner *et al*., 2004).

Owing to its detailed approach to the management of information systems and engineering programmes, the design science research paradigm is the most suitable approach for this research. The implementation of the design science research paradigm in the management of information systems is influenced by numerous factors. As such, seven major guidelines have been provided in Table 4.1 to identify ways through which efficiency can be attained. However, the guidelines are based on a fundamental principle of knowledge and understanding the design problem as well as the underlying solutions

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to the issues systems. The resolutions are attained during the building and application of an artefact.

Table 4.1 Design science research guidelines (Hevner *et al.*, 2004)

Guidelines	Details
Guideline 1. Design as an artefact	Design-science research must produce a viable artefact in the form of a construct, a model, a method, or an instantiation.
Guideline 2. Problem relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
Guideline 3. Design evaluation	The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4. Research contributions	Effective design-science research must provide clear verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies.
Guideline 5. Research rigour	Design-science research relies upon the application of rigorous methods in both the conclusion and evaluation of the design artefact.
Guideline 6. Design as search process	The search for an effective artefact requires utilising available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7. Communication of research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

Guideline 1 refers to design as an artefact and states that a design science research must lead to the production of a viable artefact (Hevner *et al.*, 2004). These components can be in the form of a model, a construct, an installation, or a method. Design science research should, therefore, provide a definition of the IT artefacts. Guideline 2 is concerned with problem relevance and determines the objective of the design science

research. The support for this model derives from its ability to allow efficient information sharing, support systems that are used to disseminate data, as well as ease the evaluation in various frameworks across organisations. In this case, the aim is to facilitate the development of technology-based solutions to the present, adverse problems that the business faces. Furthermore, to understand and perceive need for systematic framework to develop information sharing system.

Guideline 3, design evaluation seeks to determine the utility, quality, and the viability of the design artefact by rigorously demonstrating these capabilities through well-executed evaluation methods (Hevner *et al.*, 2004). Guideline 4 relates to research contributions and postulates that before design science research is considered to be effective, it must identify clear and verifiable inputs in the design methodologies. Guideline 5, research rigour, states that the process depends on the application of rigorous procedures during the construction and assessment of the artefact. Guidelines 6 discuss a search process and communication, respectively and 7 discuss taking different options in designing artefact as.

The identified model of DSR selected to be used in this research was put forward by Vaishnavi and Kuechler (2007). Furthermore, through identifying the main stages from this generic model, this study proceeds by employing these specific elements and processes. Figure 4.2 shows the DSR processes for this research in accordance with the framework by Vaishnavi and Kuechler (2007). This diagram contains five main stages, as described in Figure 4.2, which shows the objectives of each stage and also explains how each stage of the research is followed and addresses these objectives by following the DSR paradigm.
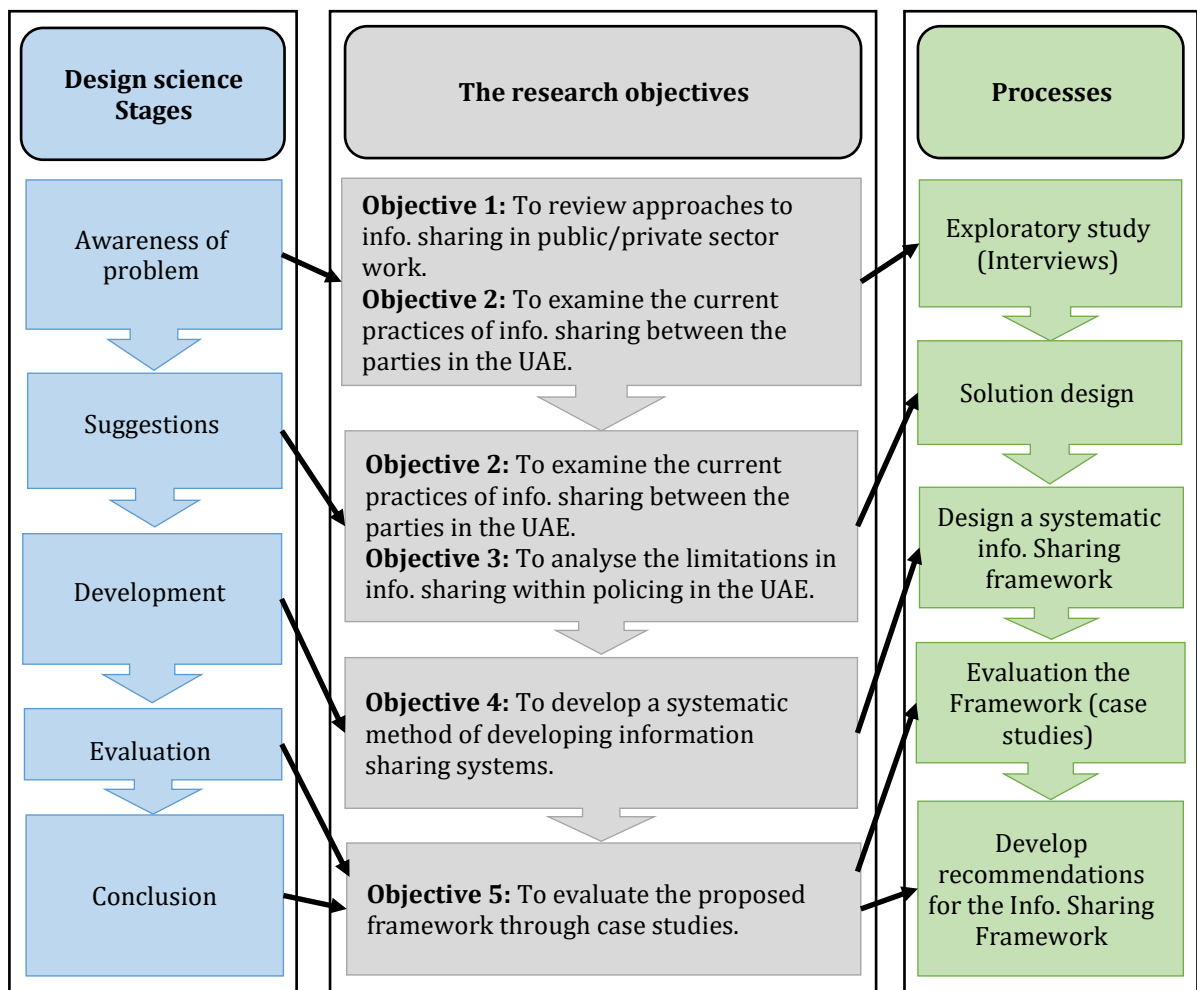
Figure 4.2. The DSR processes for this research (adapted from Vaishnavi & Kuechler, 2007)

Stage one: Awareness of problem stage. As Hevner *et al*. (2004) emphasised, this can be generated from practical or related disciplines of the organisations. In Chapter 2 it was discussed that there is a gap in the information sharing approaches and mechanisms. Also there is a lack of information sharing practices that identified the research problems. Chapter 4 presents the interviews that were conducted to explore and examine the current practices of information sharing among policing. the aim of this research is to develop an information sharing system to improve the information sharing mechanism between organisations through a better understanding of current information sharing

and communication practices between the two stakeholders in the UAE. Therefore, this stage addresses the research objectives 1 and 2.

Stage two: Suggestions stage. This considers finding problem solutions based on the theoretical foundations, and methodologies (Vaishnavi & Kuechler, 2007). This stage is focused on the related theoretical approaches for developing an information sharing framework, analysing the information, and identifying the suitable method for this research (discussed in Chapter 3). Thus, objectives 2 and 3 are addressed in this stage of this research.

Stage three: Development stage. This aims to design framework for the information sharing systems as a mechanism and how it is analysed to address the research problem. This stage aims to identify the Activity Theory that is used for designing the framework for information sharing systems and analysing the information. Consequently, the proposed framework is designed for this research (presented in Chapter 3). This stage addresses objective 4 of the study.

Stage four: Evaluation stage. This is the evaluation of the outcomes of the framework and how the artefacts from the activities support the suitability of using the framework through evaluating its aspects. Case studies in police and healthcare sectors were carried out for the evaluation of the framework products. This stage is presented in Chapter 6 and this stage addresses objective 5.

Stage five: Conclusion. This is the final stage, which includes the limitations that arise from the findings of the framework evaluation in Chapter 6. The outcome, recommendations, and suggestions of this stage is presented in Chapter 8, and this stage addresses objective 5.

4.4 Critical Realist world view in Design Science

According to critical realism perspectives, reality can be fully understood only through subjective interpretations and interventions of the interactions and behaviours in the society. The research philosophy is in accord with the critical realism approaches. Under this philosophical approach, the research phenomenon is studied in its natural environment, the UAE Police Department, with the acknowledgment of the influence of the experiences and the social background of the people under study who share information. Although design science research provides the overall framework of the process by which the artefact is developed, it does not specify how each stage should be formulated. Giving that on understanding of how information is shared in practice is required in the problem awareness stage, in this research the critical realist perspective is taken to address this aspect of design science research.

The philosophical approach admits the use of numerous interpretations of the reality and attempts to consider the social background (Neuman, 2000). However, it still maintains that the numerous interpretations of reality actually form part of the wider scientific knowledge being pursued by the research study. In the following subsections, the discussion on the research philosophy is expanded by considering four aspects, namely the grounding in critical realism, research paradigms, critical realism, and the choice of theories to guide the collection of data, all of which were influenced by the chosen interpretivist approach.

4.5   Research Approach and Techniques

Having discussed the philosophical basis of this study, this section looks at the more practical issues of the methodology and techniques to be employed.

The basis of this thesis is the qualitative research approach, which is mainly associated with the design science paradigm, thereby placing more emphasis on the socially constructed reality. Therefore, by using a qualitative approach, the researcher was more concerned about recording, analysing, and uncovering deeper meanings of socially constructed human behaviours, beliefs, emotions, and experiences. Here, the researcher is more interested in deeply understanding people's experiences, which can be generalised.

Since the study is based on the design science research framework, it was essential to come up with a clear way of developing suitable qualitative methods. Applying critical realism in qualitative research is sometimes confusing because there is little guidance on the precise methods to be used: methods on data collection, coding and analysis. Being a case study of the UAE Police Department, the study was designed to use a flexible inductive process that is consistent with the philosophical framework of design science. It places important considerations on the critical realism epistemology and ontology, such as the use of existing theories and the engagement of participants in terms of their experience and knowledge. The primary goal was to identify key causal mechanisms responsible for shaping information sharing in the UAE Police Department.

The qualitative approach adopted in this study was inductive, meaning that theories and/or patterns of meaning were looked for and developed based on the data collected. The process involves moving from the specific to the general. The process is not based on

the use of a predetermined hypothesis. In addition, a methodological approach to data collection and analysis was adopted to allow greater flexibility. The approach allows the researcher to adapt the data collection midway to address any additional issues arising (Stewart & Shamdasani, 2014).

Because the study was based on the qualitative approach, the researcher used methods that would give the respondents a certain degree of freedom. The methods used also permitted spontaneity, with the respondents not being forced to select from pre-determined responses. The research was also designed to create an appropriate environment that would allow the respondents to express themselves freely, thereby encouraging them to express accurately their emotions, feelings, thoughts, attitudes, and experiences.

Research techniques provide a detailed plan for conducting the actual research in terms of the tools of data collection, which are used as measurement devices. Here, they were used to identify the existing practice of sharing information between the Police Department and the private security companies, as well as the limitations of the current practices and strategies. Two types of research techniques were employed: the interview and the focus group.

4.5.1 The Research as a Case Study

The UAE Police Department was taken as a case study to analyse information sharing between its various stakeholders. A case study is defined as a process of research whereby detailed analysis is based on a particular group, person, institution, or situation. A case is a sample or a single instance of one (Yin, 2003).

In social science, a case study approach is used to provide a detailed examination of the chosen subject of study within the related contextual conditions. Case studies are the most popular research method, especially in the design science research. The main units of analysis in case studies include relationships and organisations. Case studies are preferred because of the ability of a single case unit to provide a great deal of qualitative data for analysis. A single case, however small, can offer big insights into the nature of the phenomenon being investigated.

The design science research paradigm, in its many forms, supports case study analysis. Here, design science researchers simply place emphasis on achieving authentic ways of data collection, and sensitivity to detailed analysis when interpreting the case. It is in line with the general argument of critical realist researchers that there is no possibility of knowing everything is real. It is also in accord with the interpretivists' argument that causality cannot be discerned (Easton, 2010).

Case studies are more suitable for answering the how and why questions that concern information sharing (Yin, 2003). These questions are essential because of their explanatory nature, which allows the in-depth understanding of the nature of information sharing among the stakeholders in the Police Department. The use of a case study helped identify, tease out, and disentangle complex factors influencing information sharing between the stakeholders of the UAE Police Department.

In design science, a case study approach is well suited if the case is clearly bounded, such as an organisation. To identify limitations and gaps in information system in policing, the issue was explored through a variety of lenses, which allowed the proper

understanding of the multiple facets of information sharing in the UAE Police Department, in line with the suggestion of Baxter and Jack (2008).

Case study research is coherent with the design science research position and is helpful for developing the systematic framework and research process for studying information sharing in the UAE Police Department. It greatly contributes to the identification of the current limitations and gaps in information sharing in policing. In short, the case study approach is appropriate for the study of information sharing system in one focal organisation, the UAE Police Department, to develop an information sharing systems delivery framework for this purpose, and then to evaluate it.

4.5.2 Interview Technique

The first research technique used is the interview (see Appendices A & B). As mentioned by Ritchie *et al.* (2013), it is often described as "a conversation with a purpose." An interview is a qualitative technique that incorporates a face-to-face encounter with a respondent in order to explore one or more themes deeply. In this investigation, the interviewer arranged a series of interview sessions with selected respondents. The interview questions were quantified, and a plan was followed. The interviewer can choose to use closed-ended, open-ended, or semi-open-ended questions. In this study, both closed- and open-ended questions were used.

The interview is one of the main tools used in qualitative research to collect data (Ritchie *et al.*, 2013). It places significance on the personal account of the individual because of the power of language associated with it, which can serve to illuminate meaning. Ritchie *et al.* (2013) elaborated on the power of language: "The expressive power of language provides the most important resource for accounts. Ritchie *et al.*

(2013) a crucial feature of language is its capacity to present descriptions, explanations, and evaluations of almost infinite variety about any aspect of the world, including itself" (p. 138). Even though there is an interview guide, the interviewer may adapt the script according to his experiences and any emerging issues during the process. The opportunity was fully utilised when interviewing respondents from the UAE Police Department. The primary goal of the interview in this study was to clearly understand and explain various aspects of information sharing as practised in the UAE Police Department. The researcher posed questions that were designed to meet the research objectives, in particular, to review approaches to information sharing, to examine the existing practices, to analyse their limitations, and lastly, to propose a technology to improve information sharing system within the Police Department and with external agencies.

4.5.3 Focus Group Technique

The second research technique that was used in this study is the focus group (see Appendices C & D). According to Edmunds (1999), by definition, a focus group is a small yet varied (in terms of demography) group of people whose reactions, emotions and behaviours are studied in a qualitative social research study in order to determine what can be expected of the entire population. In the focus group interview, the respondents were asked questions to assess their opinions, perceptions, beliefs, and attitudes towards information sharing in the UAE Police Department. Moreover, they were asked questions to determine further essential elements relating to the use of information systems in the Police Department, along with their limitations and the challenges being faced (Stewart & Shamdasani, 2014).

In practice, focus group interviews have become almost synonymous with qualitative research, that is, it is the most commonly used technique in qualitative research. The focus group interview involves convening a group of respondents to participate in an open-ended discussion about the topic being investigated (Calder, 1977). In this study, the focus group consisted of heterogeneous people in order to yield rich information for exploratory approaches and analysis. Participants were chosen heterogeneously to represent the entire police organisation. This was beneficial in allowing a clear understanding to be obtained of the success and challenges faced by various units in respect of information sharing. It also helped in identifying successful information systems and strategies suitable for each unit.

The researcher used the focus group technique to evaluate and validate the research framework. One advantage of this technique is that the researcher asks questions in an interactive setting to allow participants to talk freely on the issue being discussed. During the process, the researcher took notes and records of the vital points contributed by the participants. In particular, a focus group was valuable in learning about the UAE Police Department and their patterns of information sharing system (Krueger, 1999). The following section presents the particular methods of data collection associated with the methodology described in this section.

4.6   Data Collection Methods

This section presents detailed information about the data collection methods that were used. As described in the previous sections, the researcher relied on the use of the interview and focus group as the primary techniques of data collection for understanding and analysing the information, developing the systematic information sharing framework

and evaluating the aspects of the framework. Table 4.2 illustrates the research activities based on design science research stages.

Table 4.2 research activities based on design science research stages.

Stage	Research activity	Method	Data collection	
			Date	**Subjects**
Problem awareness	Pilot study	Interview	22nd February to 13rd May 2016	19 members from PSCs 13 members from police
Suggestion/ Development	(Design of framework)	(Framework development) Based on Activity theory	-	-
Evaluation	Evaluation of the framework	Case studies: Focus group	7th January 2018	2 members from PSCs 4 members from police
			11th January 2018	3 members from healthcare

4.6.1 Pilot Study

The interview scenarios conducted with 13 police members and 19 PSCs members. These served as a pilot study: a pilot study is conducted with a sample of the actual full-scale interviews (Dikko, 2016; Kothari, 2004). The interview scenarios were conducted to evaluate the feasibility, cost, time, and effect size, as well as any adverse events of the

research techniques (interview and focus group) in yielding consistent results (Dikko, 2016). In other words, they were conducted to get an idea about the appropriateness of the sample size as well as improve the research design.

The reason of using the pilot study was as an opportunity to (1) find out problems related to the recruitment of research participants, (2) assess the acceptability of the interview protocol, (3) assign qualitative methodology, and (4) exercise era within the research (Krueger *et al.*, 2009). An interview protocol is a guide on how to ask the right questions, the order of the questions, the level of probing, as well as the topics and related subjects that an interviewer uses during the actual interview process. The researcher also used it to refine and identify appropriate interview and focus group discussion questions. Lastly, it was used as an opportunity for testing the research techniques, that is, the focus group and interviews. The preliminary results produced were recorded and used to predict the outcome of the actual research (Dikko, 2016). Furthermore, the researcher started planning for the actual interviews and focus groups. The interviews and focus group discussions were held on separate occasions.

4.6.2 Participants Involved in the Case Study

A total of 32 participants, who were all employees of the UAE Police Department and experts in information sharing, took part; 13 were police officers while the other 19 were from the PSCs. They all participated in the individual interviews. A list of the participants and interview and comments made in the interviews are available in Appendices A and B. The first focus group used four members from the PSCRD and two members from the PSCs (see Appendices C & E). The second focus group used three members of the Ministry of Health (see Appendices D & E).

4.6.3 Interviews in Policing

An interview is exploratory in nature, which makes it one of the most suitable techniques for a qualitative research study. Polkinghorne (2007) took note that the interview is especially useful when researching a sensitive subject, which also makes it appropriate for the study of information sharing in the UAE Police Department. In this study, information sharing in the Police Department was treated as a sensitive matter that called for some level of anonymity from the research respondents (see Appendices A & B).

An interview technique was chosen because of its numerous advantages. First, it allowed the researcher to explore sensitive and complex issues easily and comfortably (Krueger & Casey, 2009). Issues relating to how PSCs members share information can be complex given the nature of the profession: some information needs to be kept sealed for some time and not all information should be shared with anyone. When it comes to reporting, there is a structured way of sharing information.

Another reason why the interview technique was chosen is that it is useful in deepening knowledge in a particular subject – in this case, information sharing in the UAE Police Department. It facilitated deep inquiry into key aspects of the information sharing and information systems as practised in the UAE Police Department. Lastly, the interview technique was chosen because it is useful in the study of a subject where there is no prior knowledge. Indeed, the researcher did not have prior knowledge of the information sharing approaches and practices being used by the UAE Police Department.

A key feature of this important qualitative research technique is that it focuses deeply on an individual. By focusing on an individual respondent, the researcher was able to dig deeper in investigating key social issues and aspects relating to the information sharing

mechanism. This further allowed the researcher to assess independently the influence of the individual's experience, feelings, attitudes, and emotions in dealing with all matters relating to information sharing and policing. This enabled the researcher to achieve a detailed investigation (Ritchie *et al.*, 2013).

In particular, the researcher used the interview technique to investigate deeply the personal perspectives of each respondent in regard to approaches to information sharing in police work, the existing information sharing practices, the limitations of the current practices, and how the current information system operated. These categories were assessed with the personal context and research location, that is, the UAE Police Department. In addition, in line with the critical realism perspectives, the use of the interview enabled the researcher to collect data by setting a perspective within the context of personal history, experience, feelings, and the social environment (Hsieh & Shannon, 2005).

All 32 participants participated in a face-to-face interview with the researcher. The details are presented in Appendix B. The interviews took place between March and May 2016. During the interview session, the researcher asked questions that were well informed by the research objectives and the outcome of the pilot study. In addition, the questions were designed in the context of the semiotics and Activity Theories. The researcher took notes and recorded voices during the interview. After all the participants had taken part in the interview, the data collected were organised, sorted, and recorded ready for analysis. The interviews were undertaken in the Arabic language and later transcripts were made and translated into the English language, after which the content analysis took place.

4.6.4 Focus Groups for Evaluation of the Framework Aspects

An advantage of using the focus group research technique is that it is low-cost as compared to other techniques, such as surveys. Another advantage is that it allowed the researcher to get results relatively quickly. It can also increase the sample size. The participants can use the opportunity to learn from one another, which a great advantage to them, given that they all work in the UAE Police Department. Furthermore, using focus group interviews is advantageous because it enables the researcher to detect a number of conflicting feelings, which are essential to making a comprehensive analysis (Krueger & Casey, 2009).

Even though the result of a focus group discussion is useful, many people cite the high level of subjectivity as its main weakness. In addition, there may be a feeling that for any given focus group interview the result might be different with a different moderator and different respondents, or even a different setting. It implies that the moderator, the respondents, and the environment (setting) might all directly influence the result of the interview (Kothari, 2004).

When used in a qualitative research study, the focus group interview may play an essential role in stimulating the thinking of the researcher. It accords with the theories and philosophy upon which this study was based because it expresses an explicit attempt to use thoughts to generate scientific constructs that could explain the information-sharing phenomenon in a police organisation. Furthermore, in line with the design science research, the use of the focus group supported the researcher to evaluate the outcome of the proposed framework. In essence, the rationale of using the focus group interview to

evaluate the framework in terms of information sharing system that capture human experiences, behaviours, feelings, motives, plus other social factors.

Only two focus group discussions were held, on 7th and 11th January 2018. In the first, four members from the UAE police and two members from the Private Security Companies took part in a discussion facilitated by the researcher. The details of Focus Group 1 are available in Appendices C and E. In the second, three members from the Ministry of Health were engaged in the discussion. The details of Focus Group 2 are available in Appendices D and E. In both cases, the participants discussed questions informed by the proposed framework. The questions were designed to explore issues indicated by the AcTIShA-Framework. Similarly, the researcher took notes and recorded voices. After the focus discussion, the data collected were organised, sorted, and recorded ready for analysis.

4.6.5 Data Analysis

Once the collected data were well organised, sorted out and cleaned, they were taken through the analysis process, which included a range of procedures and processes aimed at producing a proper explanation, understanding, and interpretation (see below). Because this was a qualitative research, the data analysis was based on the use of interpretative philosophy. The main idea in a qualitative data analysis is to examine the symbolic content and derive meanings from the data. For instance, as described by Kondracki *et al*. (2002), when analysing the interview and focus group data, the researcher attempts to identify (1) the respondent's interpretation and point of view, (2) why the respondent had such a point of view and interpretation, (3) how the respondent

came to that point of view and interpretation, (4) how the respondent conveys their own situation, and (5) what the respondent has been doing in other areas.

As explained by Elo and Kyngas (2008), there are several techniques used for analysing qualitative data: some of the techniques include content analysis, grounded analysis, and conversation analysis, among other options. Despite the availability of a wide variety, for this study the researcher only employed the content data analysis technique. Krippendor (1989) defined content analysis as a research tool that is used for making valid and replicable inferences through simple interpretation and coding of textual material within their context. It systematically evaluates texts such as oral communications and documents in order to derive meaning and interpretation (Hsieh & Shannon, 2005). The textual material can be derived from the focus group, interviews, and open-ended surveys (Kondracki *et al.,* 2002). In this study, the textual information was derived mainly from two sources: the two focus groups, the interviews and scenario (see Appendices B, and E).

Content analysis is probably one of the most commonly used data analysis techniques in social science. Krippendor (1989) states, "It seeks to analyse data within a specific context in view of the meanings someone – a group or a culture – attributes to them." The content analysis goes beyond the observable events and traces and correlates the antecedents, thereby rendering the context of the data analysable, which been used to analyse the the data collected from the interviews. It is more concerned about observing the stimuli and behaviours manifested as well as quantifying the existing social conditions (Elo & Kyngas, 2008). The content analysis contains six steps, which include design, unitising, sampling, coding, drawing inferences, and lastly validation.

The context of the analysis is defined in terms of what needs to be known and it explores the relevant sources. In this study, there are five main objectives to be known: (1) the approaches to information sharing in police work, (2) the existing practices and mechanism of information sharing, and (3) the limitations in information sharing between the police and Private Security Companies. (4) developing the framework to support information sharing systematically, (5) evaluating the framework outcomes. Furthermore, it is necessary to describe the recording units and classify them in categories of the chosen analytical constructs. The researcher used Nvivo 10 software for the coding of themes and the subsequent data analysis. The final step is to evaluate the results of the data analysis.

4.7   Chapter Summary

This chapter has presented and discussed the research methodology employed in this study of information sharing in the UAE Police Department. This is followed by a description of the research paradigms. It then describes the design science research to develop and evaluate the framework outcome, and discusses the critical realist world view in design science, upon which the study was based.

After that, it presents the research approach and techniques that was employed. A qualitative method techniques such as interviews and focus groups were used based on a case study of the Police Department. It identified how it contributed to the identification of limitations and gaps in information sharing and policing. Finally, the chapter considers the data collection methods and data analysis, including the use of two focus groups with the Ministry of Interior and Ministry of Health for the evaluation of the systematic framework for the information sharing.

A total of 13 UAE police members and 19 PSCs members participated in the interviews and 9 members from police and health sectors participated in two focus groups. Data were analysed using the Content Analysis Technique for the interview method. Therefore, a systematic framework was developed to provide a further focus on the processes of data collection and analysis, which will be our focus in the following chapter.

Chapter 5: ACTIVITY THEORY-BASED INFORMATION SHARING ANALYSIS FRAMEWORK

5.1   Chapter Overview

This chapter extends the two theories that were developed in Chapter 3 by illustrating the analysing the information sharing based on Activity Theory to refine the investigation into information sharing. An information sharing approach was chosen for the study of its exchange within organisations because it offers interesting challenges and different scenarios. Furthermore, the level of bureaucracy within the Police Department is high. These factors collectively affect the nature of information sharing. They also determine the type of information that can be socially accepted for the purpose of facilitating information sharing. This chapter also shows an example of incident procedures in terms of the mechanism of information sharing. An Activity Theory-based Information Sharing Analysis Framework (AcTIShAF) developd for organisations to analyse information and understand information sharing between the actors in each activity.

This framework is proposed to systematically develop the information sharing approach in terms of analysing and understanding the information sharing in various organisation to ensure the accuracy and the speediness of information delivery. The Activity Theory is used for analysing the information sharing because it deals with a socio-technical system consisting of technology, system, information, organisation and the people. For better analysis and understanding, social aspects of information sharing must be considered. In the sharing process, for example of the police control room scenario, the information is first received at the reporting desk. The officer/personnel in charge

records the information and determines the right channel to share it. It is then shared within the system until it reaches its outcome. This approach is useful for monitoring the flow of the information and understanding the sharing mechanism. The following chapter presents the results and the outcome in order to formulate proper solutions.

5.2   Analysing the information sharing through the Activity Theory

The Activity Theory elements have different aspects in terms of analysing the information sharing between parties. There are different relations between elements; the tool mediated between the subject and object can be any method, sign, device, instrument, etc., which is used in transferring, reporting, sharing and informing the information. The rules are mediated between the subject (actors) and community (PSCRD and PSC organisations), while division of labour is mediated between the object and community. The rules cover all norms, roles and instructions and social relations within a community; division of labour refers to the organisations of a community as related to the process of the object into the outcome which is used by the subject in each activity. Basically, there are three activities in which the object is the main information.

Widen-Wulffand and Davenport (2007) explained that information sharing in an organisation can be described and understood in terms of an activity system that can be observed at different work levels. An activity system can be used to understand information sharing in many ways. First, as noted by Wilson (2006), an activity system offers a systematic multidimensional framework of analysis, which can be used to guide both the observation and interpretation of information sharing practices within the organisation. Secondly, it allows intersections of processes and behaviour to be observed

and assessed, thereby aiding proper understanding of the practices and approaches involved.

Widen-Wulffand and Davenport (2007) make clear that by applying the activity system framework, our definition of information sharing, and information behaviour is sharpened, thereby leading to deeper understanding of the entire process. Furthermore, the framework can be used to understand information sharing in an organisation by using it to study limitations, existing gaps, as well as approaches and strategies of the current practice. The activity system highlights how the existing information sharing approaches contribute to organisational knowledge enrichment.

5.3   An Example of Incident Procedures in Terms of Sharing Information

The incident is the critical phenomenon about which full information is required, such as location, type of incident, suspect(s) if known and time. There are some stakeholders who should potentially know about the incident, such as the Premises Security Manager (PSM), Security Supervisor (SS), and police, but the question is, how do they acquire the information about it? Essentially, according to the data collection, there are two key players who have a significant role in sharing information about the incident: the security guard and the public. The security guard is generally on-site for 24/7 and deals with all the people in the premises. The public in this situation could be defined as a visitor, an employee in government or a member of the private sectors, a passer-by or a witness. Therefore, they record the information concerning the incident directly from the location. Each one has a different procedure that depends on the situation. There are two levels in relation to the timing which are required in reporting and sharing information: immediate

reporting between actors and mediate reporting for normal cases to let actors know about it.

A particular incident concerning a hotel was carried out through several interviews and scenario in the field work in regard to information sharing between the Private Security Companies (PSCs) and police (see Appendix B). The procedures relating to this incident involve multiple steps. First, the security guard records the incident and informs it in an immediate reporting to both the hotel's security manager, who provides the link between the security guards, the hotel's management, and the Security Supervisor (SS) reporting via a phone call. This procedure is followed on specific premises, such as shopping malls, universities, some government departments, etc. On the other hand, some premises follow their own policy which does not involve having a security manager, such as banks, some schools, warehouses, etc.

In the next step, the security supervisor informs the PSC control room as mediate reporting and he can take a decision to inform the police for an urgent case and make an immediate report through a direct line phone call. After that, the police will be informed by the PSC for the mediate reporting, while for the urgent cases immediate reporting, public who is directly inform police control room about the incident. Then, once the police have received the information from the public, the PSC or security supervisor will take an action, either by solving the problem directly or investigating with the security guard in the premises if necessary. Finally, the police record and store the information about the incident in their records through traditional ways, for example, in paper-based files or on Excel sheets.

5.4 Understanding of Information Sharing through the AcTIShAF in Police Activities

Bates (2005) explains that the activity system considers various elements of social and communicative contexts when discussing information sharing. In recent years, different theoretical perspectives and processes have emerged that attempt to explain information sharing. An activity system is one such theoretical perspective that can be used to understand effectively information, especially in an organisation such as a police department. It has also been used in various domains such as healthcare, education and other sectors. For instance, Widen-Wulff and Davenport (2007) used the activity system to study and analyse an insurance claims handling unit in two Finnish firms, while Guo *et al.* (2017) used the Activity Theory to study efficient knowledge sharing in an electronic health system.

An activity system can be used to understand information sharing by presenting the social dimensions as a coupled unit; that is, in an information sharing process, the individuals and social dimensions are inseparable. In essence, both objects and subjects co-define each other mutually in the transformation process. Rules, artefacts, and roles mediate the transformation process while artefacts, rules, and roles keep on shifting during the process through social groupings. In this case, the artefact works here as an outcome of the activity or incident which has been created by the actors. Engeström (1999) listed the influencing factors to include instruments, subjects, rules, community, a division of labour, and an object.

Figure 5.1 presents the Activity Theory-based Information Sharing Analysis Framework (AcTIShAF), which shows the activities of each *subject* with the expected

outcome. Based on the observation that has been conducted of police activities in the UAE, the analysis is divided into three activities. The first activity focuses on the information on the incident as an *object*, which is a significant step because of the capture of information where it is created and shared. While the *outcome* of this activity is an incident reporting, this activity has an expected outcome which is an incident reporting, the *object* of the *subject* is to create a report (information artefact) on the incident. The initiator in this activity is a security guard from the PSC who is the creator of the *outcome*, thus the security guard captures the information about the incident, recording it manually in the notebook and the records of the premises. In the bottom part of activity 1, *rule* refers to norms and regulations, which are followed by the mechanism of information sharing between the police and PSCs. The *outcome* of activity 2 is an information on the suspects and this report is used by the security supervisor at the PSC through *tools* such as a phone call and SMS in sharing the information; the *object* is details of the initial information acquired. However, the PSGs are expected to patrol during both days and nights, enforce laws, answer emergency calls, and report about suspected criminals.

In this case the PSM is involved as a supporter for the initial details on the incident. Finally, the *outcome* of activity 3 is the problem solving and information storing, which have been carried out by an agent from the PSCRD as an *object,* which consists of clear and direct information details about the incident. *Division of labour* shows the relationship between all the stakeholders and how they are involved; for example, once the contract has been signed between the premises management and the PSC, the involvement of the SSs and SGs will then take place according to the contract terms and requirements.

Tool
Methods/sings/devices
used to share information

Subject
PSC
(guard)

Object
Info. on
incident

Outcome
Incident
reporting

Rule
Norms, law &
instructions

Community
Police organisations
PSCRD & PSCs

Division of labour
Relationship between
PSCRD & PSCs

Activity 1

Tool
Methods/sings/devices
used to share information

Subject
PSC
(S. Supervisor)

Object
Details of initial
info. acquired.

Outcome
Info. on
suspects

Rule
Norms, law &
instructions

Community
Police organisations
PSCRD & PSCs

Division of labour
Relationship between
PSCRD & PSCs

Activity 2

Tool
Methods/sings/devices
used to share information

Subject
PSCRD
(Agent)

Object
Clear & direct
info. details
about incident

Outcome
Problem
solving and
info.
storing

Rule
Norms, law &
instructions

Community
Police organisations
PSCRD & PSCs

Division of labour
Relationship between
PSCRD & PSCs

Activity 3

Figure 5.1. An example of analysis using the AcTIShA-Framework

5.4.1 Information Artefact for Action Network Analysis in Policing

These information artefacts of this study are used from the AcTIShA-Framework to develop a new and suitable information sharing system based on components of the IRS and to analyse the information sharing mechanism. Basically, the IRS includes components as an outcome from the AcTIShA-Framework. This framework aims to address the identified problems for the research. Figure 5.2 shows the action network of each artefact as explained in this section. Basically, this diagram has been generated from Figure 5.1 and shows the set of information requirements, which are actions, actors, information artefacts, and purpose. Figure 5.2 illustrates the information required in policing from Figure 5.1, with the addition of the actions and the purpose of each action.
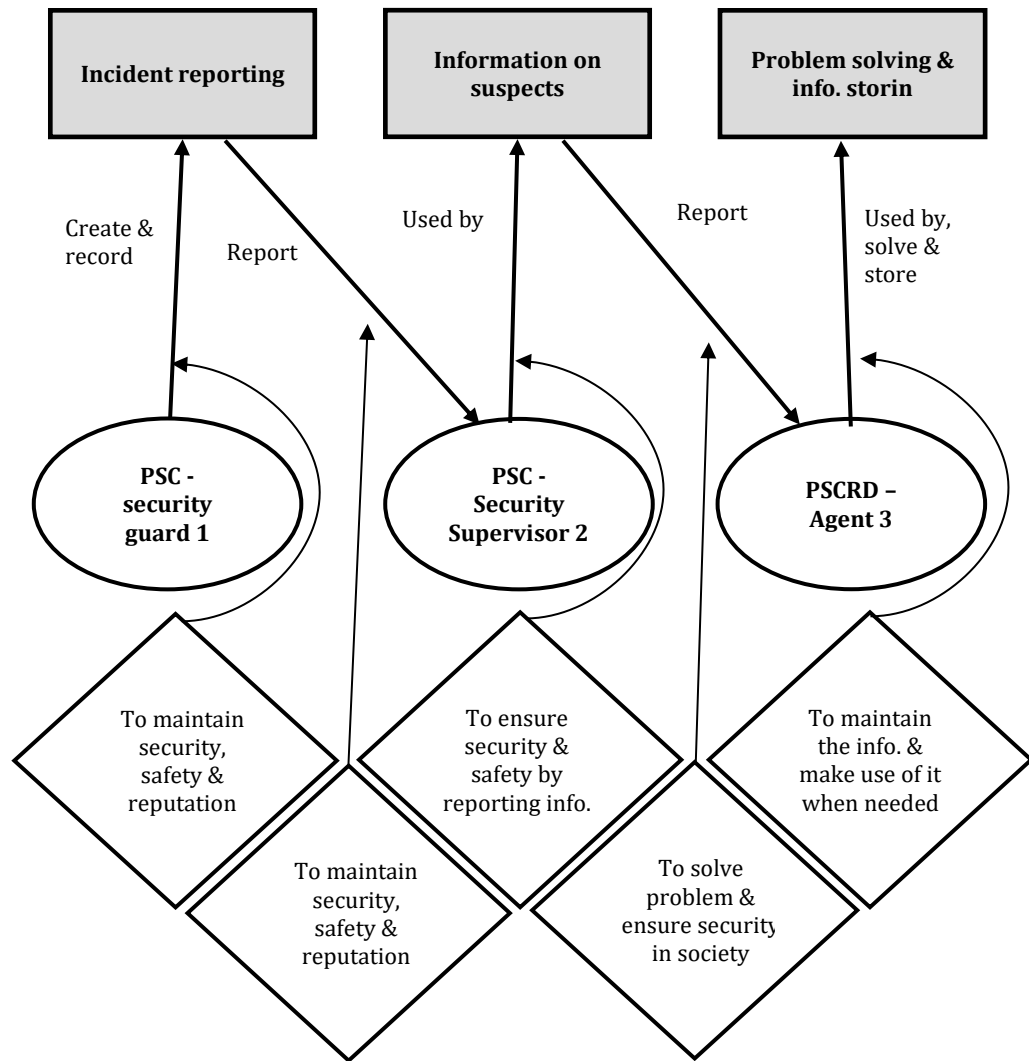
Figure 5.2. An example of analysis using IAANA

This action network of information artefacts is articulating the relationship between artefacts and subjects (actors), and it does this through the actions, where the actions are defined as a set of possible actions, which are create, record, report, used by and store information. The information artefacts are as follows: the first is incident reporting, the second artefact is information on suspects, and the third is problem solving and information storing. The arrows include actors indicate actions, and this simply shows there are five different actions, which are create, record, report, used by and store, while

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the intention of each action is explained in the rhombuses as components to help in developing an information sharing system. The incident reporting is created by actor 1 and reported to actor 2; the purpose here is to maintain the security, safety and reputation of the premises. Then the reporting of the incident is used by actor 2 for the same purpose as actor 1; after using the created report about the incident, actor 2 creates an information on the suspects to ensure security and safety, and report the information to the competent authorities.

Amron (2002) observed that police officers prevent crimes from happening, investigate different crimes, and write reports related to offences. Moreover, police officers are supposed to protect the public and property, interview suspects, victims, and witnesses. Other activities carried out by the police include preserving the crime scenes for investigation, controlling traffic jams, gathering information using intelligence, and presenting collected evidence in courts. These processes are necessary in terms of information reporting effectively in the right direction and immediately. Information on suspects is used by actor 3, and the purpose of problem solving and information storing is to maintain the information and make use of it when it is needed to ensure security and stability in the society. In the final action actor 3 stores the information because of the future need for it, which can be reused for analysis or investigation requirements for a specific matter. Furthermore, the accessibility of information artefacts to subjects is dependent on what use they would wish to make of it and hence the outcome, which will vary in different circumstances.

5.4.2 Information Requirement Set in Policing

As we have seen, the Activity Theory sets out an activity as an approach through which things are directed to a specific object. In addition, it has been discussed how the artefacts mediate the relationship between the actors in the process to ensure that the object is satisfied. These two elements define the nature of the information flow in the activity in the framework developed above for the AcTIShA-Framework, which in this case defines the flow between the UAE Police Department and the relevant Private Security Companies.

However, when the PSCs are involved, the flow of the information may change a little. In this situation, the private security sector can act as the producer (communicator) of the information. Here, it falls within the subject category. From the object level, the information is then shared to specific members of the Police Department responsible for handling it. The sharing of the information is thereby achieved through the formal and informal division of labour. The division of labour emerges from a pragmatic judgement of who in the department should answer and handle what type of information. It is further determined by their expertise and position in the Police Department. From there, the information is then used directly to produce the object.

The matrix helps as a framework for analysing information sharing between parties, departments, or within an organisation by identifying the actions, actors, the information artefacts and the purpose. Table 5.1 shows the Information Requirement Set through some activities. The left column presents the activities, such as activity 1, activity 2, and activity 3. The subjects and actions are assigned to two columns. The actions column

includes 'create', 'record', 'report', and 'used by' and 'store', which are performed by actors and every actor can use several actions depending on the situation/incident.

Table 5.1. An example of Analysis using IRS in Activities

	Information artefacts	Subjects and actions		Purpose
		Actors	Actions (Create, record, report, used by and store)	
Activity 1	Incident reporting	**Actor 1** PSC (security guard) (create, report, and record)	A1 Used by SS **Actor 2**	To maintain security, safety and reputation
Activity 2	Information on suspects.	**Actor 2** PSC Security Supervisor SS (create, report)	A2 Used by CA **Actor 3**	To ensure security stability in society
Activity 3	Problem solving and information storing	**Actor 3** PSCRD (agent) Competent Authority CA (solve and store)	A3 Solved & stored **(end)**	To maintain the information and make use of it when needed

Actors are represented as a subject in Figure 5.2, and their task in the activities is to create, use, record, report and store the information. The purpose included in Table 5.1 is to state why each action occurred, as shown in Figure 5.2. Finally, the information artefacts are the outcomes shown in Figure 5.2, and these artefacts are created, recorded, reported, used by and stored by actors as actions for sharing the information. Abrahamson and Goodman-Delahunty (2014) argued that the ideal, normative notions of

democratic information sharing dictate that information should freely flow across all parts of a civil society; however, regarding the contemporary policing environment, information sharing must be grounded within the bounds of the reality of knowledge accessibility, requirements, politics, values, security and the context of the organisation. Basically, this matrix is facilitating the analysis of information sharing between the police and PSCs, based on the Information Requirement Set.

In respect of the police case for the present study, the Information Requirement Set is defined as an action, actor, information artefact, and purpose. Thus, the IRS is consisting to treat information architecture matter. The details of the information to be shared include demographics, the source of information, the intended user, as well as the information content itself, among others. Identifying the kinds of information is useful in choosing an appropriate information sharing technology to be used in the Police Department. The information requirements also specify how to share, handle, and manage the information (Goyal, 2014).

5.5   Chapter Summary

This chapter has examined the entire approach based on the Activity Theory in relation to the analysis of information sharing. The AcTIShA-Framework has been put forward, which encompasses the Information Requirement Set with its four components of actor, action, information artefact and purpose. The chapter illustrates how the features, systems and tools can be used in different activities. Scenarios have been provided to support each component of the AcTIShA-Framework. The next step is to evaluate and develop this framework to improve the information sharing in organisations, which is the subject of the next chapter.

Chapter 6: CASE STUDIES: APPLICATION OF THE ACTISHA-FRAMEWORK

6.1 Chapter Overview

This chapter focuses on the evaluation and analysis of the AcTIShA-Framework and applies it in two sectors as case studies: the police sector and the healthcare sector. The focus group method was conducted in both sectors (see Appendices E). The AcTIShA-Framework is used to assess the consistency and feasibility of two aspects of evaluation, which are: 1) the usability of the framework in terms of information sharing systems which are generated by the framework; and 2) the accessibility of guidelines which are generated by the framework to support the information sharing system. The chapter aims to show how the AcTIShA-Framework can be used in between organisations as a way of assessing and demonstrating its utility and versatility to affirm that it can work in different organisations.

6.2 Method of Evaluation

Two separate focus groups were conducted to examine the effectiveness of the AcTIShA-Framework towards evaluating information sharing between different organisations (see Appendices C, D & E). The focus groups and scenario took place on two days: the first consisted of four officers from the PSCRD Ministry of Interior MOI and two senior managers from the PSCs and was conducted on 7th January 2018; the second consisted of four officials from the Ministry of Health MOH and was conducted on 11th January 2018.

Both focus groups were conducted using the Arabic language, which is the native language of the participants, then the transcripts were translated to the English language for analysing the data. The first group (police and PSCs) took place at the police station; all the participants were invited to attend by third party invitation and were briefed ahead of time about the purpose of the scenario and focus groups and the type of questions that would be asked and the real world scenario by applying the framework. The participants of both groups were selected on the basis of intensity, which refers to selection according to their experiences in relation to the phenomenon of interest (Onwuegbuzie & Collins, 2007).

The police and PSCs group included six members, which is small enough to encourage them to interact and share their perceptions and opinions – more details are provided in section 6.3.2. The healthcare mini-focus group consisted of only three participants so as to gather detailed information – more details are presented in section 6.3.3.

Both focus groups were led by the researcher alone, who initiated each by giving a short and concise introduction using a PowerPoint presentation to explain the AcTIShA-Framework, and how it could be used to improve and support information sharing between extended and independent organisations. The researcher informed all the participants that the data obtained would remain confidential and all names and positions linked to locations would be kept confidential; all the participants were then requested to sign an official consent form.

6.3   Profile of the United Arab Emirates

The United Arab Emirates, also known as the UAE, is a federation that is comprised of seven states: Abu Dhabi, Ajman, Dubai, Fujairah, Ras al-Khaimah, Sharjah, and Umm al-Quwain. The UAE is located between Saudi Arabia and Oman on the Arabian Peninsula and boarding the Gulf of Oman and the Arabian Gulf. The states with their rich oil and petroleum reserves have transformed the country into one of the largest economic centres in the Middle East.

The capital city of the UAE is Abu Dhabi. The UAE's population is 9.34 million people in 2018 and its land area is estimated to be 83,600 square km. The major language spoken is Arabic, and its religion is Islam (Jayaraman *et al.*, 2015). The UAE is aiming to transform its cities to "smart cities" in order to provide "smart services", including the safety and security within the society. Figure 6.1 shows the success factors of the smart city.
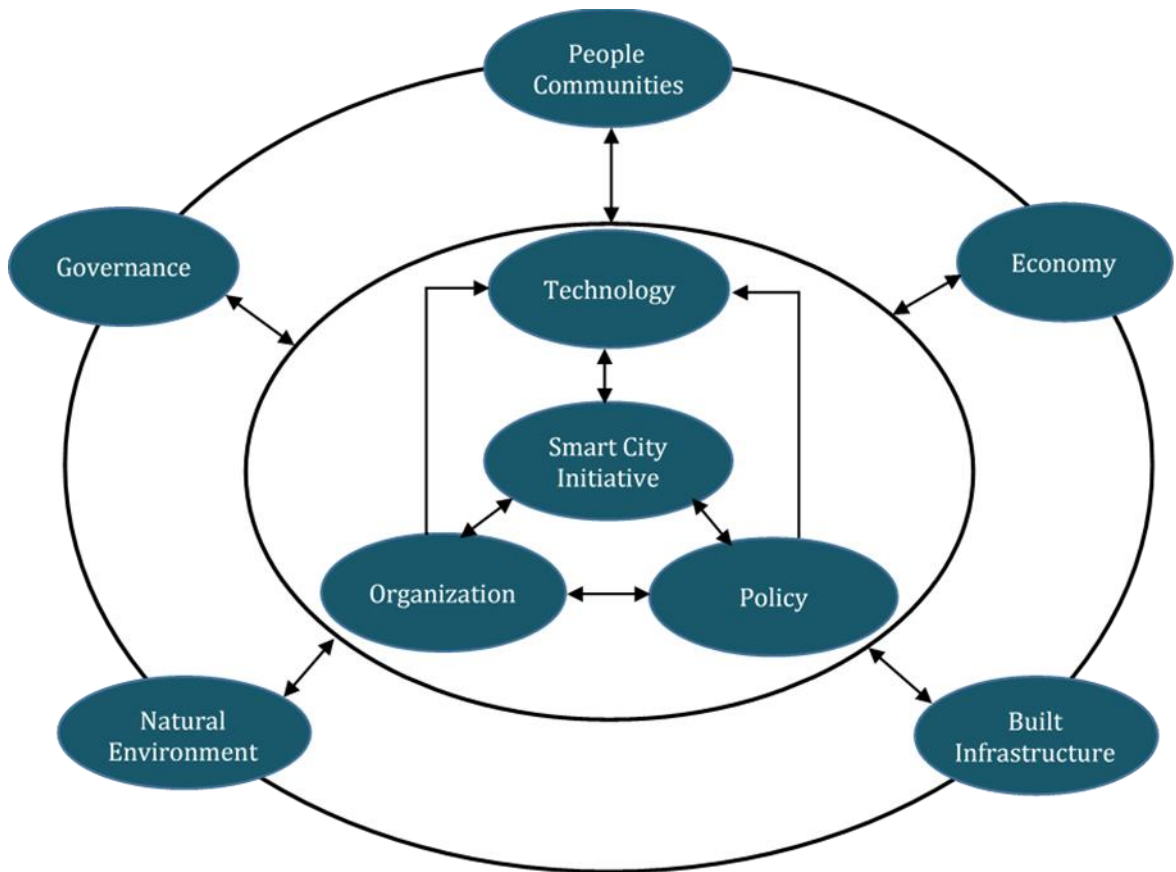
Figure 6.1. The success factors for the smart city (Mohammed *et al.*, 2014).

It can be seen in this figure that one of the success factors is governance, which relates to the outcome of this study. Governance focuses on how the exchange of information can achieve the targets toward collaboration, communication and data exchange, which are highly demanded for effective governance within the country (Mohammed *et al.*, 2014). This research contributes to supporting this aim by providing a new concept of effective information sharing systems to contribute in achieving the government goals. The police and security are issues that are a priority in the country. The police force also maintains

peace across the Emirates. There are processes being implemented to allow the sharing of information, such as consumer information.

6.3.1 Ministry of Interior

The policing and securing of communities are a collaborative effort between Private Security Companies and the police force, which is controlled by the Ministry of Interior (MOI) in the UAE. In fact, maintaining security in the UAE community is now mainly undertaken by a government organisation known as the Private Security Companies Regulatory Department PSCRD, despite a trend of the increasing use of privately funded parties known as Private Security Companies. Figure 6.2 shows the organisational structure of the PSCRD in the UAE. The role of the PSCs is to identify and protect crime by providing security services at those vulnerable and sensitive sites where this is needed. Nevertheless, the PSCRD and PSCs are highly dependent on information sharing, and have become active partners in the effort to enhance safety and security in the UAE society. In the bid to control and prevent crime, emphasis has been placed on transforming the PSCs members to become part of the problem-solving process and the essential role played by police officers in the policing of communities has made it necessary for deep changes within the police organisation (Uthmani *et al.*, 2010).
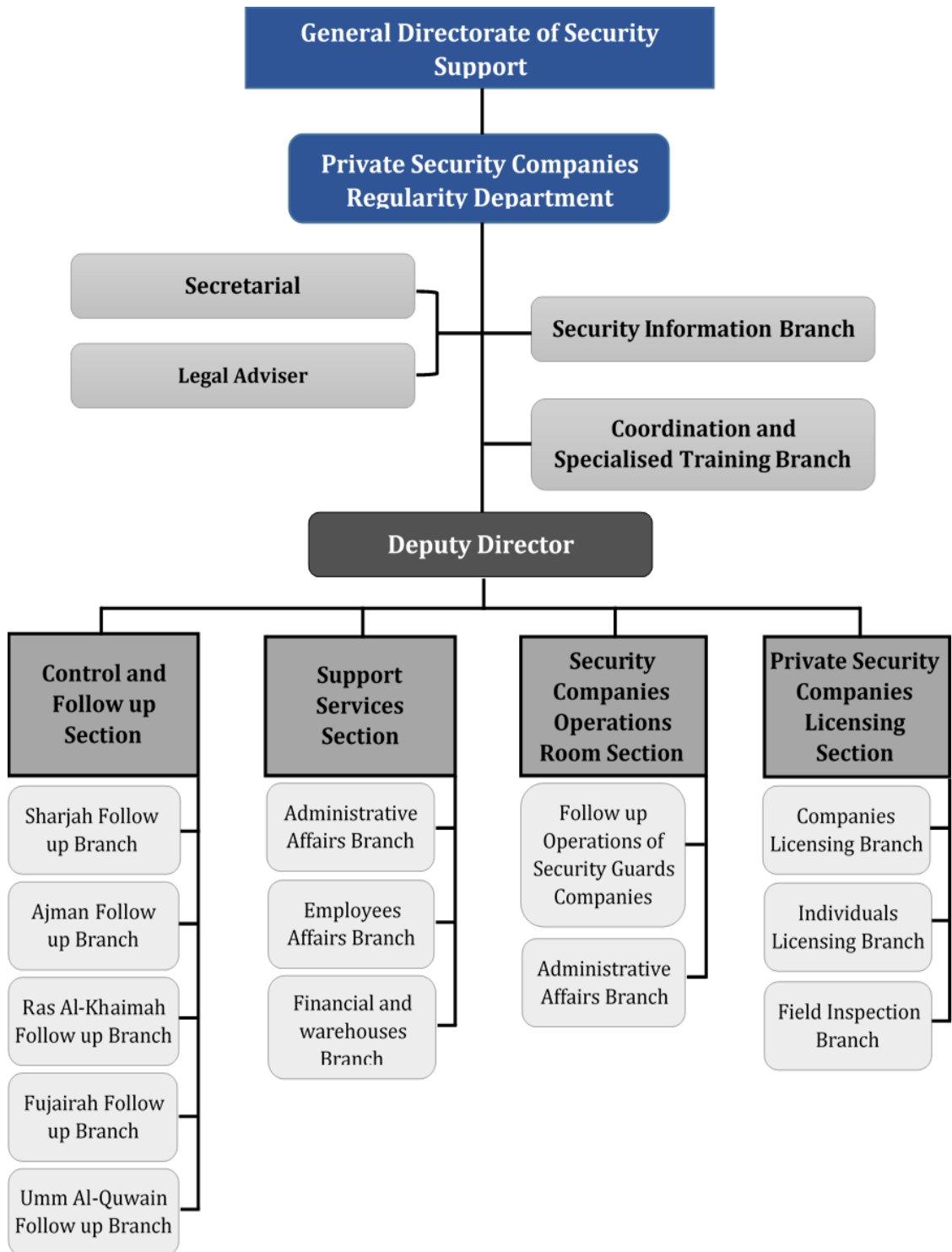
Figure 6.2. The organisational structure of the PSCRD (Ministry of Interior, UAE)

The PSCRD, after joining the PSCs as providers for the security services and with implementing the civilian private security services, could be defined as the new convention in the Ministry of Interior in the UAE. This is because of the efforts being made to create a beneficial and effective relationship between the Police Department and PSCs. This calls for the creation of closer relationships among all the members of both organisations to form effective partnerships (LeBeuf *et al.*, 2003).

6.3.2 Police Case Study

The Police Department and PSCs were a central feature and source of data throughout the study, including the capturing of data through the focus group to evaluate the AcTIShA-Framework. It was neccessary to understand the information sharing that took place among both stakeholders and how this process could be improved.

The AcTIShA-Framework was introduced to the participants as a systematic approach towards effective and efficient information sharing within organisations. It was explained to them that this research was primarily focused on the policing domain within the UAE, and how information sharing with the existing PSCs could be improved.

The framework was described to the participants as being largely designed, focused and based on the Activity Theory, for the purpose of achieving logical and coherent management of information sharing between various organisations. The participants were advised of the importance of their feedback and opinions towards the evaluation of the framework, including finding out if it could successfully be administered within real working environments. In the police and PSCs focus group, the participants directly interacted in information sharing, developing, and maintaining the mechanism of information sharing in policing, and the data collected proved valuable. After the

presentation, the participants were encouraged through the help of some key questions to participate in an open discussion. Table 6.1 presents the details of the police and PSCs focus group participants, which have been given anonymous initials for the purpose of confidentiality.

Table 6.1. Participants from police and PSCs

Focus Group 1			Sunday (07/01/2018)
No.	Participant	Organisation	Job title
1	P_1_P	PSCRD	Head of Information Department
2	P_2_P	PSCRD	Head of Operations Department
3	P_3_P	PSCRD	Information Recipient
4	P_4_P	PSCRD	Head of Control Room
No.	Participant	Organisation	Job title
1	P_1_S	PSC	W_Security Services Manager
2	P_2_S	PSC	R_Security Services Supervisor

The purpose of the AcTIShA-Framework is to provide a comprehensive coverage of improving the information sharing and help the users understand the motivation to participate in the organisation's activities. The challenge is to provide a mechanism that is useful enough not only to handle the quantity of information, but also to support users in doing their work in order to share the information effectively. In this research the evaluation of the framework focuses on two aspects, usability and accessibility, in respect of the requirements of the information sharing system and design guidance generated by the framework.

Usability is defined by ISO 9241-11, (1998) as "The extent to which a product [service or environment] can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use". ISO 9241-171 (2008) defined the accessibility as "the usability of a product, service, environment or facility by people with the widest range of capabilities". The assessment of the usability and accessibility of a product with the provided features and systems of the framework is to ease of use the mechanism of information sharing by users. The following presentation of the stages of the framework will illustrate its application to a scenario to assess its features, utility and application.

6.3.2.1   *Stage 1: Information Sharing Analysis in the Bank Scenario*

The framework was applied to a scenario by using it with potential stakeholders to evaluate the outcomes, and how much it satisfied the various requirements. The researcher conducted a focus group scenario with four police officers and two PSC members. This considered a real world scenario which was carried out with the police and PSCs as an actual incident in terms of information sharing. The incident of the bank had been chosen and agreed by participants from both stakeholders.

The first stage of this scenario is shown in Figure 6.3. The AcTIShA-Framework shows how each subject is involved in a different activity. Based on the scenario of the bank incident that was conducted within the police and PSCs in the UAE, the analysis is divided into three activities because this scenario includes three main actors, each one involved in a separate activity.

The first activity started from a particular bank where the security guard is carrying out basic patrolling; during this procedure he recognised that there is an incident in the

bank, defined as an object. The information about this incident is created by the security guard to be shared with the competent supervisor. The outcome (information artefact) from this Activity 1 is that of immediate reporting; the other action taken by the security guard is to record the information in both premises and the PSC's notebook.

The second activity is carried out by the security supervisor, who uses the information reported from the security guard via WhatsApp; he then makes a phone call to share the information and then investigates the incident with the bank management, which is the object of this activity. The information artefact from Activity 2 is information about a suspicious item found.

The final activity in this scenario involves the police agent, where the object of this activity is an intensive investigation into the incident. The outcome of Activity 3 is the problem solving and information storing, which is the final action in the activity. The other elements of the activity system such as tool, rule, community and division of labour are the same in each activity. The tools used to share the information between the security guard, security supervisor and police agent are SMS, phone call and the wireless device. Rule refers to the regulations and norms followed by the existing information sharing system between the two organisations. Police departments and PSCs are the community of all activities, while division of labour presents the relationship and involvement of all the stakeholders. The involvement by the PSCRD is using the law on the conduct of PSCs to do their tasks while the PSCs have two mechanisms: one is following the PSCs law and the other hand is to follow the premises contract which was signed between them. This is because their profit and reputation are a first priority.

Activity 1

Activity 2
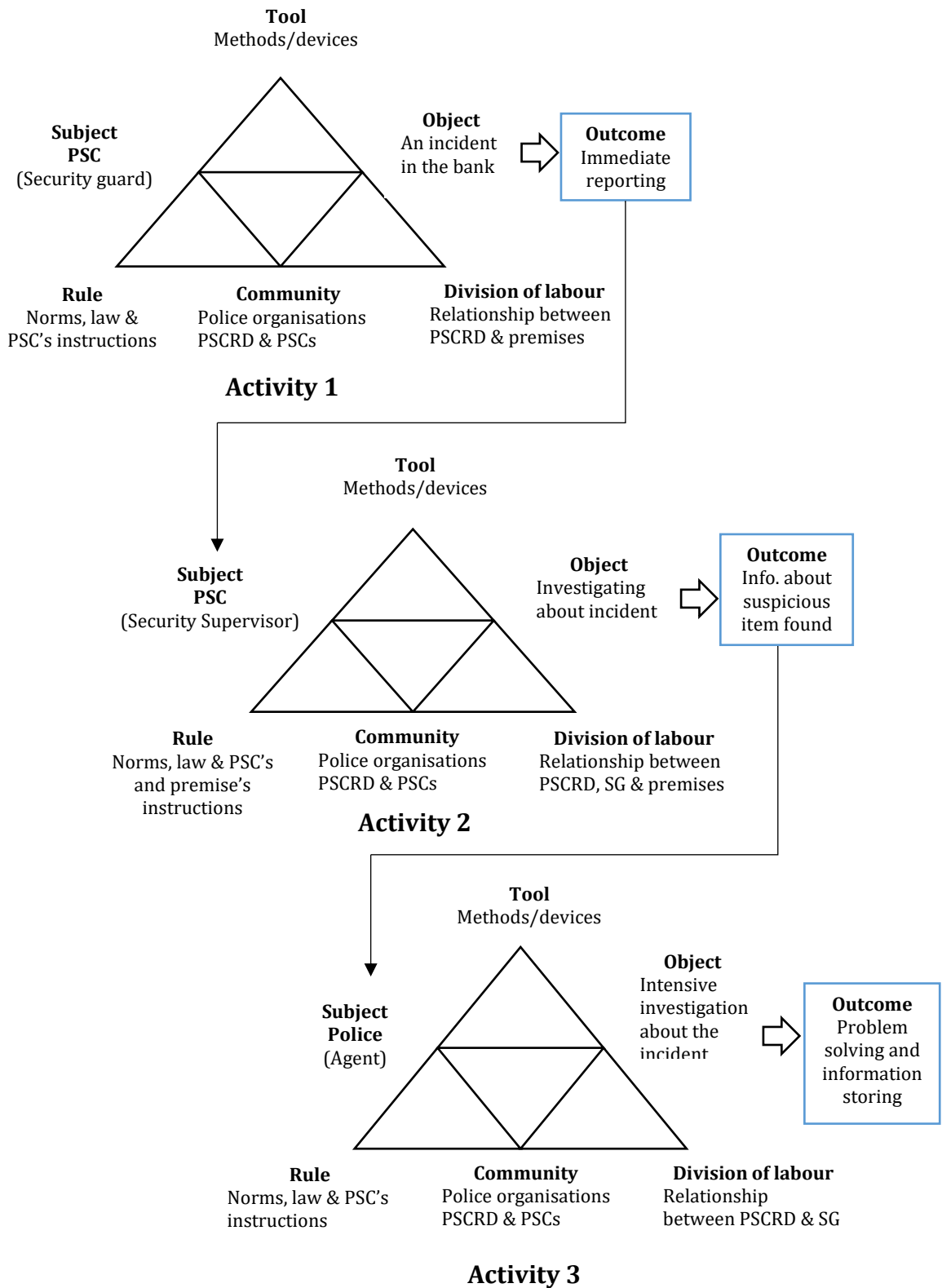
Activity 3

Figure 6.3. The Activity Theory-based Information Sharing analysis framework for the bank scenario.

In this stage of the scenario, the members from both stakeholders showed they were in agreement with all the steps in term of sharing the information. Participant (P_1_P) from the Police Department remarked that it seems unclear if the actors will accept using these processes or not, probably because some users will resist the change with the new system, technology and mechanism. Participant (P_1_P) argued that:

"In regard to the bank incident, and based on this framework, the information processes will be shared systematically from the security guard in the bank to the security supervisor and then to the police control room through the specific instruments, depending on the level of the incident; then the information is sent from the information recipient to the competent authority to solve the issue. However, the concern here is the resistance to any new system, technology, mechanism on the part of some users who refuse the change and this may be affect using it negatively".

The result from this stage suggested a resistance on the part of some of the users to use a new system/technology/mechanism, which might cause inefficient use of the system and accessibility in terms of sharing the information.

6.3.2.2 *Stage 2: Information Artefact for Action Network Analysis in the bank scenario*

After analysing the information through the bank scenario as the first stage in Figure 6.3, the next stage is to analyse the information artefacts action by explaining the procedures based on the IRS, which is generated from AcTIShA-Framework. Essentially, these

information artefacts are used in this stage to show the relationship between actors and the artefacts, as well as identifying the purpose for single actions.

The actions in this case are several, such as capture, create, record, report, used by and store information. The analysis in this stage starts by determining the information artefacts; the first is immediate reporting, the second is information about the suspicious item found, and the third is problem solving and information storing. The actors play a key role in the information sharing processes. The security guard as a first actor captures, creates and reports the information, which is an immediate reporting to the second users, the security supervisor and the bank management, with the purpose to maintain security, safety and reputation. Figure 6.4 illustrates the information artefact for the action network analysis in the bank scenario.
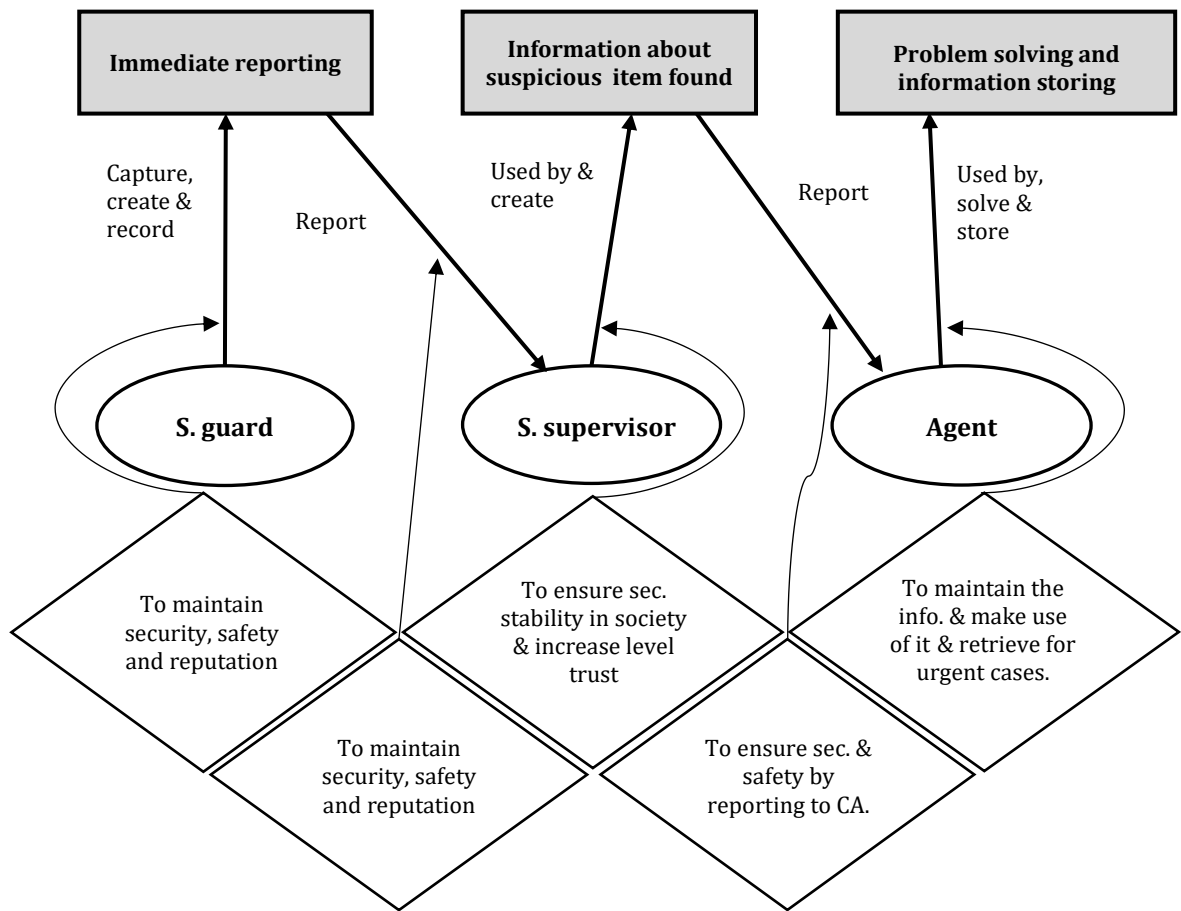
Figure 6.4. Information Artefacts for Action Network Analysis in the bank scenario.

The security supervisor uses the information artefact from the first actor and after investigating the incident he creates an information artefact, which is information about the suspicious item found and reports it to the police operations room. The reason for creating this information is to maintain the currency of the information and to be able to make use of it when retrieving the information for urgent, emergency cases or for further investigations as an end action. Participant (P_1_S) from the PSC explained that the intention for the action of using and creating the information artefact by the security supervisor is to maintain security, safety and reputation and for reporting it to ensure

security and stability in the society and to increase the level of trust. Additionally, he argued that the purpose for the actions not really needed in all activities however, it can be work with the other three components of the IRS. The participant (P_1_S) stated:

> *"Actually, we need such a system to be followed to enhance the information sharing. I personally find this framework helpful to be used in order to ensure the information sharing is effective, as applying it in this scenario. But I think using the purpose as an element in the activities of the information sharing not really needed because it may confuse actors to share the information properly. My suggestion is to have one purpose for each activity".*

The main finding from this stage is to recommend not to use the purpose as one of the IRS components for all actions because one of the group members agrees that this element is not necessary in this framework's activities.

6.3.2.3   Stage 3: Information Requirement Set in the Bank Scenario

This stage of the framework identifies the actions, actors, information artefact and purpose of each action, which details are captured from the earlier Figures 6.3 and 6.4. Basically, these elements are considered to be the main components of the IRS which have been generated from the framework in order to analyse and understand the information sharing, as well as to help determine the proper features and system/technology to use in regard to sharing the information effectively. As presented in Table 6.2, the IRS for the scenario of the bank categorises and sorts the details under each component of the IRS and creates meaningful of it.

This matrix provides the required information and details based on the elements of the IRS to determine the features required and then select the suitable tool or system for the specific activity or incident. In regard to this scenario, the information has been filled in the matrix cells in order to analyse the information sharing among the PSCs and Police Department depending on the IRS. This scenario carried out with the bank incident indicated that the Information Requirement Set does not seem to be strong enough due to using the purpose element for each action. Participant (P_4_P) said that:

"I agree that this framework is useful and through this scenario shows its suitability and applicability. I totally support my colleague that the IRS elements are satisfying the needs, except the purpose is repeated in all the activities which is not really needed for all actions but only for each activity where it makes sense. On the other hand, it might waste time in order to share the information effectively".

The findings from stage 3 show that the purpose as an element of the IRS which then might be useful to be used as an intention to each activity rather than each action due to details for single action.

Table 6.2. Information Requirement Set for the bank scenario.

	Information artefacts	Subjects and actions		Purposes
		Actors	Actions (capture, create, record, report, used by and store)	
Activity 1	Immediate reporting	**Actor 1** PSC (security guard) (capture, create, record and report)	Information Artefact 1 used by **(Security supervisor) Actor 2**	To maintain security, safety and reputation
Activity 2	Info. about suspicious item found	**Actor 2** PSC security supervisor (Security supervisor) (create, report)	Information Artefact 2 used by **CA's Actor 3**	To ensure security stability in society & gain police trust
Activity 3	Problem solving and information storing	**Actor 3** PSCRD (agent) Competent Authority (CA) (solve and store)	Information Artefact 3 solved & stored **(end actor)**	To maintain the information and make use of it when retrieving the information for urgent, emergency cases or further investigations

6.3.2.4   Stage 4: Mapping the IRS to the Information Sharing Systems and Features in the Bank Scenario

The outcomes from the framework activities after analysing and identifying the required information to be shared the mapping then facilitates using the features and system at the right time and in an effective way. This is based on the systematic mapping which is used to work on the time-space matrix, where the time includes synchronous and

asynchronous aspects representing the timing of sharing the information; and space includes the co-location and different location, which presents the place where the incident occurred. Table 6.3 shows the mapping the IRS to the information sharing systems and features for the bank scenario.

Table 6.3 Mapping the IRS for the information sharing systems and features for the bank scenario.

| | Actors | | Purpose | Features | Time | | Space | | Type of system and tool |
	From	To			Synch.	Asynch.	Co-Location	Different	
Activity 1	Actor 1	Actor 2	To maintain security, safety and reputation.	- Easy to use - Quick sending of the info. - Record	✓		✓		- Intranet system - Face-to-face communication. - Social media such as WhatsApp Police internal database
Activity 2	Actor 2	Actor 3	To ensure security, stability in society & gain police trust	- Instant sharing of the information	✓			✓	- Social media such as WhatsApp Police internal database
Activity 3	Actor 3	Final Actor (End)	To maintain the information and make use of it when retrieving the information for urgent, emergency cases or further investigations	- Instant sharing the information	✓		✓		- Intranet system. - Face to face communication. Police internal database

For these activities the required features and time-space communication there are three types of the tools based on time-space matrix used. First, is the (Synchronous – co-Location); it is urgent information and happened in a same place; and the recommended

system to share the information is the social media such as WhatsApp and intranet system while the feature is the instant delivery of the information. Participant (P_3_P) stated that:

"By identifying the tools that are used in sharing the specific information, it really can solve the issues in a current mechanism and improve the information sharing. Indeed, the IRS mapping to share the information systems and features in this scenario is clear and usable in terms of sharing the information in an effective way".

Activity 2 concerns the information shared between actor 2 and actor 3 for the purpose of ensuring security and stability in society and gain police trust; in this case, the tool needed is social media such as WhatsApp, while the feature is the instant sharing of the information. Finally, there is activity 3. Its purpose is to maintain the information and make use of it when retrieving the information for urgent, emergency cases or further investigations; the feature is instant sharing of the information and for this activity the intranet system or face-to-face communication is needed to meet the requirement.

Actually, all the participants in the focus group agreed that this mapping the IRS for information sharing systems and features is clear and usable to share the information effectively. Stage 4 is the final stage in this framework, which is for organising and categorising the interaction of the information between actors through the specific system, tool, technology and features.

6.3.2.5   *Highlighting Key Issues through Participants in the Focus Group*

As shown in Chapter 3 the provided AcTIShA-Framework and evaluating it in this chapter, the systematic mechanism is needed in order to share information effectively. As

measuring the first aspect the usability of the requirements of information sharing systems which generated by the framework. All the police and PSCs focus group participants stated that the requirements of the information sharing system consistent; because the information sharing system is usable by the users which determined that the framework include the needed requirements of the information sharing system.

The participants in the focus group expressed their positive belief in the effectiveness of the framework in respect of sharing information by saying that the framework is useful, flexible, easy to use and effective. The following quotations illustrate the participants' perceptions and views. This was a response from a police member:

> *"Regarding the requirements of the information sharing and its usability, this framework is flexible and easy to use in terms of the sharing of information and also in terms of the activities in the real world"* (P_1_P).

Another participant from the police remarked:

> *"Actually, we need such a system to be followed to enhance the information sharing. I personally found this framework useful and effective in terms of sharing the information in order to ensure the information is shared in the right order; the requirements of the information sharing system are easy to use without complexity"* (P_2_P).

The response from the participants about the current mechanism seemed to be negative in that they stated that the process of the current system is random and unorganised. One participant from the police force reported:

"It's really important to identify the requirements that are used in sharing the specific information where the existing one is traditional and the information is shared randomly without following any system and no requirements are used for information sharing and also without any structured mechanism" (P_3_P).

One participant from a PSC agrees that the current mechanism is ineffective:

"I agree with my colleagues that the systematic method is needed in order to share information and this approach can exactly fit the current mechanism, and will effectively help in sharing the information and support collaboration between our security guards and police agents" (P_2_S).

Turning to the second aspect of the evaluation, the accessibility the design guidance generated by the framework to support the information sharing system, the participants stated that the information sharing framework design is useful and efficient to be used in sharing the information. One participant responded:

"The design guidance of the information sharing system is clear and flexible because it perceives the effectiveness of the information sharing achieved by the guidance of the information sharing" (P_1_P).

"The design guidance is organised efficiently in terms of the service provided to share the information systematically. This is because we don't have any followed systematic mechanism, so through the AcTIShA-Framework the information sharing can be more effective" (P_2_P).

Another participant from the police stated:

"Well, the suitability in regards to information sharing analysis flow achieved

by the design guidance additionally, it can ease the usability of It" (P_4_P).

This shows that the suitability of the analysis of information flow is can be achieved through the design guidance. These comments from all six participants show that they were in agreement about the issues to do with sharing information between the police and PSCs and how this affects the current information sharing mechanism. Further, all the participants from both stakeholders were also in agreement that the AcTIShA-Framework is useful and supports effective collaboration, and enhances information sharing between the users within organisations.

6.3.3 Healthcare Case Study

The healthcare sector is one of the valuable fields in information sharing, and it has been chosen as a case study where the source of data is gathered through a focus group, from understanding the environment, and then as a secondary form of data through the mini-focus group for the evaluation of the AcTIShA-Framework. The purpose of conducting this focus group is to show whether the framework could be use and applied within a different kind of organisation.

Th scenario took place in the main public hospital in Fujairah Health District, which belongs to the Ministry of Health and the departments were chosen by the Head of the Health District. The first department was the Information Technology Department; the second was the Patients' Registration Department; and the third was the Statistics Department. These departments are involved in using and sharing information between departments and users within the hospital. The participants from the healthcare sector in the UAE were directly involved in information sharing, and maintaining the mechanism

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of information sharing within healthcare activities. It is important to understand the information sharing that took place among them to improve the sharing of the information.

The researcher introduced the framework to the participants as a systematic approach towards effective information sharing within their departments. The AcTIShA-framework was discussed to the participants as having been created on a theoretical basis, for the purpose of rational, and controlling of information sharing between several departments. A thorough presentation was made to give the participants a clear idea of the framework in respect of information sharing towards the evaluation of aspects of the framework. Table 6.4 presents the details of the healthcare mini-focus group, which have been given anonymous initials for the purpose of confidentiality.

Table 6.4 Participants from the hospital.

Focus Group 2		Thursday (11/01/2018)	
No.	**Participant**	**Job title**	**Gender**
1	P_1_H	Head of IT department	Female
2	P_2_H	Patients' Registration department manager	Female
3	P_3_H	Head of Statistics department	Female

The mini-focus group were presented with a scenario to evaluate the framework in terms of its ease of use in developing the mechanism of information sharing by users. Essentially, this scenario was conducted to show that the AcTIShA-Framework is

applicable to a variety of organisations overseas. The following stages of the framework will illustrate the evaluation of a scenario to assess its features and utility.

6.3.3.1 Stage 1: Information Sharing Analysis within the Patients' Registration Scenario

The focus group was conducted to assess the framework through the scenario with the officials from the hospital to evaluate its outcome within their activities in regard to information sharing. The patients' registration scenario was selected by the participants from the healthcare sector based on the information sharing within their practices. This scenario was carried out with one particular health district in the UAE as a real example of the sharing of information between departments.

Figure 6.5 illustrates the AcTIShA-Framework and the involvement of the actors in each activity. This scenario has five activities, with each activity having one actor who deals with the information. Activity 1 is the point where the patient starts to provide the information to the registration reception; the first actor in this activity is the patient registrar. The object of this activity is the patient record and the outcome (information artefact) of this activity is the patient profile. The outcome from activity 2 is used by the nurse who is represented as actor 2 in activity 2. The information about the patient's status is the object in activity 2 which is created by actor 2 and this activity's outcome is the initial test results of the patient.

Activity 3 is supported by the general doctor, where the object from this activity is the check-up and the initial diagnosis, and the outcome, which created by actor 3, is the patient's status report. The fourth activity involves the specialist doctor, represented as actor 4, who uses the information artefact 3, and the object from this activity is the

patient's extra tests and findings. The outcome of activity 4 is the prescription (treatment); this outcome is used by the pharmacist who plays the role of actor 5, where the object of activity 5 is the medication ordering process and the outcome of this activity is the medication and instructions.
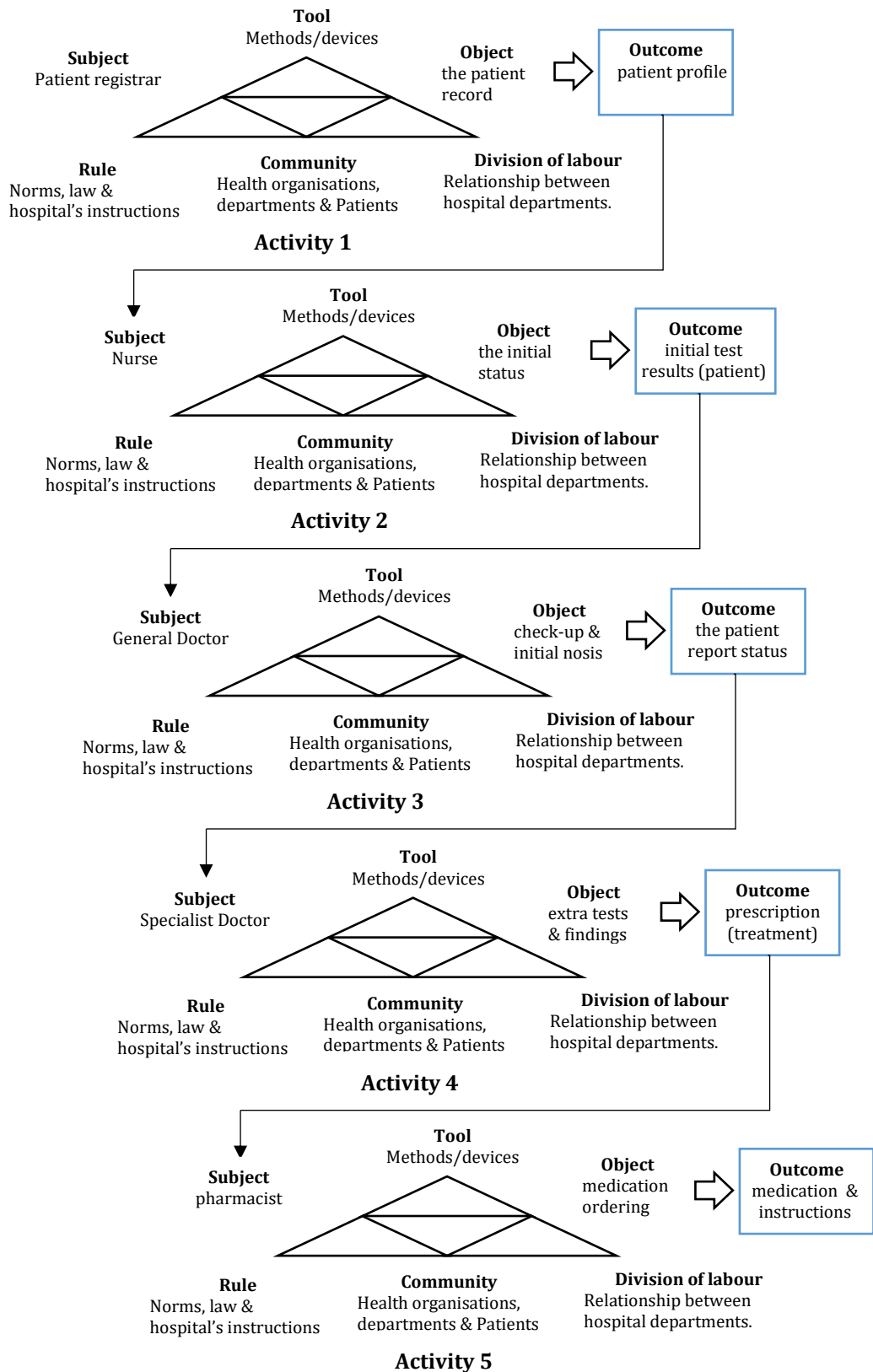
Figure 6.5. The Activity Theory-based Information Sharing analysis framework for the patients' registration scenario.

Stage 1 of this scenario is concerned with starting to analyse the information about the patient and the processes of sharing it between actors. The participants from healthcare found this step usable in terms of the information analysis and sharing within the health practices.

6.3.3.2 *Stage 2: Information Artefact for Action Network Analysis for the Patients' Registration Scenario*

Throughout this stage of the scenario there takes place further analysis and categorisation of the information artefacts action by processes based on the IRS. The information artefacts created in Figure 6.5 are used in Figure 6.6, which identifies the purpose for each action with the relationship between the actors. There are numerous actions to do with the information shared between the departments of the healthcare which are named (create, record, send, used by and store).

Figure 6.6 illustrates the information artefacts for the action network analysis, where the artefacts are identified from stage 1. The top parts in this figure are the needed information artefacts that are created and shared by all the actors. The first information artefact is the patient's profile, which is created by the patients' registrar; information artefact 2 is the initial test results of the patient; information artefact 3 is the patient report status; information artefact 4 is the prescription (treatment); and the final information artefact is the medication and instructions. There are nine actions concerning these information artefacts acted by the five actors, and each action has its own purpose to determine what is required for creating the information artefact.
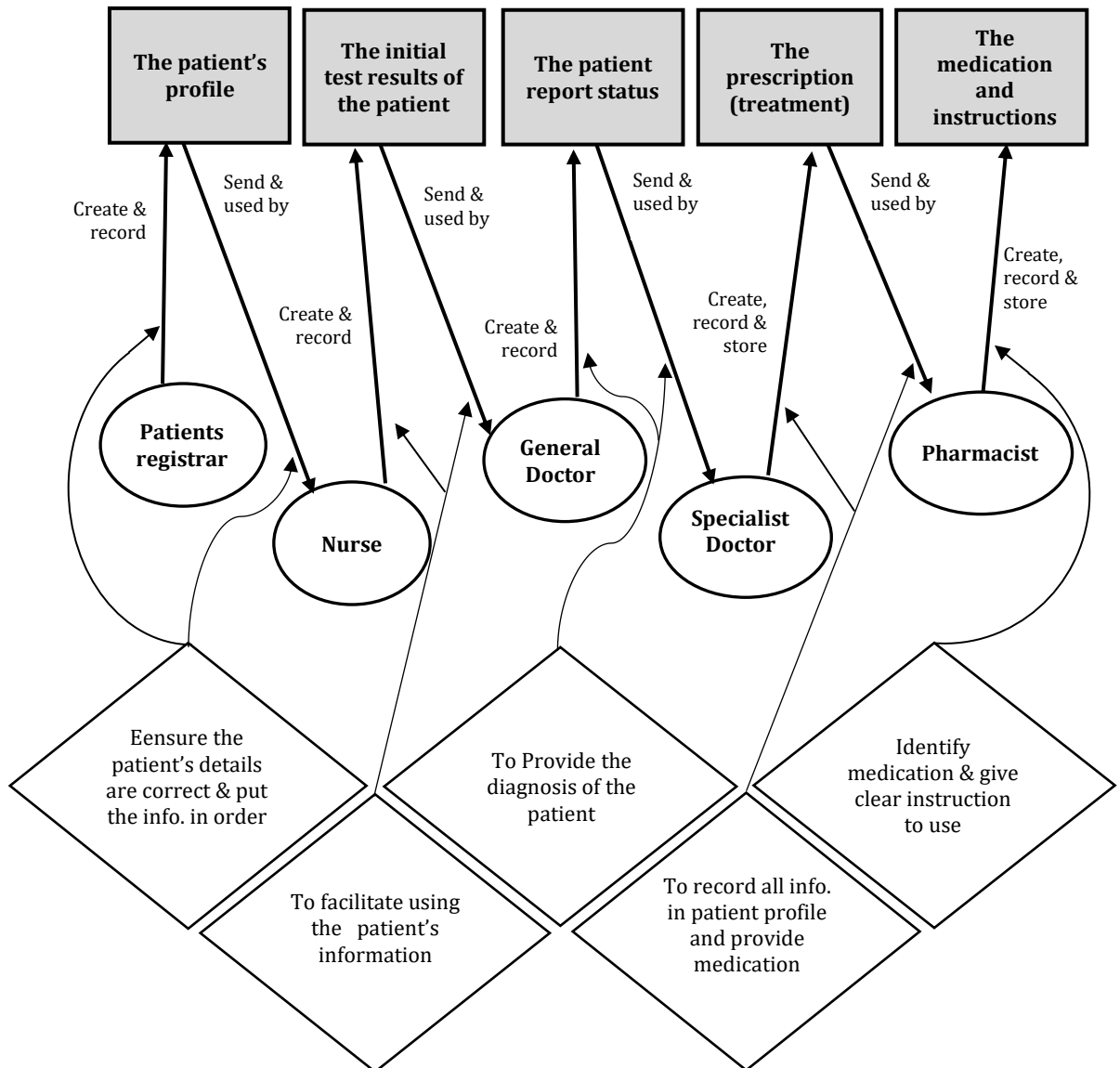
Figure 6.6. Information Artefacts for Action Network Analysis for the patients' registration scenario.

As we can see in Figure 6.6, the same two actions have been carried out for the same purpose, because this is required of each activity. Information artefact 1 was created and recorded by the patients' registrar in order to ensure the patient's details are correct and to put the information in order, and for the same purpose actor 1 sent the information to be used by the nurse (actor 2). The nurse used information artefact 2 and created and

recorded information artefact 3 to facilitate using the patient's information and then sent it to the general doctor for the same purpose. The general doctor created the patient report status and recorded it, the reason being to provide the diagnosis of the patient, and then sent it to be used by the specialist doctor, who then created, recorded and stored the prescription (treatment) for the patient. This artefact was sent by the specialist doctor to be used by the pharmacist to create the medication and instructions, who then recorded and stored it through the healthcare database. The next stage of this scenario shows the information requirement set and how each element is identified in each activity.

6.3.3.3 *Stage 3: Information Requirement Set for the Patients' Registration Scenario*

The elements of the information requirement set are identified as an action, actor, information artefact and purpose; these elements are used in all activities. These activities and their processes are taken from Figures 6.4 and 6.5, as already discussed. Furthermore, the IRS includes the key elements to analyse and understand the information sharing; it also supports the identification of the needed tool, system and specific features to share the information in an effective way. Table 6.5 explains the elements of the IRS for the scenario of the patients' registration, where the information is identified and organised in each factor of the IRS.

Table 6.5 below presents the four elements of the IRS and how they apply in each activity among the healthcare departments to facilitate identifying the features needed and the technology suited to share the information. The focus group found that the IRS has organised in a meaningful way all the activities in terms of the four elements of the IRS.

Table 6.5 Information Requirement Set for the patients' registration scenario.

	Information artefacts	Subjects and actions		Purposes
		Actors	Actions (capture, create, record, report (send), used by and store)	
Activity 1	The patient's profile	**Actor 1** (Patient registrar) (create, record and send)	Information Artefact 1 Used by **(Nurse)** **Actor 2**	Ensure the patient's details are correct & put the information in order
Activity 2	The initial test results of the patient	**Actor 2** (Nurse) (create, record and send)	Information Artefact 2 Used by (**General Doctor)** **Actor 3**	To facilitate using the patient's information
Activity 3	The patient's status report	**Actor 3** (General Doctor) (used, create, record and send)	Information Artefact 3 used by **(Specialist Doctor)** **Actor 4**	To provide the diagnosis of the patient
Activity 4	The prescription (treatment)	**Actor 4** (Specialist Doctor) (used, create, record, store and send)	Information Artefact 4 used by **(Pharmacist)** **Actor 5**	To record all information in patient profile and provide medication
Activity 5	The medication and instructions	**Actor 5** (Pharmacist) (used, create, record, store)	Information Artefact 5 created by and stored **(Pharmacist)** **Actor 5** **(end actor)**	To identify the medication and give clear instruction to use

6.3.3.4 Stage 4: Mapping the IRS for the Information Sharing Systems and Features for the Patients' Registration Scenario

This stage focuses more on how the information can be shared based on the identified required information. The reason for mapping the IRS for the information sharing systems is to facilitate selecting the features and systems that can be used effectively. This scenario has five activities, each of which has specific requirements; for example, for the time there might be need to be an immediate sharing of the information or the normal procedure, while for place it may be in the same premises or in a different location. Table 6.6 shows mapping the IRS for the information sharing systems and features for the patients' registration scenario.

Table 6.6 Mapping the IRS for the information sharing systems and features for the patients' registration scenario.

	Actors		Purpose	Features	Time		Space		Type of system and tool
	From	To			Synch.	Asynch.	Co-Location	Different	
Activity 1	Actor 1	Actor 2	Sharing the patient's details correctly.	- Easy to use - Quick sending - Record info. in the database	✓		✓		Intranet system Healthcare internal database
Activity 2	Actor 2	Actor 3	Providing an initial patient's status report immediately.	- Quick response - Record info. in the database	✓		✓		- Intranet system. - Face to face communication. Healthcare internal database
Activity 3	Actor 3	Actor 4	Providing the diagnosis of the patient immediately.	- Instant sharing the info.	✓		✓	✓	- Shift work groupware. - Face to face communication
Activities 4 & 5	Actor 4	Actor 5	- Recording all information in patient's profile. - Storing the information for the future uses.	- Instant sharing the info.	✓	✓		✓	- Chat system/intranet system Healthcare internal database
	Actor 5	End Actor							

Activity 1 in this scenario required immediate information sharing about the patient through the system used among their departments, with the information being shared in the same location. On the other hand, activity 5 also required immediate information sharing but the medication will be in a different location. Basically, each activity has its

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own requirements for sharing the information, depending on the level of importance and the location.

6.3.3.5   *Stage 5: Highlighting Key Issues through Participants in the Focus Group*

With regard to the usability of the framework in respect of information sharing systems, like the police and PSCs participants, the participants from the healthcare sector also agreed that the framework is effective, usable and suitable in terms of an information sharing system. One of the participants said:

> *"In my opinion, you covered the basic requirements of the information sharing process; in addition to that, the requirements of the information sharing system is useful to share the information in effective way. Because the requirements of an information sharing system is usability and suitability for the user's needs"* (P_1_H).

Another participant pointed out:

> *"I think the usability of the framework in terms of the information sharing in a systematic way is considered to be effective enough which can be used easily without any difficulties, because this framework is not complicated and it is very clear in how to use it"* (P_2_H).

These remarks support the usability of the framework in terms of the information sharing and that it achieves its purpose. Regarding the second aspect, the accessibility of guidelines which generated by the framework to support the information sharing system, the participants from the healthcare sector expressed their opinion that the

framework is easy to use and effective to share the information through. One healthcare sector participant explained:

> *"Indeed, the design guidance of the information sharing system is useful, and easy to use in terms of the efficient design of the system, because of its flexibility and simplicity" (P_1_H).*

> *"I agree that this design is effective in terms of information sharing. In addition, I am supporting my colleague that the design guidance is flexible and simple to use. Because my experience was that I used to work on a system for patient information to share it with the statistics department, which required many details of information and was very complex to use, wasting time and producing inaccuracy" (P-2_H).*

Another participant responded:

> *"It is a useful design guidance of information sharing, which perceived the consistency of information sharing, also this design is considered to be efficient" (P_3_H).*

Thus all the participants from the healthcare sector agreed that in regard to the sharing of information, the framework is usable and accessible to the extent of being easy to use, flexible, simple and suitable, and is therefore effective and beneficial. Furthermore, this case study achieved an inclusive coverage of the consistency of the aspects of the framework outcomes.

6.4   Findings

The AcTIShA-Framework has a concrete theoretical foundation upon which it has been developed, as shown in Chapter 3. The results of the evaluation conducted on the police and healthcare sectors through the case studies in the UAE have been taken into account to improve the information sharing based on the AcTIShA-Framework. The aspects of the developed framework which have been assessed through the focus groups in both the police and healthcare sectors have achieved the purpose of the framework, which is concerned to produce effective and efficient information sharing system/tools. The participants from the police, PSCs and healthcare sectors were all in agreement that there is a need to apply and implement such a framework for the activities within their departments to improve the information sharing.

Through the evaluation, outcomes were used to enhance the information sharing system which requires to be implemented in regard to sharing the information within the sectors of the police and healthcare. The healthcare sector participants suggest that the framework is easy to use, useful, effective, flexible and simple; these key factors show the usability and accessibility of the framework. The assessment of the outcome of the framework resulting the information sharing design and analysis of the information flow as is consider to be effective.

Based on the findings, the suggestions and recommendations from the scenario of the bank were presented to the focus group members from the police and PSCs for discussion. The scenario had applied the framework for sharing the information about the incident. It was divided into four stages and each stage had various activities established with

analysing, sharing and identifying information. The following are the findings which were captured from the scenario:

1- The resistance from some of the users to implement a new framework which might cause inefficient usability and accessibility in terms of sharing the information.

2- The purpose as an element of the IRS was recommended not to be used for all actions because it confuses the actors to share the information effectively.

3- Most of the participants from the police and PSCs focus group were in agreement that this AcTIShA-Framework is useful and suitable to be implemented within both organisations.

4- All the participants from the healthcare focus group agreed that this framework is applicable, appropriate and easy to use because of interaction of actors and analysis steps to share the information and through that can identify the tools which are suitable to a specific information to be shared.

6.5 Discussion

This chapter has evaluated the proposed framework through the case studies. The application of the AcTIShA-Framework within the UAE police and healthcare sectors is supported by the focus group findings, which indicate there is a requirement to apply a systematic framework for information sharing between departments. The findings further support the usability and the accessibility of the AcTIShA-Framework to achieve comprehensive coverage of the improvement of the information sharing mechanism. Evaluation of the framework includes considering the applicability of the AcTIShA-Framework components to any users in any organisation.

The AcTIShA-Framework provides a systematic approach that can enhance the efficiency and improve the productivity of information sharing in the UAE's public sector, as well as any other organisation. Furthermore, the process of sharing the information within the government sector provided through the AcTIShA-Framework allows the process to identify the right features and right system through which to share the information. One significant finding from the participants from the police and PSCs indicated that there is no need to use the purpose for each action but that it is enough to use it for the overall activity. However, the purpose for each action is actually important because it specifies a certain type of system, feature and technology to share the information. Obviously, the purpose is required to choose the kind of system and also for the further appropriate analysis of the information.

The AcTIShA-Framework satisfied the needs of the users evaluating the case studies in order to acquire an effective system. The fulfilment of these needs is expected to benefit the organisations, the users and also many others in society, to provide a better and effective information sharing system.

6.6 Limitations of the AcTIShAF

This section discusses the limitations of the analysis which has been conducted with the UAE government sector as two case studies in the police and healthcare, along with the private sector, the PSCs. These limitations concern resulted as importance of improving the information sharing system to provide a new concept of the information sharing mechanism to the organisation. The following are some of the limitations of the conducted analysis on the framework:

- The AcTIShA-Framework has been developed in terms of the information sharing between the PSCRD and PSCs, though it might be valuable for further development to use multiple departments in the Ministry of Interior and also sharing between different kinds of departments in the UAE.

- The framework only considers the simplest sequence of information flow in which each actor only produces one information artefact, which is then received by the next actor who only receives that one information artefact and only produces one information artefact, and so on. There will be many situations in real life where this is too simple, and this approach fails to deal with situations where an actor receives several information artefacts, perhaps relating to the same incident but from different actors. Further, an actor may produce an information artefact that is sent to several actors, but who have different purposes and act on it in different ways, creating different information artefacts.

The analysis conducted did not address some important limitations of the present framework. In particular, in its present form, there are some potential conflicts and inconsistencies may arise in such situations. Using the examples noted in section 5.2.3:

1) In one scenario concerning activity 1, actor 1 may create a report for actor 2 and in a later activity, actor 2 is supposed to create a report for actor 1, which may create an inconsistency in the action's purpose.

2) When actor 2 in activity 2 shares the information with actor 3 for a specific purpose, but actor 3 then takes a different action from the intended purpose, a conflict may arise from the different understandings of the purpose.

3) In activity 3 actor 3 creates an information artefact about a situation for actor 4 and actor 4 takes an action based on it and finds that the information artefact is not clear enough; this might show conflicts in purpose and artefact.

The framework does not deal with such potential conflicts or inconsistencies, or others that may occur, for example because of human error or system failure to send/receive a message. Another issue partly ignored by the present framework is how to deal with the situation where several actors have authorised access to the same device, although if they have different purposes, the framework can help in this. Consequently, the focus groups did not consider all these issues. In real life, it is important to design information sharing systems that minimise conflicts and inconsistencies arising, and can enable the users to deal with them when they do, but at present the framework does not address these various issues.

After assessing the AcTIShA-Framework in the context of the UAE's government sector by participating members of the police and healthcare in the government sector, which are illustrated in sections 6.3.2 and 6.3.3. The limitations directly influence the efficiency of the information sharing in the police and healthcare departments. The discussion of the focus groups findings to find out whether the AcTIShA-Framework can contribute to solve the limitations that determined.

6.7 Chapter Summary

In this chapter the findings of two focus groups from different sectors have been used to demonstrate the usability of the AcTIShA-Framework presented in Chapter 3. These case studies of the UAE's government sector have been used to assess whether the proposed framework can be applied and used for information sharing. The findings suggest the

framework can be applied to an information sharing system in any organisation. Additionally, the application of the AcTIShA-Framework and its components has shown how the limitations of the information sharing mechanism in the government sector in the UAE can be addressed.

Chapter 7:EVALUATION OF THE RESEARCH

7.1 Chapter Overview

This chapter evaluates each component of the research, discussing its strengths and limitations. Evaluation is a significant key factor of the research process. Design science is naturally iterative, hence the evaluation stage provides feedback to the building stage. This chapter evaluates four aspects of the study: the research topic chosen, the methodology adopted, the framework developed, and finally, the application of the proposed framework through case studies.

7.2 Research Topic

Although information sharing was established as the scope of this research since its inception, the specific research topic changed. The first topic was "Information Architecture for Supporting Collaboration in Policing for Managing Crime Prevention and Safety: A Case of the United Arab Emirates Civilian Private Security Services". This research started by exploring the existing system and mechanism of the information sharing between the PSCRD and PSCs in the UAE in order to develop information architecture to support information sharing. However, after two years of extensive literature review, the research started to move towards the Information Requirements Set, which has been defined in terms of the information sharing elements. The IRS is defined as a set of actions, actors, information artefacts, and purposes; the goal that underlines the entire study is the design of the information sharing framework.

The research has impact on the adoption of the level of the data collection in relation to its results. Moreover, the information sharing approach was developed to be a

systematic method due to its high potential of facilitating the process of sharing the information. The possible data collection was limited by the lack of usage of this approach, which contributed to changing the aim of the research in order to develop a mechanism to use the AcTIShA-Framework. Despite that, the design of the framework based on the Activity Theory has achieved the research aim and facilitated achieving the effectiveness of information sharing.

The focuses on the significance of choosing the method of developing the information sharing system as a research topic for two reasons: one is the concept of information sharing offers a highly potential of providing a new systematic approach to a better understanding of information sharing. The second reason is the lack of studies on information sharing approaches based on the Activity Theory.

7.3   Methodology

The design science research paradigm was adopted as a research approach to comprehend related situations, which have contributed in designing the AcTIShA-Framework (explained in Chapter 4). According to Hevner *et al*. (2004) the evaluation, the utility and effectiveness of a design artefact should be revealed by appropriate evaluation approaches, whether observational, experimental, testing, descriptive, or analytical. As explained in Chapter 6, the Activity Theory-based Information sharing Analysis Framework and the method which evaluated the proposed framework in terms of its usability and accessibility through the case studies in police and healthcare sectors. The understanding and interactions can give meaningful research findings. Thus, the researcher identified the research method needed to investigate the factors of interest in information sharing.

Part of the methodology in this study concerned the development of the AcTIShA-Framework. In particular, taking the semiotics perspective and the Activity Theory as an analytical basis has proved to be beneficial in understanding the nature of the information and the mechanism of exchanging the information between organisations. Aspects of the Activity Theory have been used to specify the tools, object, subject, rules, community, and division of labour in terms of information sharing within the context of the research. On the other hand, semiotics has been used to analyse and understand the nature and type of information shared.

The purpose of the interviews was to review, explore and examine respondents' perceptions of practices and activities of the information sharing that is carried out within their own organisation, which then helped to build a framework of the information sharing. The UAE was selected as the research case study, which was used to identify the limitations of the current practices of the information sharing. The AcTIShA-Framework has been used to design information which is provided by the government sectors of the UAE as a method of evaluation. The information sharing approach has been identified and demonstrated using the AcTIShA-Framework in Chapter 3, which has provided theoretical perceptions, followed by its application in Chapter 6, which is assessed by two focus groups conducted as case studies in the Ministry of Interior and Ministry of Health in the UAE.

The qualitative research method is adopted because of the requirement to understand the challenges of the information sharing and its limitations. Consequently, semi-structured interviews and focus groups were employed for data collection through reviewing and studying various studies of the information sharing. The purpose of these

qualitative techniques was to explore and examine the perception of Police Department members on how the information is shared. Section 7.5 evaluates and discusses the case studies in this research, where the two small samples of participants may be considered a limitation. On the other hand, the participants have provided a deep understanding of the problem as a result of their knowledge of the research purpose and their role and impact on the conducted case studies.

7.4 Activity Theory-based Information Sharing Analysis Framework

The Activity Theory-based Information Sharing Analysis (AcTIShA) Framework has been presented as a systematic framework to improve the design of information sharing. The framework is based on the Activity Theory as a new mechanism used for sharing information so as to capture the information processes. Through reviewing and analysing the literature, limitations related to the mechanism of information sharing were identified. Therefore, it was necessary to develop a systematic framework based on the information sharing which was not considered by the existing mechanism; for example, to guide how to analyse information within the organisational phenomenon, to guide how to understand the information flow to be followed accurately, and to guide how to identify the right system in terms of its features.

The mechanism to design an information sharing system for analysing and sharing information. Accordingly, the development of the AcTIShA-Framework aimed to fill the gap in the information sharing system. Its development was achieved through a number of consistent stages, as in the following:

- Reviewing the literature about the Activity Theory.

- Studying the potential of the Activity Theory approach in different domain and identify limitations for the current mechanism in terms of information sharing.

- Developing a framework to address the issues.

- Understanding the use of the activity elements and devising the questions to conduct interviews in the police and PSCs in the UAE.

- Exploring and analysing the information sharing in the police context in the UAE and identifying the problems.

The main features of the AcTIShA-Framework concern first, its usability in terms of the information sharing systems which are generated by the framework; and second, the accessibility of the guidelines which are generated by the framework to support the information sharing systems. These aspects of the framework have been assessed in the Police, PSCs and health sectors in the UAE through case studies based on the scenarios and focus group methods. These case studies have provided useful feedback and findings that have demonstrated the suitability, usability and flexibility of the evaluated components of the AcTIShA-Framework.

In the AcTIShA-Framework, the method of description was used to establish the suitability of the framework by evaluating it through the case studies in the UAE. The AcTIShA-Framework was demonstrated to be suitable to contribute to a better understanding of the information sharing and to improve the information sharing systematically.

However, this framework can be used in different organisations, and not just in the UAE, towards designing an information sharing system that is effective and efficient; this

is because of its flexibility and usability in being applied to a variety of organisations and sectors, such as police departments, healthcare departments and private security companies. The evidence for this is presented in Chapter 3. Therefore, our assumption is valid that the AcTIShA-Framework can be used in the different contexts of other countries in respect of sharing the information. However, as the research has applied the framework in two case studies which were carried out with only one actor for each activity, it cannot be claimed that the framework can work for multi-actors until further case studies are conducted. This will be considered as a future work which aims to refine the framework and its components in order to achieve better results.

7.5   The Application of the AcTIShA-Framework

The case studies were chosen as a method of this research, which was conducted based on the need to evaluate the utility of the proposed framework. It was developed for understanding the research on information systems and evaluating it in terms of a set of guiding principles to assist and enhance the design process (Hevner *et al.*, 2004).

There were several motivations for choosing the UAE to be the research case study. This was done to provide a better understanding of the information and develop a new concept of information sharing within the country's policing, to improve the lack of information sharing within it; it offered a convenient way to obtain data and feedback as the UAE is the researcher's home country. The improvement of the UAE policing system has been one of the main motivations of the research, particularly after the researcher had taken account of the key challenges of aspects of the AcTIShA-Framework in the UAE.

The participants were key government officials in the UAE who had the responsibility of developing and maintaining the information sharing systems in the policing of that

country. Therefore, they were aware of the limitations of the use of the mechanism of the information sharing and were in a position to evaluate the possibility of using any proposed solution in order to enhance the information sharing mechanism. The participants were involved over the case study in two stages; the first stage took place on 7th January 2018, when a scenario and focus group has been conducted with officers from the police and senior managers from private security companies in the UAE. This phase was to evaluate the outcomes of applying the AcTIShA-Framework in the UAE and to shed light on certain objectives stated in the UAE's policing strategy, such as evaluating this approach. This process has helped in understanding the information sharing in the context of the policing.

The purpose of the scenario and focus group was to use the AcTIShA-Framework to specify aspects of it and how the information can be analysed and shared. The AcTIShA-Framework was presented to the focus group participants and they discussed its potential for providing an effective system to share the information through. The participants decided to use a bank incident as a scenario to assess the framework aspects within its stages. Then the data were collected from the scenario and the focus group was further used to highlight the key issues in the application of the approach. The data collected from participants, who expressed their own insights and experiences of evaluating the framework within the policing activities, was valuable.

The second phase took place on 11th January 2018, and was conducted with officials from the healthcare sector in the UAE, through a mini-focus group of three members, the Head of Information Technology Department, Patients' Registration Department Manager and Head of Statistics Department. The focus group was conducted for the purpose of

further exploring and measuring the use of the framework in term of information sharing within the context of the healthcare in the UAE. This platform has provided the research with agreement of the use of the information sharing approach which was used in the development of the AcTIShA-Framework. Conducting these two case studies was not quite sufficient to provide a confident evaluation of the use of the framework, so this is one limitation of the research, though further studies were not feasible in the time available. Section 8.4 on future research addresses this limitation.

This systematic framework focuses on just one actor in each activity, which may not be relevant to multi-users engaged with one activity, as explained earlier; therefore, further assessment is needed to define the domain the framework can be applied to and to test its suitability. The AcTIShA-Framework needs to be evaluated in another case study where there are multi-actors in each activity. However, the case studies presented have already shown that the AcTIShA-Framework does have benefits in improving the sharing of information within an organisation.

7.6   Chapter Summary

This chapter has evaluated and discussed the strengths and limitations of the various components of the research project. These components of the research have been identified and justified for selecting the research topic, choosing the methodology, developing the AcTIShA-Framework, and designing the case studies. The significance of the research findings has been considered.

Chapter 8: CONCLUSIONS AND FUTURE RESEARCH

8.1   Chapter Overview

This chapter begins with the conclusions of the research project, summarising what has been covered and done in section 8.2. This is followed by a discussion of the research theoretical contribution in section 8.3.1 and the practical contribution in section 8.3.2. The chapter concludes with suggestions for future research to extend the present study based on its limitations in section 8.4.

8.2   Summary of the Research

The literature review revealed there is a lack of information sharing within the policing. The research seeks to address this issue. It began with identifying the problem by conducting an exploratory study of the policing in the UAE to understand the nature of the information and its mechanism in terms of sharing the information. The exploratory study was based on semiotics and the Activity Theory, which help in understanding the information and its analysis in the context of improving the information sharing between the police and Private Security Companies in the UAE. The research concentrated on the analysis of the information and practices of the police and PSCs. It then developed a framework, the AcTIShA-Framework, for analysing and understanding the information and its sharing. The framework was created on the theoretical foundation of the Activity Theory and was then evaluated for its suitability based on case studies.

Several conclusions have been drawn. First, the framework does offer the potential benefits of usability and accessibility. Second, the AcTIShA-Framework provides a systematic method by which to enhance the information sharing within an organisation.

Third, the approach suggested a mechanism that can provide a strong link between the police and PSCs in order to support the collaboration and information sharing. These conclusions can be used to improve the understanding of the information sharing mechanism, as well as to illustrate that the AcTIShA-Framework which has addressed the research problem presented in chapter 1 of this research. The use of the AcTIShA-Framework can be considered to provide an understanding and analysing approach to overcome the obstacles of information sharing. The findings demonstrated the importance of utilising this approach.

8.3 Research Contributions

This research presents two key contributions. The first contribution is to enhance the understanding of information sharing between the PSCRD and PSCs, specifically in the UAE. The systematic mechanism has been suggested based on the AcTIShA-Framework to increase the performance of such information sharing. An information sharing approach has been developed to improve the information sharing mechanism between the PSCRD and PSCs in the UAE in addressing the research problems. The second is a practical contribution, which is to provide a systematic approach to the design of information sharing systems, and to develop a new understanding of information sharing in distribution works for wider implementations. The overall research contribution can be divided into the theoretical and practical, as set out in the following subsections.

8.3.1 Theoretical Contribution

The research has examined and determined the collaboration and information sharing, both in general and in the police practices and activities. The research has adopted two

valuable theories to help in understanding and analysing the information in the context of organisations. A model has been put forward based on two theoretical foundations: semiotics (Liu, 2000) and the Activity Theory (Engeström, 2000). The semiotics complements the Activity Theory and enables an activity-oriented analysis to characterise the semiotic interpretation of information sharing. The semiotics leads to the constricting of a compulsory system of norms that identifies the understanding, sharing and analysing of the information via the team actors and users. Essentially, semiotics established the norms which determine the understanding of the information being been shared within and between organisations, and therefore the norms needed in this study. In addition, the Activity Theory provides the systematic approach to design the information sharing systems framework. A new framework was constructed in this study based on the Activity Theory to facilitate the analysis of the factors that influence effective information sharing in policing: the Activity Theory-based Information Sharing Analysis Framework.

8.3.2 Practical Contribution

This research had the goal to develop an approach that can be used for supporting collaboration and sharing information effectively between the police and PSCs. This goal has been achieved. This approach has been applied in the UAE based on two case studies in the police and healthcare sectors, which have revealed evidence of the applicability and suitability of the framework. The development of the AcTIShA-Framework in this research has provided a set of components of the IRS and the process for each stage that will encourage the design of the system to improve the effectiveness of the sharing of information. Therfore, the development of the AcTIShA-Framework and the components

generated from it have contributed to practical knowledge by creating a new systematic mechanism for collaboration and sharing information, which are interrelated by the developed processes and procedures.

8.4 Limitations and Future Research

This research study has some potential limitations that were identified in Chapter 6. Five limitations were discussed, which may open up fruitful areas for future work. This research provides new insights and draws valuable instructions with regards to the AcTIShA-Framework. Furthermore, the main limitations indicated by the research results in applying the AcTIShA-Framework to prove its practical utility and accessibility for analysing an enhanced understanding of information needs and the information sharing between stakeholders. Because of the limited time of this study, it was not possible to expand the AcITShA-Framework to have multi-users in order to interact within each activity. Therefore, further research on extending the framework is needed to assess the framework's usability within the context of multi-users and any organisation.

The components of the AcTIShA-Framework, which support collaboration and the information sharing, have been developed based on the needs for a systematic mechanism, and usability, and accessibility of each component of the stages. To conclude, this study has identified several concepts that can be used within further examination and investigations. The following are some key limitations and suggestions for future research:

1) The research concentrates on policing in the UAE as a background and analysis of the information sharing. This research has guided the identification of components within this kind of organisation, in particular in the government sector. The present

evaluation is limited to organisations in the government sector, with only one actor in each activity. Future research should be conducted in various sectors, for instance, private sectors and in different countries to shed further light on key issues such as usability, privacy and accessibility. Once such studies have been carried out, comparisons can be made between the government and private sectors, and between different countries.

2) The present case studies only employed a small sample of participants from the Police Department, PSCs and healthcare, which is limiting. Future studies should consider using larger samples with different respondents in different areas, which might differ significantly from the existing sample participants.

3) The case studies used for the evaluation of the AcTIShA-Framework were limited in further ways. The data collection for the police was only carried out through the face-to-face interviews, focus groups and scenario methods; the reason for that was the confidentiality of the information and the nature of the research in regard to the sensitivity of their activities and practices. However, this research could be extended using a quantitative research approach, including the use of surveys (questionnaire) to cover most of the organisation's members within other organisations that are transparent and disclose information to evaluate and validate the results and obtain great findings and recommendations.

8.5   Chapter Summary

This research has developed a new theoretical framework to understand and analyse the sharing of information between the police and Private Security Companies in the UAE: the Activity Theory-based Information Sharing Analysis Framework. It was presented to two

focus groups who confirmed that they found it useable, and that it offered guidance on the design of information sharing systems that is accessible. The study has contributed to the understanding of the sharing of information within organisations, including the police and Private Security Companies, and how to improve the information sharing by utilising the proposed framework. Some suggestions for future research are offered.

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Appendix A

(Application for Research Project Approval)

Introduction

The University Research Ethics Committee allows Schools to operate their own ethical procedures within guidelines laid down by the Committee. The University Research Ethics Committee policies are explained in their Notes for Guidance (see the link to "Guidance Notes (PDF – 299kb)" which can be found at http://www.reading.ac.uk/internal/res/ResearchEthics/reas-REethicshomepage.aspx) .

The School of Management (SoM) has its own Research Ethics Committee and can approve project proposals under the exceptions procedure outlined in the Notes for Guidance. Also note that various professional codes of conduct offer guidance even where investigations do not fall within the definition of research (e.g. Chartered Institute of Marketing, Market Research Society, etc). A diagram of the SoM Research Ethics process is appended to this form.

Guidelines for Completion

- If you believe that your project is suitable for approval by the SoM's Research Ethics Committee you should complete this form and return it to the Chair of the Committee. Note that ethical issues may arise even if the data is in the public domain and/or it refers to deceased persons.

- Committee approval must be obtained before the research project commences.

- There is an obligation on all students and academic staff to observe ethical procedures and practice and actively bring to the attention of the SoM's Research Ethics Committee any concerns or questions of clarification they may have.

- Records will be maintained and progress monitored as required by the University Research Ethics Committee, overseen by the School Ethics Committee.

- This form should be completed by the student/member of academic staff as appropriate. **All forms must be signed by a member of the academic staff before submission.**

- This form is designed to conform to the University's requirements with respect to research ethics. Approval under this procedure does not necessarily confirm the academic validity of the proposed project.

- All **five** parts of the form and **all** questions must be completed. Incomplete forms will be returned. Students should submit forms to their supervisor, who together with staff should pass these to the SoMREC.

- **Student research projects** - initial approval may be given by the academic supervisor. **At the completion of the project students should submit a further copy of the form** to confirm that the research was conducted in the approved manner. **The project will not be marked until this form is received**. If in the course of work the nature of the project changes advice should be sought from the academic supervisor.

Project details

Date of submission   Student No (if applicable)

17 February 2016

Title of Proposed Project:-

Method of Developing Information Sharing System based on Activity Theory

Responsible Persons

Name & email address of principal researcher/student/programme member (*delete as appropriate*)

Abdulla Alhefeiti

a.alhefeiti@pgr.reading.ac.uk

Name and email address of supervisor (*if applicable*)

Dr. Keiichi Nakata

k.nakata@henley.ac.uk

Nature of Project   (mark with a 'x' as appropriate)

Staff research	☐	Masters	☐
Undergraduate	☐	Doctoral	☒
MBA	☐	Other	☐

Brief Summary of Proposed Project and Research Methods

The research attempt to develop and enhance the level of security in terms of information sharing and design the beneficial framework among the police and Private Security Companies (PSCs) in their operations and activities within the Ministry of Interior in the United Arab Emirates (UAE). The Police have to be proactive in managing and regulating crime prevention and safety. In order to provide a professional security services for the UAE.

The qualitative method is used to conduct the research and in this stage, the extensive study of the efficiency of various governmental and PSCs in supporting collaboration in policing for maintaining security and safety of society, in reference to the Private Security Companies Regularity Department (PSCRD). Furthermore, the UAE as a case study to examine the current practices of information sharing between PSCRD and PSCs. The interviews to be conducted with the PSCs and the PSCRD, that then to analyse the barriers in information sharing among of both stakeholders. A number of sources are required to undertake the research including both primary as well as secondary sources of information. In order to collect the data the CEOs', security managers, the officials and security guards from private security companies' are considered as participants. The police officers also will be part of the study along with the support Participants from the following departments Information Security Department, Monitering and Follow up Department and Operational Room.

☒ I confirm that where appropriate an information sheet and consent form has been prepared and will be made available to all participants. This contains details of the project, contact details for the principal researcher and advises subjects that their privacy will be protected and that their participation is voluntary and that they may withdraw at any time without reason.

☒ I confirm that research instruments (questionnaires, interview guides, etc) have been reviewed against the policies and criteria noted in The University Research Ethics Committee Notes for Guidance. Information obtained will be safeguarded and personal privacy and commercial confidentiality will be strictly observed.

☒ I confirm that any related documents which would include any questionnaires, interview schedules etc, and, where appropriate, a copy of the Information Sheet, Consent Form are attached and submitted with this application.

Henley Business School
School of Management
Research Ethics Committee

Consent Form

1. I have read and had explained to me by

Abdulla Ali Alhefeiti

The accompanying Information Sheet relating to the project on:

Method of Developing Information Sharing System based on Activity Theory

2. I have had explained to me the purposes of the project and what will be required of me, and any questions I had have been answered to my satisfaction. I agree to the arrangements described in the Information Sheet in so far as they relate to my participation.

3. I understand that participation is entirely voluntary and that I have the right to withdraw from the project at any time, and that this will be without detriment.

4. In understand that this application has been reviewed by the School Research Ethics Committee and has been given a favourable ethical opinion for conduct.

5. I have received a copy of this Consent Form:

Name: ………………………………………………………………………………

Signed: ……………………………………………..………………………………

Date: …………………………………………………...………………………

Appendix B

(Interviews and scenario with the police and PSCs practices)

RE: Data Collection in the UAE by Abdulla Alhefeiti

I am writing in my capacity as supervisor for Mr Abdulla Alhefeiti who is currently carrying out his PhD research under my supervision. His research is aimed at developing an information architecture to enhance collaboration between the police and private security companies in the UAE through effective knowledge sharing. He has so far carried out literature review to develop a conceptual framework for analysis based on which a preliminary study to identify key issues was conducted.

This is to confirm that in the next stage of Mr Alhefeiti's research, it is necessary and important for him to carry out a field work in the UAE to engage in further data collection on current information sharing practices between the police and private security companies. The planned period for this field work is from 22 February to 13 May 2016.

If you require further information on this matter, please contact me.

If you have any questions, please contact Mr Abdulla Alhefeiti by e-mail: a.alhefeiti@pgr.reading.ac.uk; mobile: UK +44 (0) 7741144222; or UAE 0509997169.

Yours sincerely

Keiichi Nakata, BEng, MEng (Tokyo), PhD (Edinburgh), FBCS, FHEA
Associate Professor in Social Informatics
Deputy Head of Business Informatics, Systems and Accounting
Henley Business School

(Interviews and the hotel scenario)

United Arab Emirates, Ministry of Interior - Private Security Companies Regulatory Department (PSCRD): Monitoring and Following up Department, Information Security Department and Operation Room Department staff.

	Organisations	Participant	Gender	Date and Location	Time
1	PSCRD - Information Security Branch (ISB)	Director of Information Security	Male	24 Feb. 2016, Abu Dhabi	14:00 pm 29 mins
2	PSCRD - ISB	Employee in information security branch (ISB)	Male	25 Feb. 2016, Abu Dhabi	10:00 am 23 mins
3	PSCRD - ISB	Employee in ISB	Male	28 Feb. 2016, Abu Dhabi	11:00 am 26 mins
4	PSCRD - Information Security Department	In-charge in information security	Male	28 Feb. 2016 , Abu Dhabi	13:30 pm 30 mins
5	PSCRD - ISB	Deputy Director of Information Security	Male	1 March, 2016, Abu Dhabi	13:39 pm 35 mins
6	PSCRD - ISB	Employee in ISB	Male	2 March, 2016, Abu Dhabi	12:42 pm 25 mins
7	PSCRD - ISB	Employee in ISB	Male	2 March, 2016, Abu Dhabi	14:05 pm 36 mins
8	PSCRD - Monitoring and following up department (MFD)	Director of Fujairah Monitoring and Following up Branch (MFB)	Male	3 March, 2016, Abu Dhabi	11:05 am 40 mins
9	PSCRD - MFD	Director of Ras Al-Khaimah MFB	Male	6 March, 2016, Abu Dhabi	13:05 pm 45 mins
10	PSCRD - MFD	Employee in Monitoring and Following up Department (MFD)	Male	7 March, 2016, Abu Dhabi	10:00 am 50 mins
11	PSCRD - MFD	Employee in MFD	Male	8 March, 2016, Abu Dhabi	10:00 am 35 mins
12	PSCRD - MFD	In-charge of secure of money transfer	Male	9 March, 2016, Abu Dhabi	11:15 am 39 mins
13	PSCRD - MFD	In-charge of information gathering	Male	10 March, 2016, Abu Dhabi	14:05 am 30 mins

Personal Details:

Participant ID:	Age:	Gender:
Education:	Job (C/O):	Grade:
Date:	Start:	End:
Consented for recording:		

Systems /methods been used in communicating and sharing information:

Questions:

- What system do you use for communicating and sharing information between your organisation and PSCs?

- What kind of tools do you use to share information between your organisation and PSCs? How do you use them?

- How does the current tool work in terms of sharing information?

The policies and bureaucracy:

Questions:

- What policies and rules on information sharing exist?

- Are the rules followed in communicating and sharing information?

- How/why has the rule been applied/implemented?

- How do you monitor the adherence/implementation of the policy within the organisation?

The communication and sharing information concept within the PSCRD staff, PSCs and stakeholders:

Questions:

- How do you assess the information-sharing culture in your organisation?

- Who do you mostly communicate and share with?

- Who are the people you collaborate with to acquire information?

- What is the effectiveness of information sharing?

- How do you assess the effectiveness of information sharing?

The relationship, performance and trust between the PSCRD and PSCs

Questions:

- How do you rate the relationship between your organisation and PSCs in terms of communication?

Low	1	2	3	4	5	High

- How do you control and monitor the PSCs' work?

- How do you assess the performance of PSCs in terms of information sharing?

- How do you evaluate the implementation of decisions by PSCs?

- How do you evaluate the effectiveness of decisions towards PSCs?

- To what extent do you believe that the PSCs are doing what they are supposed to do on your behalf?

Low	1	2	3	4	5	High

- To what extent do you trust PSCs to perform their work?

Low	1	2	3	4	5	High

- Any comments and views on information sharing with PSCs or other organisations?

(Interviews and the hotel scenario)

United Arab Emirates, Private Security Companies (PSCs):

CEO, Security Managers and Security Supervisors and Security Guards

	Organisations	Interviewees	Gender	Date and Location	Time
1	Al Falah Security services Company	Security manager	Male	13 March, 2016, Ajman	10:30 am 37 mins
2	Al Jaber Security Company	Security supervisor	Male	24th March, 2016, Abu Dhabi	10:00 am 31 mins
3	Skill Fury Security Company	Security manager	Male	24 March, 2016, Abu Dhabi	12:00 pm 29 mins
4	Professional Security systems Company	Security manager	Male	25 March, 2016, Ajman	10:00 am 33 mins
5	Spark Security Services	CEO	Female	25 March, 2016, Abu Dhabi	12:00 pm 46 mins
6	Elite Security Company	Security manager	Male	29 March, 2016, Abu Dhabi	11:00 am 52 mins
7	Al Najm Security Company	In-charge of events and festivals	Male	30 March, 2016, Abu Dhabi	11;30 am 45 mins
8	Group 4 Security company	Security manager	Male	31 March, 2016, Ajman	10:45am 40 mins
9	Spark Security Company	In-charge of events and festivals	Male	2 April, 2016, Abu Dhabi	11:15 am 35 mins
10	QBG security - LLC	CEO	Male	5 April, 2016, Abu Dhabi	18:05 pm 34 mins
11	Al-Watan security services	Security manager	Male	6 April, 2016, Fujairah	9:30 am 40 mins
12	Al-Raed security services	Security manager	Male	6 April, 2016, Fujairah	01:05 pm 35 mins
13	Al Shamaleyah building security services	Security manager	Male	7 April, 2016, Abu Dhabi	12:35 pm 45 mins
14	Arabian Eagle security services est.	Security manager	Male	10 April, 2016, Fujairah	09:45 am 50 mins
15	Arabian Eagle security services est.	Security Supervisor	Male	11 April, 2016, Fujairah	12:00 pm 40 mins
16	Al-Raed security services	Security guard	Male	12 April, 2016, Fujairah	14:00 pm 35 mins
17	G4s Secure Solutions L.L.C	Security supervisor	Male	17 April, 2016, Abu Dhabi	16:00 pm 47 mins
18	Aman Security & Guard Systems co. L.L.C	Security supervisor	Male	20 April, 2016, Abu Dhabi	11:30 am 44 mins
19	Rotana For Security & Guarding	Security supervisor	Male	25 April, 2016, Ras Al-Khaimah	11:20 am 39 mins

Participant ID:	Age:	Gender:
Education:	Job (C/O):	Grade:
Date:	Start:	End:
Consented for recording:		

Systems /methods been used in communicating and sharing information:

Questions:

- What system do you use for communicating and sharing information between your organisation and PSCs?
- What kind of tools do you use to share information between your organisation and PSCs? How do you use them?
- How does the current tool work in terms of sharing information?

The policies and bureaucracy:

Questions:

- What policies and rules on information sharing exist?
- Are the rules followed in communicating and sharing information?
- How/why has the rule been applied/implemented?

- How do you monitor the adherence/implementation of the policy within the organisation?

The communication and sharing information concept within PSCRD staff, PSCs and stakeholders:

Questions:

- How do you assess the information-sharing culture in your organisation?
- Who do you mostly communicate and share information with?
- Who are the people you collaborate with to acquire information?
- What are the procedures you follow to share information with the PSCRD?
- What is the effectiveness of information sharing?
- How do you assess the effectiveness of information sharing?

The relationship, performance and trust between PSCRD and PSCs:

Questions:

- How do you rate the relationship between your unit and the PSCRD in terms of communication?

| Low | 1 | 2 | 3 | 4 | 5 | High |
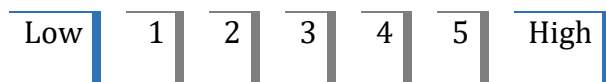
- How do you control and monitor your activities?
- How do you assess the performance of your unit in terms of information sharing?
- How do you evaluate the implementation of decisions by the PSCRD?

- How do you evaluate the effectiveness of decisions by the PSCRD towards PSCs?

- What are the procedures to implement the decisions that are issued by the PSCRD?

- To what extent do you believe that the PSCRD trust the services you provide?

| Low | 1 | 2 | 3 | 4 | 5 | High |

- To what extent do you believe that the clients trust the services you provide?

| Low | 1 | 2 | 3 | 4 | 5 | High |

- To what extent do you believe that you are satisfied with the services you provide?

| Low | 1 | 2 | 3 | 4 | 5 | High |

- To what extent do you trust the PSCRD in terms of the working arrangement?

| Low | 1 | 2 | 3 | 4 | 5 | High |

- Any comments and views on information sharing with the PSCRD or other organisations?

Appendix C

(Evaluating the AcTIShA-Framework in the UAE case studies)

RE: Data Collection in the UAE by Abdulla Alhefeiti

I am writing in my capacity as supervisor for Mr Abdulla Alhefeiti who is currently carrying out his PhD research under my supervision. His research is aimed at improving an information sharing to enhance collaboration in the policing in the UAE through effective knowledge sharing. He has developed a framework, which needs to be evaluated through various case studies in the following sectors:

- Police sector

- Healthcare sector

This is to confirm that in the next stage of Mr Alhefeiti's research, it is necessary and important for him to carry out a field work in the UAE to evaluate the proposed framework developed through his research to enhance information sharing mechanism in a systematic way. The planned period for this field work is from 24 December 2017 to 11 January 2018.

If you have any questions, please contact Mr Abdulla Alhefeiti by e-mail: a.alhefeiti@pgr.reading.ac.uk; mobile: UK +44 (0) 7741144222; or UAE 0509997169.

Yours sincerely

Professor Keiichi Nakata, BEng, MEng (Tokyo), PhD (Edinburgh), FBCS, FHEA
Professor of Social Informatics
Head of Business Informatics, Systems and Accounting (BISA)
Henley Business School, University of Reading, United Kingdom**.**

Appendix D

(Draft Consent Form)

Consent Form

1. I have read and had explained to me by

Abdulla Ali Alhefeiti

The accompanying Information Sheet relating to the project on:

Method of Developing Information Sharing System based on Activity Theory

2. I have had explained to me the purposes of the project and what will be required of me, and any questions I had have been answered to my satisfaction. I agree to the arrangements described in the Information Sheet in so far as they relate to my participation.

3. I understand that participation is entirely voluntary and that I have the right to withdraw from the project at any time, and that this will be without detriment.

4. In understand that this application has been reviewed by the School Research Ethics Committee and has been given a favourable ethical opinion for conduct.

5. I have received a copy of this Consent Form:

Name: ……………………………………………………………………………

Signed: ………………………………………………...…………………………

Date: …………………………………………………...……………………

Appendix E

(Evaluating the AcTIShA-Framework for the PSCRD, PSCs and Healthcare in the UAE)

Focus Group 1

(Police Department)

Date:	7th January 2018 – Sunday
Start time:	10:00am
Finish time:	12:10pm
Duration:	2 hours 10 minutes
Venue:	Ministry of Interior, PSCRD

Participants from the Ministry of Interior and PSCs

No.	Participant	Organisation	Job title
1	P_1_P	PSCRD	Head of Information department
2	P_2_P	PSCRD	Head of Operations department
3	P_3_P	PSCRD	Information Recipient
4	P_4_P	PSCRD	Head of Control Room
No.	Participant	Organisation	Job title
1	P_1_S	PSC	W_Security Services Manager
2	P_2_S	PSC	R_Security Services Supervisor

Applying the AcTIShA-Framework and aspects of evaluation:

Bank Scenario:

Aspect 1: The usability of the framework in terms of information sharing systems which are generated by the framework.

Aspect 2: The accessibility of guidelines which generated by the framework to support the information sharing system.

P_1_P: Regarding the bank incident, and based on this framework the information processes will be shared systematically from the security guard in the bank to the security supervisor and then to the police control room through the specific instruments depends on the level of the incident, then the information sent from the information recipient to the Competent Authority (CA) to solve it. However, the concern here the resistance to any new system, technology, mechanism from some users who refuse the change and this may be affect using it negatively.

P_2_P: I like how this framework has been organised, as my colleague mentioned and in addition to that the information will be shared faster than it is currently because using and following a system that is directly reporting the information available can solve the problem of delays of information shared.

P_3_P: By identifying the tools that are used in sharing the specific information it really can solve the issues in a current mechanism and improve the information sharing. Indeed,

the IRS mapping to share the information systems and features in this scenario is clear and usable in terms of sharing the information in an effective way.

P_4_P: I agree that this framework is useful and through this scenario shows its suitability and applicability, I am totally supporting my colleague that the IRS elements satisfy the needs, except the purpose is repeated in all the activities which not really necessary for all actions if only for the each activity it makes sense on the other hand it might waste time in order to share the information effectively.

P_1_S: Actually, we need such a system to be followed to enhance the information sharing. I personally find this framework helpful to be used in order to ensure the information sharing is effective, as applying it in this scenario. But I think using the purpose as an element in the activities of the information sharing not really needed because it may confuse actors to share the information properly. My suggestion is to have one purpose for each activity.

P_2_S: I agree with my colleagues that the systematic method is needed and this approach can fit exactly the current mechanism and will effectively help in sharing the information between our security guards and police agents.

Applying the AcTIShA-Framework and aspects of evaluation:

Focus group:

Aspect 1: The usability of the framework in terms of information sharing systems which are generated by the framework:

Question:

How good are the requirements of the framework in terms of the usability of the information sharing system?

P_1_P: First of all, thank you for your presentation about the useful framework. Regarding the requirements of the information sharing and its usability, this framework is flexible and easy to use in terms of the sharing of information and also in terms of the activities in the real world.

P_2_P: Actually, we need such a system to be followed to enhance the information sharing. I personally found this framework useful and effective in terms of sharing the information in order to ensure the information is shared in the right order; the requirements of the information sharing system are easy to use without complexity.

P_3_P: It's really important to identify the requirements that are used in sharing the specific information where the existing one is traditional and the information is shared randomly without following any system and no requirements are used for information sharing and also without any structured mechanism.

P_4_P: In fact, this system provides the appropriate requirements of the information sharing, which exactly fit with the needs for the supporting the information sharing; also

it is not difficult and complicated to use; this is because of clearly identifying the method of understanding the information within the activity processes.

P_1_S: This framework is organised very well, as my colleague mentioned earlier, in addition to that the information will be shared more effectively than it is currently unorganised and normal through this systematic approach.

P_2_S: I agree with my colleagues that the systematic method is needed in order to share information and this approach can exactly fit the current mechanism, and will effectively help in sharing the information and support collaboration between our security guards and police agents.

Researcher: So, most of the answers indicate that this framework is effective, flexible, useful and it is easy to use the framework in terms of information sharing requirements.

Question:

Why do you think the AcTIShA-Framework is effective in sharing the information?

P_1_P: Because using and following a system that directly reports the information with the necessary requirements mentioned in the earlier framework.

P_2_P: Well, because through this framework the information will be shared systematically within the organisation, also it shows the consistency of the information sharing.

P_1_S: The reason is that the current mechanism operates on a random and normal basis to share information, while this framework contains the requirements that can support the information sharing within the activity more efficiently.

P_2_S: This is because the framework includes the required components, system and features in which the mechanism of information sharing needs such a developed system for sharing information in an effective way.

Aspect 2: The accessibility of guidelines which generated by the framework to support the information sharing system:

<u>**Question**</u>**:**

How consistent was the design guidance for the information sharing model in terms of accessibility?

P_1_P: The design guidance of the information sharing system is clear and flexible because it perceives the effectiveness of the information sharing achieved by the guidance of the information sharing.

P_2_P: The design guidance is organised efficiently in terms of the service provided to share the information systematically. This is because we don't have any followed systematic mechanism, so through the AcTIShA-Framework the information sharing can be more effective.

P_3_P: Yes, many times I had faced various issues about the unstructured mechanism of information sharing on an incident which shouldn't happen, as this framework organised effectively and I think because it's flexibility and easy to use.

P_4_P: Well, the suitability in regards to information sharing analysis flow is achieved by the design guidance as an additional aspect, it can facilitate the usability of it.

P_1_S: I am really happy to see this work, It is well organised and it will ease the sharing of the information to the police confidentially and clearly and immediately.

P_2_S: As my tasks are to creating, recording and reporting the information, this framework is constructed and organised in a professional way, and can systematically

share the information and enhance the information sharing between the PSCs and the police force.

Question:

Do you have any suggestions or recommendations to improve the AcTIShA-Framework in terms of the information sharing system within your organisation's activities?

P_1_P: My suggestion is to implement this framework and be sure to include the different languages in this framework like Arabic and English.

P_2_P: I recommend that the framework must be applied as soon as possible as it features this systematic way and to submit it to the Information System Department (ISD) to develop it technically.

P_3_P: I agree with my colleagues that this framework needs to be implemented, because of the high demand on this type of approach.

P_4_P: This is a highly recommended system to be applied to improve the mechanism of the information sharing within our activities.

P_1_S: I suggest conducting multi-workshops in terms of improving all users' skills which then can facilitate the procedures of information sharing correctly.

P_2_S: I would highly recommend this approach to facilitate the information sharing, to ease the sharing the information.

Focus Group 2

(Healthcare Sector)

Date:	11th January 2018 – Thursday
Start time:	11:00am
Finish time:	01:10pm
Duration:	2 hours 10 minutes
Venue:	Ministry of Health, Fujairah Medical District

Participants from the Ministry of Health

Focus group 2		Thursday (11/01/2018)	
No.	**Participant**	**Job title**	**Gender**
1	P_1_H	Head of IT department	Female
2	P_2_H	Patients' Registration department manager	Female
3	P_3_H	Head of Statistics department	Female

The aspects to be measuring in terms of the framework:

Aspect 1: The usability of the requirements of information sharing systems which are generated by the framework:

<u>**Question**</u>**:**

How good are the requirements of the framework in terms of the usability of the information sharing system?

P_1_H: In my opinion, you covered the basic requirements of the information sharing process; in addition to that, the requirements of the information sharing system is useful to share the information in an effective way. Because the requirements of an information sharing system are to be usable and suitable for the user's needs.

P_2_H: I think the useable of the framework in terms of the information sharing in systematic way is consider to be effective enough which can be use it easily without any difficulties, because this framework is not complicated and it is very clear in how to use it.

P_3_H: I can say that this approach is appropriate to analyse and understand the information processes easily and clearly.

Aspect 2: The accessibility of guidelines which generated by the framework to support the information sharing system:

<u>**Question**</u>**:**

How consistent was the design guidance for the information sharing model in terms of accessibility?

P_1_H: Indeed, the design guidance of the information sharing system is useful, and the system is easy to use, because of its flexibility and simplicity.

P_2_H: I agree that this design is effective in terms of information sharing. In addition, I am supporting my colleague that the design guidance is flexible and simple to use. Because my experience was that I used to work on a system for patient information to share it with the statistics department, which required many details of information and was very complex to use, wasting time and producing inaccuracy.

P_3_H: It is a useful design guidance of information sharing, which perceived the consistency of information sharing; also this design is considered to be efficient.

<u>**Question**</u>**:**

Do you have any suggestions or recommendations to improve the AcTIShA-Framework in terms of information sharing within your organisation's activities?

P_1_H: I suggest applying this framework among our sector to facilitate the information sharing processes between departments.

P_2_H: I would like to recommend applying this framework within our sector.

P_3_H: In addition to the above suggestion, an implantation method and action plan will be useful to consider when approaching organisations or departments for the application of the framework.