

**ASSESSING INFORMATION VALUE FOR  
HARNESSING KNOWLEDGE NEEDED FOR  
IMPROVING DECISION-MAKING AND  
EFFECTIVENESS OF A GOVERNMENT  
ORGANISATION: A CASE STUDY OF ABU DHABI  
POLICE FORCE**

By

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## ABSTRACT

Due to many adverse consequences of poor decision making in organisations there is a need to focus on the quality of information and knowledge. This research focuses on how to obtain and use, or “harness” knowledge from information in improving organisational decision-making in a civil protection/security organisation to become effective and enter an organisational wide learning spiral. This is necessary in order to gain a high degree of intuitiveness and intelligence and to be effective. The researcher explores how information-knowledge can be processed and converted into deeper level knowledge, while at the same time how to get decision makers to codify knowledge in order to help them to externalise it. In order to achieve this, the “information-space” model was used to show the information-to-knowledge dynamic journey.

The research involved using quantitative and qualitative methods. The quantitative approach is used to obtain computable results from key decision-makers, such as senior workers, and test a model derived from the literature. Seventeen hypotheses were proposed based on theory to evaluate the proposed model. Primary data was collected during the empirical phase of the research from 135 respondents. A structural equation model was used and included exogenous and endogenous latent constructs. On the other hand, a use of qualitative research helped to obtain deeper insights into the use of information and knowledge in decision making. It was underpinned by several propositions and its aim was to expose the role of information-knowledge and the creation of a learning organisation.

The results of the quantitative approach revealed that twelve hypotheses are positively significant. Two hypotheses have a significant negative impact on other constructs. Additionally, three hypotheses are non-statistically significant. The results reveal some very interesting insights, such as that demographic factors, such as age, level of education, gender, work experience and level of authority, have a significant impact on problem solving and decision making. In terms of type of information, the proprietary and common sense information types have more significance for solving problem and decision making. But, much to the researcher’s surprise, the public information and personal information played a very minor role. On the other hand, the results of the qualitative data collection show how key decision makers made decisions and gained a certain degree of intuition from it. Therefore, this research has met its objective in helping towards improvement in a civil protection/security organisation to become a learning organisation and help it to enter a learning spiral and make continual improvement. Hence, the researcher succeeds in making suitable recommendations to a number of different stakeholders, in particular the civil protection/security organisations to (i) to develop their management and specialist personnel, and, (ii) to have the necessary information management strategy in place that would harness information and help towards (iii) creating an effective and robust knowledge management strategy.

**KEYWORDS:** Information Quality, Information-Space, Information-Space, Knowledge Management, Decision Making, Organisational Effectiveness

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## ACRONYMNS

APF	Abu Dhabi Police Force
BA	Business Analytics
BI	Business Intelligence
CMV	Common method variance
CFA	Confirmatory Factor Analysis
DSS	Decision Support Systems
DS	Defence and Security
EC	European Commission
EIS	Executive information systems
E2E	Existence and Enlightenment
ICT	Information And Communication Technologies
IT	Information Technology
GOF	Goodness Of Fit
KM	Knowledge Management
MIS	Management Information Systems
OLAP	Online Analytical Processing
ODM	Organisational Data Mining
PCA	Principal Component Analysis
ROI	Return On Investment
SEM	Structural Equation Modelling
SLC	Social Learning Cycle
UAE	United Arab Emirates

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# Chapter 1

## Introduction Chapter

### 1.1. Chapter Introduction

This chapter provides an introduction to this research by highlighting the research background, its purpose, its aims and the chosen theoretical and methodological approaches, and it outlines the thesis structure. It will highlight the need for a civil protection/security organisation to achieve organisation-wide effectiveness and learning by making better use of 'information' (Boisot, 1998). The chapter will also focus on the civil protection/security organisation problem situation and the information-related issues in question.

This concept of yielding value from information is relatively new to APF and many other public organisations in UAE. A civil protection/security organisation, specifically APF, operates with other UAE police departments through the Ministry of Interior to achieve a safer society. APF serves four major UAE districts: Abu Dhabi, Al-Ain City, the External Region, and the Western Region. APF has several units, which include police patrol, emergency response, crime investigation and traffic control. The primary objective of the organisation is to become an intelligence-led, proactive police force that reacts to the needs of society with the highest level of integrity and training. In order to achieve this, APF has constantly undergone development of its information systems in order to integrate a range of processes that include individual development along with the deployment of software and hardware with the ultimate goal of improving the accuracy and quality of decisions they undertake. Due to many issues with the use of information and wrongful decision-making, APF have now established the "Decision-Making Support Centre" to help the organisation explore future challenges and enter a learning spiral. The centre also helps in quality assessment and control to see how information-knowledge use can enhance its process of learning as an organisation overall. Hence, this research topic was chosen as an implication of having this department.



Therefore, this research looks at how information and knowledge can be used by decision makers to develop better intuition and intelligence to help a civil protection/security organisation to become more effective and enter learning. The focus is on information-to-knowledge conversion and harnessing knowledge. Thus the nature and quality of Information and conversion to knowledge is critical for decision makers to become more effective, accumulate knowledge and then share it. Making critical decisions in organisations is a complex process and many variables and aspects are involved.

## **1.2. Background to the Problem Statement**

Alfaki and Ahmed (2017) discuss the Knowledge Economy, and an over-reliance on oil challenges the long-term sustainability of the UAE. They note that the UAE places a lot of importance on a comprehensive strategic planning exercise to transform the country's economic structure from relying heavily on hydrocarbon resources to becoming a knowledge-based economy. They predict that non-oil will account for 80% of the country's economy by 2021. There is to be a shift from oil to base in the Arab World to transform itself into a leader in the adoption of scientific innovations. They evaluate the UAE's success in diversifying its economy and implementing the principles and approaches of a Knowledge Economy.

Abu Dhabi Emirate is undergoing a complete overhaul of public organisational systems, which is aimed at bringing together a range of processes, including human resource and technical resource, such as software and hardware deployment, in order to improve results and the quality of decisions made. As a result, public sector/civil security organisations have evolved at a phenomenal speed and their systems, approaches, mechanism of management and decision-making have also developed at an unprecedented speed. While this has been a very positive thing, nonetheless it has faced various constraints, such as the ability and capacity of many decision-making individuals to process information and, even more seriously, to convert it into intuition and knowledge.

Civil protection/security organisations have many negative experiences in recent years with wrongful use of information leading to ineffective and even wrong decisions being made due to inaccurate or too much information, causing the organisation to become the antithesis of a learning organisation. There has been a lack of information absorption and, given the current era of high levels of crime and terrorist threats, that level of ineffectiveness imposes a real risk. The decision makers, even in higher posts, are heavily reliant upon computing tools, such as

decision-making systems. As a result, there is a lack of information/knowledge conversion (codification), thus a lack of intuitiveness and internalisation of information and its conversion into knowledge. Finally, there is a lack of knowledge documentation, most of it residing in the heads of workers. Hence, any employee attrition imposes high risk for the public sector/civil security organisation, once again threatening its ability to learn and share knowledge.

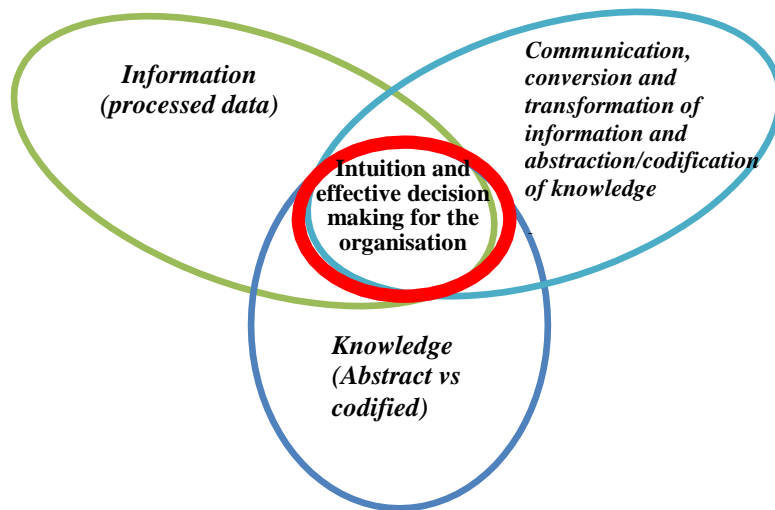
Al-Busaidi and Olfman (2017) note that knowledge sharing through systems is very pertinent in allowing, social and economic development especially in knowledge-intensive sectors. Authors look at the impact of knowledge worker, peer, inter-organizational knowledge sharing systems, organization and sector factors on knowledge workers' intention to share knowledge (Milner, 2002; Theocharis and Tsihrintzis, 2016; Senthilkumar et al., 2018). Michalopoulos (2016) seeks to shed some light on the field of organizational learning in public organizations. He found that middle managers are, in fact, far from fulfilling the role of knowledge engineers in Greek public organizations, succumbing to old style operational duties. Middle managers are merely conduits, translating plans into action, monitoring and controlling activities to keep things on track.

Therefore, there are many consequences of wrongful information, its use and of its not being converted to knowledge. Public sector/civil security organisations have been spending a lot of money on information systems for many reasons, including, in order to improve the use of information. Processing vast amounts of data and extracting accurate information is not easy, nor may it always be the right thing to do. Thus, due to many issues with use of information and wrongful decisions, civil protection/security organisations have established the "Decision-Making Support Centre" to help the organisation explore future challenges rather than just conduct research on current phenomena. The centre also helps in quality assessment and control. However, results have not been achieved as expected. The researcher was obliged to research this topic due to the need of this department and a managerial requirement. However, while the technology helps in this respect, it is not sufficient for improving decisions to a significant level of assurance, as many experiences have shown. Organisations simply need "good" information to make decisions.

Information-knowledge are important in an organisation for supporting decision makers in order to reach the best decisions possible and consequently attain the organisation's objectives (Dwivedi et al., 2015; Lee et al., 2016; Romano et al., 2016; Rasmussen et al., 2016; Silverstone, 2017; Khosrow-Pour, 2017). Hence in a civil protection/security organisation the

need for good quality information has to be embedded into the fabric of the civil protection/security organisation. In the case of public organisations, decisions ultimately concern the public, hence further diligence is required to make sure that these decisions do, for instance, preserve economic resources, maintain public health, and provide national security. The decision-making process requires a wealth of relevant and rich information in order to achieve efficient results.

The academic scope of this research aims to consolidate concepts to focus on information capture, interpretation, use and conversion into knowledge. These aspects will be looked at as interdependent properties of effective decision-making and accumulation of intuitiveness in the decision maker while improving the effectiveness of the organisation leading to organisational learning, as shown in Figure 1.1. The aim is to create a learning organisation, which can sustain and continue to enhance its excellence.



**Figure 1.1. Research Parameters**

The processing, filtration, interpretation and retaining of information and knowledge are pertinent aspects in creating a learning organisation; however, little research has gone into this dimension of a learning organisation. This is where the organisations need to pay attention to the effective interplay between information and knowledge. Boisot (1998) describes the dynamic flow of knowledge through a series of six phases known as the 'Social Learning Cycle', as discussed in the literature search chapter and this will be used in this research. Most importantly, his work shows the conversion of data into understandable information through filtration. This can then be used to generate useful knowledge that can then be used by the decision maker. This is a cycle where the data is filtered to produce meaningful information that is then abstracted and codified to produce useful knowledge for learning and even innovation.

This knowledge can then be applied to different situations to produce new experiences and uncodified forms that can lead to new knowledge. Vassilopoulou et al. (2016) look at talent management in non-Western contexts. They believe that talent is important in the context of the UAE, where talent shortages exist alongside high unemployment of Emirati nationals. They look at the foundation for evidence-based talent management for governmental policy makers and for public sector/civil security organisations in the public and private sectors. They suggest that focusing on empowerment and employment of Emirati talent is important but insufficient for organisations to tackle the complexity of talent.

### **1.3. Research Aims and Questions**

This research aims to help civil protection/security organisations to identify how particular types of information-knowledge can help decision makers to solve problems and become more intuitive, which they can then use to increase organisational effectiveness and enter a learning spiral.

The research objectives are provided below and this research will aim to achieve these through undertaking primary research and through its compilation of chapters:

1. To assess the extent of problems caused in decision-making due to information-knowledge related issues in public government organisations.
2. To identify specific information-knowledge and its interpretation issues in decision making in public government organisations.
3. To expose the process of information use and its conversion to knowledge through primary research.
4. To expose the information-knowledge-information cycle using information space and its impact on organisational effective performance and in creating a learning organisation.
5. To make realistic civil protection/security based specific recommendations to public organisations, particularly to APF to help its quest to become a learning organisation and be more effective in its operations.

Based on the research aim and objectives, the researcher hopes to answer the following important research questions that will have many implications for the organisation and many other organisations in this sector. The main Research Questions (RQs) which the researcher aims to answer are:

**RQ1: What is the significance of looking at information-to-knowledge, as one dimension in solving problems and effective decision-making?**

The literature relating to information and knowledge use for problem solving is vast; however, most of it sees these two elements as being separate and distinct. Thus, in this research the researcher uses the works of Boisot (1998), Boisot (2013) and Boisot and Canals (2004), and Crossan et al. (1999), who see this as a single dimension where information-knowledge are merely a conversion of the same phenomenon. This also includes the incorporation of explicit and tacit knowledge which are linked to the 'learning' process (March and Olsen 1976; Sim and Gioia 1986; Simon 1991), where explicit knowledge developed by individuals within the context of an organisation. The tacit knowledge of an individual can be used to benefit an organisation (Nonaka 1994; Nonaka and Takeuchi 1995; Spender 1996; and McPhee and Poole, 2001). This research aims to explain the knowledge distribution that occurs in organisations, through its formal structures. For example, researchers like Choo (2002) believe that sense making, knowledge creation and decision-making form the structure of the cycle of organisational knowing, which facilitates the flow of information in organisations. There are many writers looking at the usefulness of information and knowledge in solving complex problems and decision making: Festinger, 1950; Polanyi, 1958, 1966; Kraut, 1990; Teece, 2015; Dwivedi et al., 2015; Lee et al., 2016; Romano et al., 2016; Rasmussen et al., 2016; Schmitt, 2016; Onuoha and Godswill-Chinyere, 2016; Shollo and Galliers, 2016; Rothberg, 2017; Silverstone, 2017; Khosrow-Pour, 2017. Shollo and Galliers 2016; Choo et al., 2016; Nawinna and Venable, 2016; Contractor et al., 2016; Choo et al., 2016; Oancea, 2017; Trieu, 2017.

Sub RQ's:

RQ1.1. What is the relationship between the type of information-knowledge and its processing by decision makers?

RQ1.2. How can decision makers resolve problems using information?

RQ1.3. How do decision makers become more learned and intuitive using particular types of information?

## **RQ2: How does a decision maker's intuition impact organisational effectiveness and help it to enter a learning process?**

The purpose of focusing on information and knowledge is to enhance the intelligence and intuitiveness of the decision maker. For example, as Miller and Ireland (2005) write, many executives and managers embrace intuition as an effective approach to important decisions. Chilcote (2017) examines intuition as unconscious, holistic knowledge gathered without using an analytical process and knowledge derived through synthesis, not analysis. There are many writers who discuss the importance of intuition and the challenges in its elicitation (March and Olsen 1976; Sim and Gioia 1986; Simon 1991; Nonaka 1994; Nonaka and Takeuchi 1995; Spender 1996; Miller and Ireland, 2005; Polanyi, 1958, 1966, Kolb, 1984, Tsoukas, 2009; Fowler, 2016; Czerniak and Berkner, 2016; Chilcote, 2017). Fowler (2016) found that there was widespread implementation of managerial intuition in choosing retail sites. He found that a great deal of intuition was used when making decisions; however, the decision makers were not familiar with the process of decision-making. Hence this research focuses on the decision maker's development and use of new intuition to help the rest of the organisation.

Sub RQ's:

RQ2.1. How do decision makers engage, appropriate and internalise the information and convert it into knowledge?

RQ2.2. Can effective use of information and knowledge lead to the whole organisation entering a learning process and spiral?

Being able to solve problems and make effective decisions leads to more intuition. This can then be used to become more effective and to create a learning organisation, and enter a learning spiral of continual improvement. This happens when a decision maker works with those close to their specialism and those based in other parts of the organisation. Thus they can harness knowledge as a strategic resource (Nonaka 1994; Nonaka and Takeuchi 1995; Kolb, 1984, Tsoukas, 2009; Fowler, 2016; Chilcote, 2017).

## **1.4. Organisation of the Thesis**

This thesis is organised into the following chapters:

Chapter 1, explains the purpose of this research, where it states the research objectives, research questions and sub questions. It then proceeds to provide the overview of the underpinning theory, and provides the conceptual framework that will guide the researcher. This chapter also provides an overview of the methodology to be followed.

Chapter 2, reviews the relevant literature and focuses on the theoretical context, based on Boisot (1998). It shows how this theory helps to build the important foundations for this research. It successfully brings together and collects, consolidates and collates the studies on information quality and use.

Chapter 3, provides the research conceptual framework and the research model used in this research. It provides the model derived from the literature, the hypothesis, propositions and the data collection schema.

Chapter 4, explains the research methodology, which highlights the research design and outlines the methodology employed in this research. It presents the research approach and methods used to conduct the empirical investigation with an explanation behind the choice. The chapter also explains the data analysis techniques used in this study and addresses the criteria for judging its methodological approach rigour.

Chapters 5A and 5B, provide the research results and findings, where analyses are provided in two sections – quantitative and qualitative results. Here the use and processing of information by decision makers of civil protection/security organisation is highlighted, along with the impact.

Chapters 6A and 6B, provides a detailed discussion of the quantitative and qualitative findings. It discusses the major findings of the study in relation to the past literature aligned to the conceptual model that posited that hypotheses.

Chapter 7, provides the conclusions, recommendations, and limitations of the study, its contributions and implications. The chapter also makes practical recommendations to civil protection/security organisations to develop their decision-making and leverage the knowledge to be more effective.

Finally, the Appendices contain further information related to steps and activities covered during the research processes, data collection and data analysis processes, and are provided at the end.

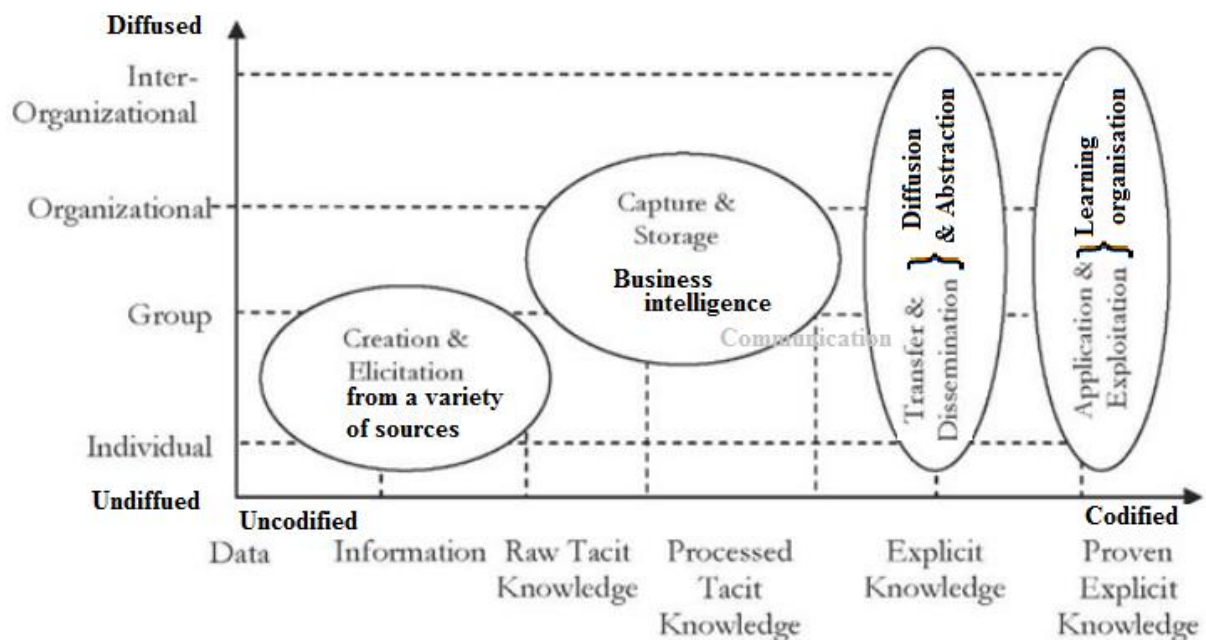


# Chapter 2

## Critical Literature Review

### 2.1. Chapter Introduction

This chapter provides a comprehensive review of literature surrounding the research topic that explores how information and knowledge can be used to help the decision makers in a civil protection/security organisation to gain a high degree of intuitiveness and intelligence to be effective. The literature is reviewed to understand how information can be processed and converted into deeper level abstract knowledge while at the same time how to get users to codify it in order to help them to externalise the knowledge that they hold. This chapter pays particular attention to those aspects of information-knowledge based literature that help to achieve the research aims of this research, as shown in Figure 2.1a. It focuses on the notion of information, where it looks at the processes that are used to ensure that data is of high quality. It looks at the information management tools and also cites Boisot and Canals (2004), who note that information cannot be considered separately from the individual and explain this by showing the differences between knowledge, data and information. The aim is to generate a model/framework for processing information and knowledge acquisition and to create more intuitive decision makers.



## **2.2. Importance of Data and Information Quality in the Public Sector**

There are several ways in which data quality is of high importance in the public sector. Generally speaking, quality data increases the productivity of organisations. Improvement of the level of productivity of an organisation as a result of availability of high quality data occurs in several ways and across different sectors of the economy. For example, availability of data of good quality can be used to help organisations reallocate resources appropriately (Yiu, 2012). This leads to attention being given to areas of greater concern in the operations of the organisation.

Secondly, data that is of good quality can be used to enhance the productivity of organisations by being used to make improvements in the way the organisations offer their services (Bujak et al., 2012). For example, organisations operating in the public health sector can considerably improve their service delivery by relying on more accurate and complete data about the health condition of their patients. It is by relying on continuous improvements in service delivery, which in turn is dependent on the use of quality data, that organisations are able to increase their productivity to the general public. The end result is that the performance of the organisation is improved over time and the benefits arising from increased productivity are passed down to the general public.

The most obvious way in which data quality is important to the public sector is with regard to the role that such data plays in the decision-making processes of organisations and the impact of this to the general public. Usually, the decision-making process plays a very important role in the way organisations carry out their responsibilities. For example, organisations rely on well-developed predictions to plan for how they can respond to possible future scenarios (Yiu, 2012). By forecasting their future operations, organisations are able to respond to changes in policy quite effectively. In order for organisations to make such decisions, it is important that they have access to high quality data. Therefore, quality data is important for organisations in the public

sector in that it helps them make decisions about their future courses of action. This is important because by doing so organisations are able to plan on how to provide high quality services to the public (Health Information and Quality Authority HIQA, 2011). This is applicable to different public sector organisations in that they can use quality data to predict trends in the market and respond by instituting the most appropriate risk management strategies.

Another way in which high quality data is important to the public sector relates to the benefits that members of the public and organisations can derive from the process of sharing information on the operations of organisations that operate in the sector. In general, the public is in support of the practice of organisations sharing important data on how they operate (Shakespeare, 2012). For this process to be successful, organisations need to share with the general public data that is of the highest possible quality. When this happens, individuals are able to understand the way organisations conduct their operations. This enhances the accountability of organisations in the public sector. This is helpful, not only to individuals, but also to different organisations. For example, when one is accessing specific documents, the input of several public organisations is required at different stages of the process. When such organisations share high quality data among themselves and the general public, this makes the process much easier and more transparent.

According to SOA and LL Global (2011), poor quality data usually leads to undesirable consequences for organisations, which include the risk of losing profitability, the manner in which the organisation manages its capital and its overall rating by the public. When applied to the public sector, it can be seen that organisations require high quality data as a way of avoiding the consequences of using data that is of poor quality. For example, an organisation that fails to use accurate data to present its performance to the public risks losing its overall rating and profitability over the long-term.

Data quality is important in the public sector because it helps the public understand the way organisations conduct their operations. Further, by using high quality data, organisations are able to reallocate their resources and make general improvements to the way they conduct their operations. In order to ensure that they have and use high quality data, organisations apply the Total Quality Data Management (TQDM) approach to the data handling process. Data quality in public organisations will be investigated later in this chapter, and primary data from seven

organisations in Abu Dhabi Emirate are explored in later chapters. Boisot (1998) stated that with the rapid development of information and communication technologies, (ICTs) knowledge management is gaining an importance in its own right as a discipline.

### **2.2.1. Information Systems (IS)**

Much of the information is processed by information systems that are used for automation and decision making. They can be categorised on the basis of purpose dimension and scope dimension (Gordon and Gordon, 2004). To perform in the purpose dimension, IS should have the elements of Automation Systems (AS), Transaction Processing Systems (TPS), Management Support Systems (MSS), Decision Support Systems (DSS), Groupware, and Executive Information Systems (EIS). To perform IS in the scope dimension, the information systems should hold the attributes of serving among individuals, be departmental/functional, allow enterprise, and act as inter-organisational systems. There are different types of Information Systems that are used by modern organisations (Rainer and Cegielski, 2013). Some of the IS are Transaction Processing Systems (TPS), Management Information Systems (MIS), and Enterprise Resource Planning (ERP) systems, Customer Relationship Management (CRM) systems, and Supply Chain Management (SCM) systems. IS may be classified into two different categories – operations support systems (OSS) and management information systems (MIS) (O'Brien and Marakas, 2010).

### **2.2.2. Use of information systems in the public sector of Abu Dhabi**

Most recently countries in the developed world have strong presence online under the so-called “e-governance umbrella”. Some of the developing countries have started introducing e-governance into their service mechanisms. Industrialised countries are taking the best of e-governance to achieve benefits. Such benefits include providing citizens and organisations with more convenient access to government information and resources, conducting transactions with businesses and with those working in the public sector, and delivering public services to citizens (Davidrajuh, 2004).

Further to these benefits, the main objective of any country from e-governance is to utilise e-governance for the development of the nation's economy and improvement of the quality of life and opportunities of the citizens. In Abu Dhabi, this aim is set forth. Following the successful endeavour of the neighbouring emirate, Dubai, the government of Abu Dhabi has introduced a policy to deliver most of its services to customers electronically and set a vision to build e-Abu Dhabi. The vision of e-Abu Dhabi is explained and clarified by the Director General of the Abu Dhabi Systems and Information Centre (ADSIC), Mr. Rashed Lahej Al Mansoori, who asserts that:

*“the e-Governance site is designed to provide services to all the government departments, authorities and administrations and ensure transparency of the services so that most of the officials use it as a vital tool of providing quality and effective service to the diverse customers”* (ADSIC, 2015).

To acknowledge the fact and advantages of e-governance, the civil protection/security organisation sets a vision in their mission statement and strategy. The civil protection/security organisation is, hence, committed to executing the vision of central government by implementing and providing most of its services online.

According to the official documentation, the vision of e-Abu Dhabi is to develop into a *“high performance government delivering world class services to the benefits of all its customers”* (Abu Dhabi e-Government, 2015). The Government of Abu Dhabi believes that the vision will benefit them in various ways with their customers and also transform the way government works electronically. The Government of Abu Dhabi defines the customers as including individuals and every business. The idea behind this vision includes four focus and design themes for the e-government strategy. The focus concentrates on end-users and increasing the efficiency of the service. The design themes are comprehensive and cross-governmental in design (Source: e-Abu Dhabi-

### 2.3. Decision Support Systems

The definition of Decision Support System (DSS) is roughly that it is a computer-based information system which is designed to aid organisations regarding their decision-making activities (March and Hevner, 2007). Decision support systems are used in the mid and upper levels of corporations to aid in management functions and planning. These areas usually change rapidly as a result of external factors, such as competitor innovations or inroads, along with rapidly changing customer tastes (Arnott and Pervan, 2008). Understanding of decision support systems is central to this study, thus an additional definition shall be used to ensure understanding. Laudon and Laudon (2010) define a DSS as a system which supports either one or a group of managers working on problem-solving situations to solve problems or issues. This is accomplished by providing management with information scenarios arising from differing ways to look at or ascertain potential outcomes (Laudon and Laudon, 2010). DSS includes varied potential solutions or suggestions which can be analysed (Laudon and Laudon, 2010). In terms of a further explanation of DSSs, Shim et al. (2002) explore many definitions resulting in synthesising the explanation to one that describes a DSS as an interactive computer based decision system that (Figure 3.7):

- i. Is used to provide support to decision-makers as opposed to replacing them.
- ii. That the process uses models and data in the performance of its varied functions.
- iii. DSS solves problems in varied structure modes. These can include non-structured and semi-structured.
- iv. The DSS focuses on the effectiveness of outcomes as opposed to the efficiency or facilitation of the decision process because it seeks the end result as being the purpose.

(Source: McLeod and Schell, 2007)

As a means to further understand DDS, the levels in terms of problem-solving support from its lowest function to its highest are ranked as Laudon and Laudon (2010) state:

- i. The retrieval of information elements is the lowest-ranked function.
- ii. The next function is the retrieval of information files.
- iii. This is followed by the use of multiple files to create reports.
- iv. The estimation concerning the consequences of decisions ranks fourth.
- v. The prior function provides the means for the DSS process to propose decisions.
- vi. All of the prior areas are aimed at decision-making, which is the top function.

DSS is a concept that leads to the development of systems to address particular types of decision. The use of DSS is not confined or restricted to any one type of application (Laudon and Laudon, 2010). The three main objectives of DSS are to provide assistance in helping to solve semi-structured issues or problems to support managers, and to contribute to the effectiveness of the decision process (McLeod and Schell, 2007). Figure 3.9 helps to visually understand the manner DSS works (McLeod and Schell, 2007):

DSS aids in solving problems by providing improved communications and enhanced focus concerning discussions, along with reducing time needed for decisions as it allows for the exploration of scenarios prior to actual application. The following provides an understanding of how the process (DSS) accomplishes the above (McLeod and Schell, 2007):

- Decision rooms
  - Small groups face-to-face
  - Parallel communication
  - Anonymity
- Local area decision network
  - Members interact on a LAN
- Legislative session
  - Large group of interaction
- Computer-mediated conference
  - Permits large, geographically dispersed group interaction.

### **2.3.1. DSS Importance and Need**

The highly competitive nature of today's business environment calls for increased government efficiencies and service to its populace that has created the need for increased efficiencies (Srivardhana and Pawlowski, 2007; Carter and Belanger, 2005). The vast repositories of information and complexities that are a part of operating huge governmental systems and business operations means the use of past experience factors, information databases, tendencies and associated facets are needed to aid in decision-making and planning (Srivardhana and Pawlowski, 2007). The above summary analysis has been used to provide an understanding of the complex environment that government and business operate in. It is a part of a broad range of information management and analytical tools that have become an integral

part of the knowledge management aspect of society. These represent the services and administration provided by government, along with the broad range of business uses.

The complexities that accompany today's competitive business arena and the broad range of services, regulations and governance means information needs to be processed effectively (Heeks, 2000; Edmunds and Morris, 2000). These two arenas need to be able to harness the power of databases and information for solutions that can be accessed for varied uses. In discussing governmental needs Heeks (2000) states that one of the more important functions is defining and meeting specific areas concerning the populace. Therefore, by understanding the differing needs of constituents, governments can craft policies and services. Moreover, the problem of information overload requires insights. Information overload represents the volumes of information that businesses and managers receive, generate, gather, use, and need in order to conduct operations, deal with competitors and the expectations of consumers (Edmunds and Morris, 2000).

An important revelation at the core of the need equation is the fact individuals have what is known as human information behaviour. This is described "*as the totality of behaviours (active or passive) that people engage in to gain access to, organise and use information*" (Huotari and Wilson, 2001, p. 23). "*Thus, it will include not only pro-active steps to gain access but also the passive reception of information, which then or later, turns out to be of use*". The above provides the basis for understanding where and how organisational informational behaviour evolved. The need for information is not new, but rather represents a human and organisational trait that has always been the case. Hence:

*"organisational (or corporate) information behaviour embraces not only the formal systems set up to manage internal information flows, but also the systems, including libraries and information centres designed to access external information as well as the organisational and personal communication systems through which information reaches the organisation and is disseminated"* (Huotari and Wilson, 2001, p. 23).



The above areas have brought to light that information is a critical driver of the decision-making process in companies. Decision-making in companies is the basis for success or failure as it is dependent on the quality and quantity of information used (Saaty, 2006). Information overload in business can be just as damaging to a company as too little information (Edmunds and Morris, 2000). In terms of understanding the importance and need of a decision support system, it is necessary to recognise it as a function of leadership, management and organisation (Saaty, 2006). Leadership is significant in this process as it is management that makes decisions and is responsible for establishing systems to gather, correlate and put information to use. The decisions made by management impact the success of the enterprise. This includes employee morale, performance, competitive decisions, marketing, financial and other areas. The above means the fates of all organisations (in business or government) are determined by the quality of their decision-making capabilities.

### **2.3.2. DSS Use in Business**

In terms of equating the use of DSS in companies, the two categories described in the above section (History of development) are used. These represent model-driven and data-driven examples. Under the model-driven approach. Some of the main approaches used under DSS entail decision analysis, intelligence management, predictive modelling and decision management. In a report by Oracle (2014), it is shown that in excess of 85% of U.S.-based Fortune 500 companies use what are termed as Crystal Ball products. This is one of the leading spreadsheet applications used for forecasting, predictive modelling, optimisation and simulation. It is a DSS software type that provides businesses with insight concerning varied factors that affect risk that permit management to make tactical decisions important to achieving objectives (Oracle, 2014). Another DSS application was developed by Frontline Systems that uses a system of solvers and optimisers used in Quattro Pro, Excel and Lotus 1-2-3, which are used by consumers, accounting professionals and companies internationally.

Another type of model-driven DSS software is MeetingWorks. It is a software application that aids company managers in organising and conducting meetings that are more productive and streamlined (Antunes and Carrio, 2003). Data-driven DSS applications are used in companies and large corporations (Hedgebeth, 2007). One of the largest vendors of data-driven DSS systems is Cognos (Power, 2008). The company's BI/OLAP (Online Analytical Processing) application is a business intelligence (BI) software tied to OLAP, which is a technology used to

conduct queries in statistical databases (Jovanovic et al., 2012). The success of OLAP is dependent on the design of multidimensional databases (Jovanovic et al., 2012). Cognos' BI/OLAP application serves over 22,000 corporate customers in virtually all countries (Power, 2008). The business solutions offered by Cognos aid businesses in understanding, managing and monitoring their performance. The software also includes business analysis and reporting, the measurement of profitability, optimisation of forecasting and cost management. Cognos provides an efficient means to aid in the delivery of intelligence data for business. It uses data warehouse information to construct replies to data queries.

### **2.3.3. DSS use in Public Organisations**

The examples concerning the use of Decision Support System applications in public organisations are widespread (National Forum for Educational Statistics, 2006). In an extensive report on the use of DSS in public organisations, the National Forum for Educational Statistics (2006) states that various forms are being used in the United States' educational system. The uses range from the administration of personnel, accounting functions, course curriculum design to teacher performance comparisons in districts, states and regions (National Forum for Educational Statistics, 2006). In another report, it is argued that the use of DSS in the public sector aids organisations to utilise data along with models to uncover and identify problems as well as solving them.

The typical use in public organisations entails aiding administrators to use and manipulate data and use checklists, along with building and using models. The application of DSS in the public sector entails cooperative measures to build and form a consensus, as opposed to the authority driven approach used in the private sector. DSS in the public sector can be found in all segments. Whilst the terminology will differ for various countries, the general parameters are the same in terms of application (Riad et al., 2011).

### **2.3.4. DSS in the United Arab Emirates Public Sector**

In terms of identifying the use of DSS in the public sector of the United Arab Emirates (UAE), e-government may be the place to uncover such a use. The UAE e-government represents “... *activities that take place over electronic communications among all levels of government, citizens and the business community, including: acquiring and providing products and services;*

*placing and receiving orders; providing and obtaining information; and completing financial transactions*” (Riad et al., 2011, p.124). The key element in the above definition is that e-government utilises DSS as its structural foundations. E-government offers the most cost-effective and efficient use of computer aided systems as it drastically reduces installation, communication and information exchange costs. Whilst Western developed countries were able to convert long-standing computer systems to e-government platforms, countries in the Middle East lacked the infrastructures for e-government and have embraced it as the means to introduce the efficiencies and cost saving measures of computer aided systems employing DSS. In the Middle East, most governments are using the installation of DSS service-oriented architecture as the platform to link and integrate services along with applications between different agencies and ministries (Riad et al., 2010).

The use of DSS provides Middle East countries with support for unstructured and semi-structured uses (Riad et al., 2011). This includes the combination of computerised information outputs and human judgment factors where DSS provides support for varied governmental levels. DSS components used in the Middle East usually consist of “...*(i) database management subsystem (DBMS), (ii) model base management subsystem (MBMS), (iii) knowledge-based (Management) Subsystem, and (iv) User interface subsystem (Dialogue) ...*” (Riad et al., 2011, p.126).

The above understanding is critical in understanding the use of DSS in the United Arab Emirates. A recent study conducted by the United Nations (2010) ranked the United Arab Emirates as 49<sup>th</sup> internationally concerning its use of and sophistication in e-government development (Riad et al., 2011, p. 126). Despite this, the country was rated as 86<sup>th</sup> in terms of e-participation and 99<sup>th</sup> in its use of online services (Westland and Al-Khoury, 2010). In providing a base to correlate the standing and development of e-government in the United Arab Emirates, Westland and Al-Khoury (2010) used the developed system in the United Kingdom to illustrate the potential benefits.

Citizens use the government system to enable tracing user interests, inquiries and allied aspects that are aided by DSS applications. In terms of services under e-government in the UAE, they mainly consist of a broad range of services for citizens and businesses across varied federal and local governments (Al-Hujran, 2012).

## 2.3. Relationship between Information and Knowledge

According to Boisot and Cannals (2004), “information is an extraction from data that, by modifying the relevant probability distributions, has a capacity to perform useful work on an agent's knowledge base”. They provide the relationships between data, information and knowledge, as shown in Figure 2.1:

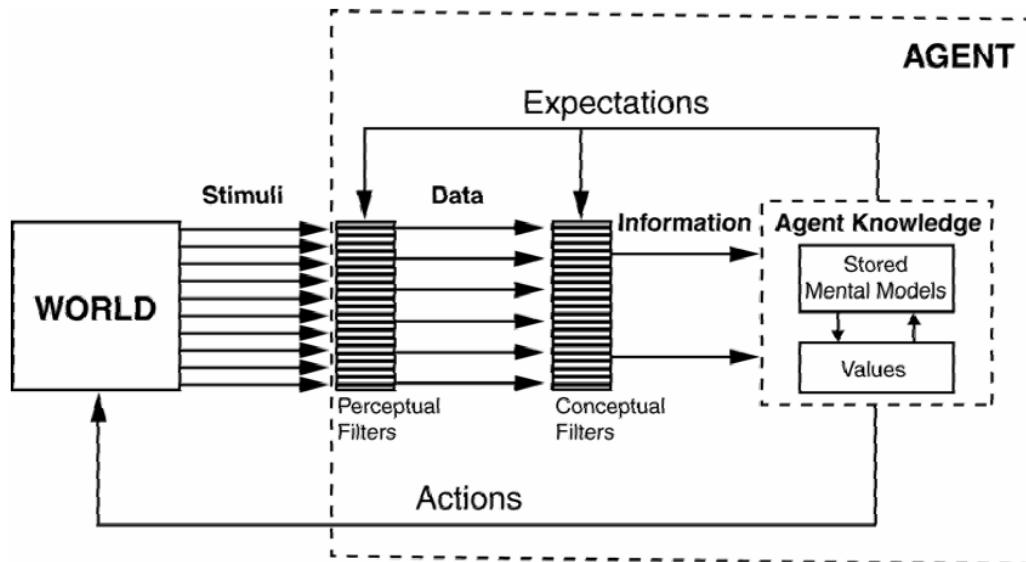


Figure 2.1b: The Agent-in-the-World

Figure 2.1b shows that an agent operates two types of filters in transforming the incoming stimuli into information. The perceptual filters orient the senses to particular types of stimuli that operate within a given physical range. Here the stimuli passing through this initial filter get registered as data. Conceptual filters then extract *information bearing* data from what has been then registered. They believe that both types of filters get “tuned” by the agents’ cognitive and affective expectations (Clark, 1997; Damasio, 1999), shaped as these are by prior knowledge, to act selectively on both stimuli and data. They believe that this schema allows one to view data, information and knowledge as distinct kinds of economic goods, each possessing a specific type of utility. Data can carry information regarding the world and it can modify an expectation or a state of knowledge. It can then allow an agent to act in the real world and can make a change.

There is an increased awareness around the fact that knowledge cannot be managed as a physical entity and, more so, a debate around what knowledge actually consists of. The research also claims that knowledge differs from data and information in that it is dispositional, i.e. actions or behaviours are caused by internal characteristics and not external. This affects data processing and communication and, therefore, abstraction and codification process are undertaken. This is the reason for many new roles being formed in the sector, such as chief knowledge officer, and also for a rapidly growing interest in knowledge management.

Haldin-Herrgard (2000) proposed that one of the most important difficulties faced when trying to manage knowledge resources is the diffusion of knowledge within organisations. Knowledge management requires varying methods and can be based on Internal individual processes, such as experience, that acquires tacit knowledge. This is so difficult to code and therefore cannot be managed and shared as explicit knowledge. To rely on personal tacit knowledge alone is very risky and conversion of that knowledge to explicit, or at the least ability to share it, offers a much greater value to an organization. However, there can also be difficulties in sharing that knowledge, such as perception, language, time, value and distance.

### **2.3.1. Knowledge Management and Business Intelligence**

Rothberg (2017) aims to bring together the existing theory from knowledge management (KM), competitive intelligence and data analytics to develop a more comprehensive view of the full range of data, information, knowledge and intelligence. By doing so, the interactions of these intangible assets can be better understood and recommendations can be made for the appropriate structure of data systems in different circumstances. Metrics are also applied to illustrate how one can identify and understand what these different circumstances might look like.

BI, along with KM, also has the tendency to be misrepresented, therefore on occasions wrongly applied in organisations to resolve issues that are beyond its remit, scope and purpose. As a result, extensive KM projects lead to failure, primarily due to limited understanding of the KM proposition (Cody et al. 2002; Chung et al. 2003). Another contributing factor in addition to this misinterpretation, is that both BI and KM are often used interchangeably, with a lack of clarity regarding what each constitutes. A survey conducted by OTR consultancy found that 60% of consultants were unaware of the differences between both concepts (Herschel and Jones 2005).

Although, the context and scope of the survey are not provided, the literature surrounding KM and BI also indicates towards the transferable use of both concepts, whilst in reality they differ and it is difficult to readily interchange the two (Becerra-Fernandez and Sabherwal 2015). This can be reflected through the central research aims of previous studies that aim to integrate both BI and KM systems together (Cody et al. 2002; Herschel and Jones 2005; Rao and Dey 2012).

Khan and Quadri (2012) similarly distinguish between both concepts through their dealings with knowledge, also affirming that BI handles only explicit knowledge. This type of knowledge is defined as objective, technical knowledge, which can be formalised, coded and deposited. On the other hand, KM deals with tacit knowledge, which can be described as a subjective and cognitive type of knowledge. In addition, Becerra-Fernandez and Sabherwal (2015), propose inputs of BI are data and information, whereas information and knowledge are the inputs of KM. Figure 2.1c highlights further distinctions between them:

**A Comparison of Knowledge Management and Business Intelligence**

	Knowledge Management	Business Intelligence
Intellectual Components	Primary: Knowledge (Explicit and Tacit) Secondary: Information, Data	Primary: Data Secondary: Information, Explicit Knowledge
Processes	Knowledge Capture, Sharing, Application, and Discovery	Data Access, Analysis, and Presentation
Key Components	Social Mechanisms and Information Technology	Mainly Information Technologies

Figure 2.1c: Knowledge Management and Business Intelligence

(Source: Becerra-Fernandez and Sabherwal (2015: 41))

It is due to this proposal that Herschel and Jones (2005) position BI as a subset of KM. However, KM is also referred to as an 'internal-facing BI' that distributes intelligence amongst the organisational workers, allowing them to effectively perform functions within their business domains, and in turn managing the use of various BI techniques (McKnight 2002). Therefore, this does not combine KM and BI, but rather positions BI under KM. This arrangement is also upheld in this study since the counteracting view that KM is a subset of BI is established on the premise that KM encompasses both tacit and explicit knowledge types, whereas BI only focuses on the latter and, as a result, BI is viewed as a component of KM (Hussain, Asad and Alketbi, 2017).

Shollo and Galliers (2016) however, suggested that BI also deals with tacit knowledge, therefore defying the underlying basis for Herschel and Jones (2005) to place BI under KM. The

differences between BI and KM are subtle, as formerly discussed, therefore associations between BI and CI are also differing. Several views relating to the associated between BI and CI can be related from the literature. The first perspective draws no distinction between BI and CI, for instance Vedder et al. (1999), Kinsinger (2007) and Calof and Wright (2008) all exploit the term BI, when referring to competitive intelligence, offering no variations between the terms. Calof and Wright (2008) support that CI fully comprises all aspects pertaining to the competitive environment, which incorporates existing and potential competitors, by the means of collecting both internal and external information, which, in turn, allows organisations to recognise opportunities, whilst also detecting threats. Vedder et al. (1999: 109) categorically associate both by suggesting, 'CI is also known as business intelligence'. Though, according to Štefániková and Masárová (2014) this position is primarily established in American literature, thus highlighting the potential regional influences on the interpretations of these concepts.

McKnight's (2002) positioning of KM within the BI context regards CI as a component of BI, therefore classes CI 'as a sub discipline of BI'. Obeidat et al. (2015: 48) and Zheng et al. (2011: 698) also support this view by stating that '*CI has emerged as an important area within BI*'. Weiss (2003) and Štefániková and Masárová (2014), also view CI as a product of BI. This emphasis of BI as an extensive umbrella concept for CI and other associated intelligence terms (such as, competitor intelligence, market intelligence, customer intelligence, and strategic intelligence) is particularly evident in European literature and is expressed in Figure 2.2, contrary to American literature's synonymic interpretation.

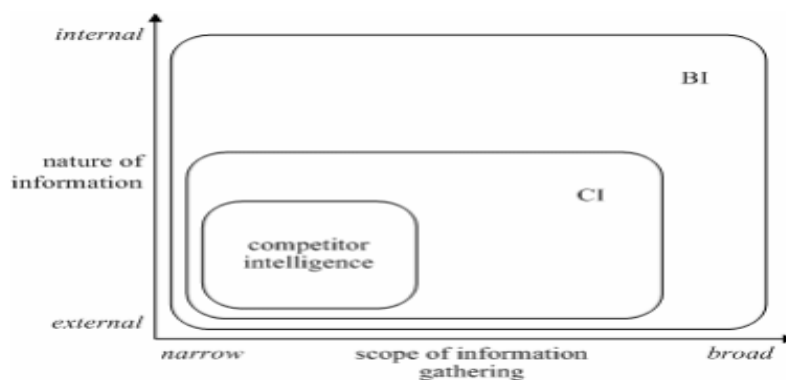


Figure 2.2: Intelligence concept scope and nature

(Source: Choo, 2002)

The last CI perspective views both as being distinctively separate information systems. Špingl (2007), like the other two pieces of research, views both as being completely separate information systems, suggesting that CI focuses on the external rather than the internal environment; whilst BI does the opposite. Therefore, they both inherently deal with different

information sources. Other researchers advise that CI has an external orientation for gathering and manipulating information, whereas BI, in its nature, focuses on internal data within an organisation (Kahaner 1996; Vibert 2004 and Yermish et al. 2010). Although this emphasis on the placements of both CI and BI is justified, because BI has the ability to manage external information, it can be linked to the internal components of the organisation (Cook and Cook 2000).

Choo (2002) further adds to this by suggesting that BI has the ability to deal with the strengths and weaknesses of an organisation, whilst at the same time it can also mediate external factors, such as economy or political matters. Zheng et al. (2012) advise that currently BI systems are not able to provide the CI proposition fully as the data is not able to be gathered very easily and also because of the reliance on third parties to provide data. The BI systems that can provide a complete set of information regarding competitors are usually very expensive and can sometimes be based on historical rather than current data.

Watson (2015) states that the names, concepts and ideologies are always being changed by decision makers and professionals in order to attract consumers and other company propositions. After looking extensively at the BI literature, it can be clearly seen that many positions can be accredited to Business Analytics (BA) and BI. Laursen and Thorlund (2010) put forward the idea that BA is an extended branch of knowledge within BI, whilst BA is just thought of as a subset of BI (Davenport and Harris 2007). Watson and Wixom (2010) refer to these organisations as 'BI-based organisations' as opposed to just 'organisations'; these can also be said to be 'knowing' organisations, whereas the BI systems facilitate the organisational knowledge. Due to the fact that the idea of knowing can be rejected as being lightly connected, it does show the critical role and influence of BI in organisations, focusing not just on the analysis of historical data, but also on the analysis of current data (Glancy and Yadav 2011).

The study of Steiger (2010) is based on Nonaka's (1991, 1994) knowledge spiral, a BI theory known as knowledge creation, indicating how BI can focus on the decision-makers in order to uncover and enrich their mental model, whilst improving the quality of decisions. These can be taken to be the first indications of knowing combined in BI literature, though both studies fail to distinguish exactly between what supports the decision and the actual knowledge itself. Studies show that organisational decision-making is caused directly by the BI systems and their ability to



detect behavioural trends, business processes and opportunities (Truxillo et al. 2012; Chau and Xu 2012; Elbashir and Williams, 2007). Choo (1998) outlines the process by which an insight to these factors can be achieved and how they can then be used to assist in decision-making and links them to the organisational knowing processes. The MIS Quarterly has a compilation of many studies that show the link between BI technology and the ability to withdraw information and also new ideologies that are formed as a result of BI methodologies (Hu et al. 2012; Lau et al. 2012; Park et al. 2012).

The most relevant study that addresses organisational knowing and BI is illustrated by Shollo and Galliers (2016). This work is highly regarded in relation to this piece of research for several reasons. Firstly, Shollo and Galliers (2016) address the role that BI systems play in the creation of organisational knowledge. Secondly, this study shows how BI is used in decision-making and focuses on the latter stages of BI, even after the output so that they can determine the source of the knowledge and its use by the decision makers.

## **2.4. Information to Knowledge Journey**

Ronquillo et al. (2016) use the data-information-knowledge-wisdom (DIKW) model, which has mainly been utilised in nursing informatics. The development of DIKW in nursing informatics was studied, while also incorporating accounts from other sources. This also incorporated investigation around the hierarchy and linearity of the model. There are two main aspects which are considered. Firstly, whether DIKW serves clinical information systems, or solely nurses alone. Secondly, what level of theory does DIKW occupy? The DIKW model has been very useful in evolving the independent field of nursing informatics. Therefore, if the model is to thrive, then its role and functions must be explored.

Knowledge was historically understood as transformation from data, information, knowledge and wisdom. Knowledge continues to have many definitions and discussions up to the present day. According to Machlup (1980), information is basically a flow of messages. However, one of the main discussions in firms is how to improve productivity and the flow of these messages (Epple et al., 1996). Structured data supports decision-making (Laihonen, 2006) and forms knowledge pyramids. While Nonaka discussed tacit knowledge and its process of conversion, he also

defined four phases (Figure 2.3): (1) from tacit knowledge to explicit, (2) from explicit knowledge to explicit knowledge, (3) from tacit knowledge to explicit knowledge, and (4) from explicit knowledge to tacit knowledge (Nonaka, 1994). This model indicates the importance of social factors and interactions.

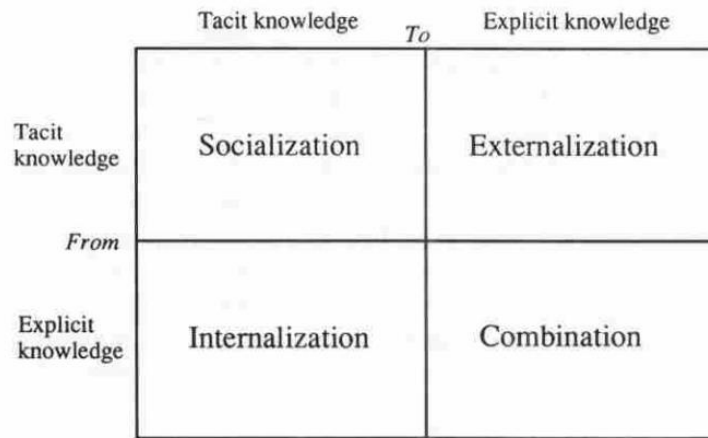
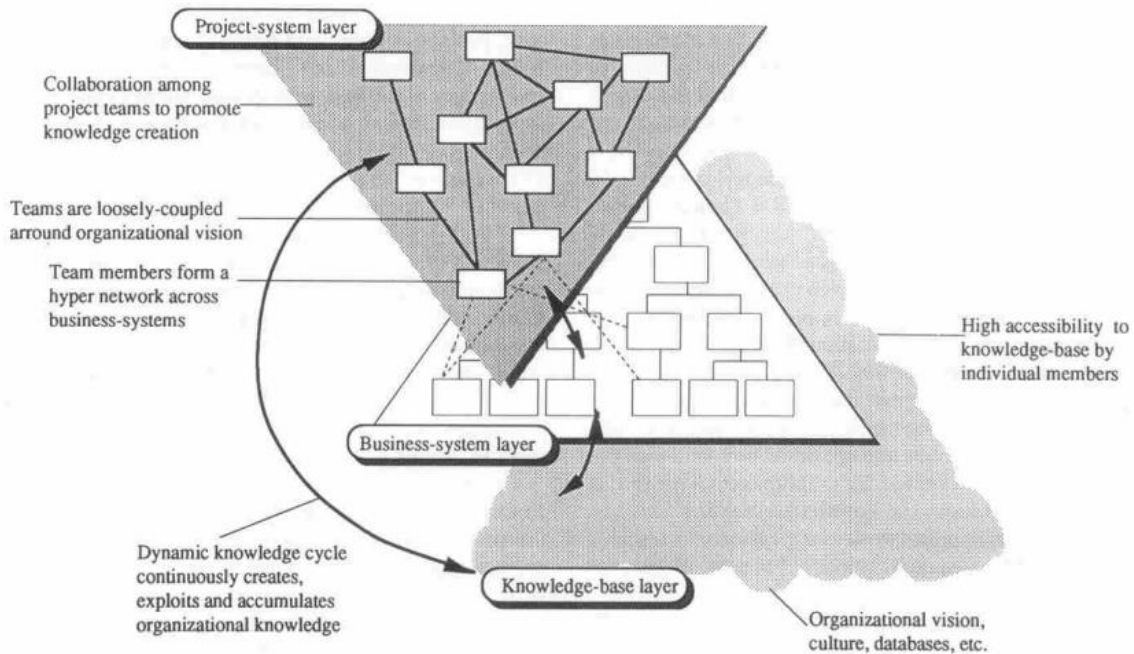


Figure 2.3: Mode of Knowledge Creation

(Source: Nonaka, 1994)

This theory was expanded by many authors, who define a non-linear processing stage as “Existence” and “Enlightenment” as E2E model (Faucher. et.al, 2008) and can also be described as “meta-knowledge being knowledge to knowledge” (McElroy, 2003; Wiig, 2004).

Nonaka also described three layers: a project-system layer, business-system layer and knowledge-based layer in firm activities (Figure 2.4). He then applied this theory to Japanese firms in 1995.



Source: Nonaka, Konno, Tokuoka, and Kawamura (1992).

Figure 2.4: Hypertext Organization – An interactive Model of Hierarchy and Non-hierarchy (Source: Nonaka et al., 1992)

According to Bhatt (2001), knowledge creation is the first process to share knowledge; however, David (2000) mentioned that culture forms major barrier in the form of value, practices, norms and interactions behaviour when harnessing knowledge. Boisot's (1995) and Nonaka's (1994) literature was used by Hall (2003) (Figure 2.5) to outline the process, recognition and education in processing information and knowledge within an organisation. There are three dimensions, which are codification, diffusion, and mind-set as a new axis that is adaptive competency for disruptive technology.

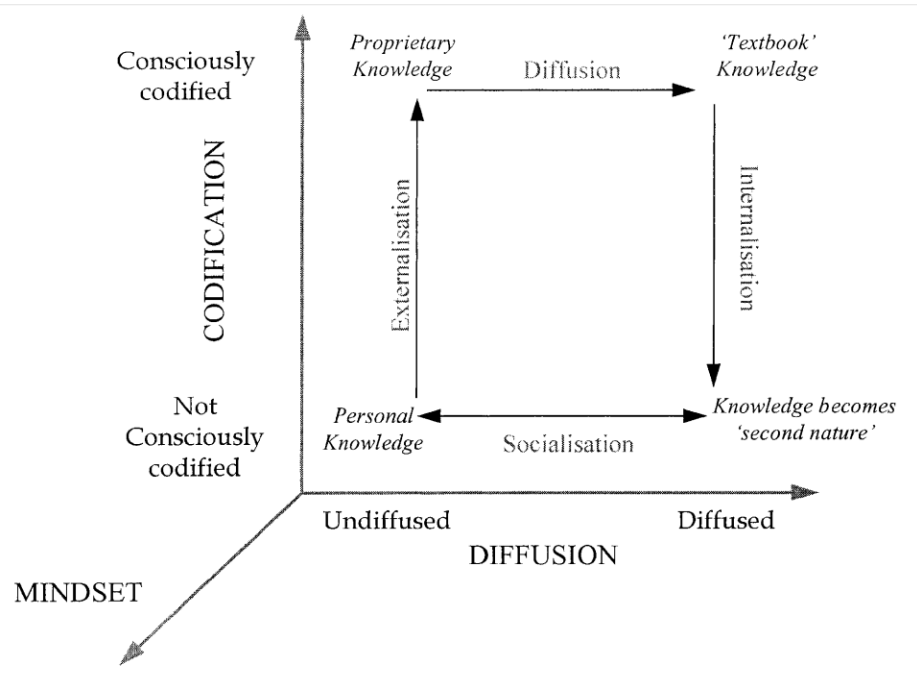


Figure 2.5: Knowledge space (Adapted from: Nonaka, 1994; Boisot, 1995; Hall, 2003)

There are five processes: (1) Externalization, (2) Education, (3) Internalization, (4) Socialization, (5) Radical transformation and the associated unlearning. It shows that not only culture and resource are needed, but also technology and tools need to be considered as they may affect the overall outcome. In relation to the outcome, Tynjälä (2012) described the process of learning as an insight into academic space.

The Information Space or information space was developed by Boisot as a conceptual framework relating the degree of structure of knowledge (i.e. its level of codification and abstraction) to its diffusibility as that knowledge develops. This results in four different types of knowledge (Boxer, 2006):

- Public knowledge, such as textbooks and newspapers, which is codified and diffused.
- Proprietary knowledge, such as patents and official secrets, which is codified but not diffused. Here barriers to diffusion must be set up.
- Personal knowledge, such as biographical knowledge, which is neither codified nor diffused.
- Common sense knowledge – i.e. what 'everybody knows', which is not codified but widely diffused.

The Information space (I-Space) model produced by Max Boisot (1995,1998) is a concept around the structure of knowledge and its relationship to its ability to diffuse as the knowledge advances (i.e. information is what an individual will take from a data set by means of their own

knowledge/experience). Boisot suggests that the easier data can be structured and then converted on to information, the easier it is to diffuse.

The model itself can be envisioned as a three dimensional cube with three aspects: uncodified to codified, concrete to abstract, and undiffused to diffused. It shows how knowledge is shifted from concrete to abstract, i.e. language of a high degree where it then becomes easier to diffuse. Once it has been centralised, it can then shift back to the concrete phase (Snowden, 2010). This information space phenomenon is known to be influenced by the development of the Cynefin framework (Snowden, 2002).

There are three dimensions to grasp to understand Boisot's work (Dalkir, 2017):

- from uncodified to codified,
- from concrete to abstract,
- from undiffused to diffused.

Boisot (1995, 1998) proposes a Social Learning Cycle (SLC) that uses the I-Space to model the dynamic flow of knowledge through a series of six phases:

- Scanning: insights are gained from generally available (diffused) data
- Problem-Solving: problems are solved giving structure and coherence to these insights (knowledge becomes 'codified')
- Abstraction: the newly codified insights are generalized to a wide range of situations (knowledge becomes more 'abstract')
- Diffusion: the new insights are shared with a target population in a codified and abstract form (knowledge becomes 'diffused')
- Absorption: the newly codified insights are applied to a variety of situations, producing new learning experiences (knowledge is absorbed and produces learnt behaviour and so becomes 'uncodified', or 'tacit')
- Impacting: abstract knowledge becomes embedded in concrete practices, for example in artefacts, rules or behaviour patterns (knowledge becomes 'concrete')

SLC enables one to link content, information and knowledge management in a very effective way - the codification dimension is linked to categorization and classification; the abstraction dimension is linked to knowledge creation, and the diffusion dimension is linked to information access and transfer. He believes that the knowledge element sitting at the opposite extreme of the I-Space (least abstract, least codified and most diffused) have "the highest level of entropy;

therefore, have the least potential for performing value-adding work. Organizations pursuing competitive advantage need to move their knowledge assets into the region of minimum entropy. An important aspect of SLC is the recognition of the elusive and dynamic nature of knowledge. It means that data is filtered to produce meaningful information and this information is then abstracted and codified to produce useful knowledge. Consequently, knowledge is applied in diverse situations, hence produces new experiences that produces data for a new cycle of knowledge creation.”

Furthermore, Nonaka and Takeuchi (Nonaka and Takeuchi, 2005, as cited in Dalkir, 2017) note that the way in which to sustain a competitive gain over other organisations is to create knowledge. Since a competitive environment and preference of the customer is something with the likelihood to continuously change, knowledge perishes relatively quickly. According to the Knowledge-Creating Company, managers have the ability to create knowledge due to many years of insight from Japanese firms and can then produce innovative services and products.

On the other hand, Choo’s (1998) Sense-Making KM Model focuses on the creation of knowledge and also on decision making. Choo puts emphasis on “knowing organizations” that use information advantageously in three specific areas; sense making, knowledge creation and decision making. These three areas are very well connected and play a key role in the vision of the organisation’s knowledge and also its potential to create knowledge (Neto et al., 2009, p.595).

Knowledge creation is defined as the process that allows an organisation to create/gain information which is then processed and organised so that it can result in new knowledge being generated through learning (Neto et al., 2009, p.595). The new knowledge generated then develops the organisation’s abilities and capabilities, develops new products and services and allows for an improvement to the organisational processes. This is referred to as the “potential to act” (Neto et al., 2009, p.595).

The third element of Choo’s (1998) model is associated with decision-making. The organization has to decipher what the best option is and pursue it based on the organization’s own strategy. According to March (1978), decision-making processes within organisations are limited by the bounded rationality principle. A lot of different factors can influence the decision-making theory, as described by Choo (1998). These include the decision-making process, which is determined

by the need for a better alternative instead of finding the best solution, the choice of a single alternative by giving up existing ideas and a completely rational decision requiring information that is outside of the capabilities of the information implementation and collection. The decision-making process ends in the organisation committing to a certain action and Choo's model focuses on how each piece of information is selected and then chosen to be a part of these actions.

Organizational action is a result of the concentration and absorption of information from the external surroundings that feed into each cycle and within each of these phases is the involvement of an external stimulus. (Dalkir, 2017). The Wiig KM model (1997a) says that if the knowledge is to be effective and valuable, it needs to be organised and should be organised according to what it is to be used for. The main areas outlined by the Wiigs KM model are completeness, connectedness, congruency, perspective and purpose (Dalkir, 2017).

Completeness is the measure of the relevant knowledge that is available from a certain source. These sources can include the human mind and/or a knowledge base (in other words tacit or explicit knowledge). It is important to ascertain the source of the knowledge and also which subject it is in regards to in order to make effective use of it (Dalkir, 2017). Connectedness is the relationship between varying objects of knowledge. These objects are usually connected and the more connected they are, the more coherent the knowledge is and the higher the value of the content (Dalkir, 2017). A knowledge base needs to be consistent, and is when facts, concepts, perspectives, values, judgments, and relational links between the objects are compatible. Unfortunately, most knowledge bases do not meet these specifics (Dalkir, 2017).

Perspective and purpose is an ideology whereby an individual has knowledge of something but only from a particular viewpoint and for a certain purpose. This is the way in which most people organise their knowledge (Dalkir, 2011:77). Wiig's model defines the level of internalisation in relation to knowledge, which could actually be related to the fourth quadrant of internalisation by Nonaka and Takeuchi. The different levels of internalization include varying stages ranging from novice to master and include beginner, competent and expert. A novice is not aware of the knowledge that is available and in which manner it can be utilised. A beginner is aware of the knowledge and from where they can obtain it, but is unable to comprehend it. The competent individual is also aware of the knowledge and can also use it but only by means of external knowledge bases (i.e. documents and manuals). The expert individual is aware of the

knowledge, can understand and apply it to where needed and holds this knowledge in their own memory without the use of external sources (Dalkir, 2017). Wiig (1997a/b) also proposed the idea that this hierarchical model including shared, public and personal knowledge sources.

When taking into account only knowledge, there are only two views, which are knowledge management and knowledge flow. Knowledge flow in individuals and within organisations is defined as knowledge management (Nissen, 2002). Knowledge flow is also defined as a channel to communicate with each other. The Informal channels influence the interaction within varying social interactions. The other aspects of knowledge flow are shown in Figure 2.6.

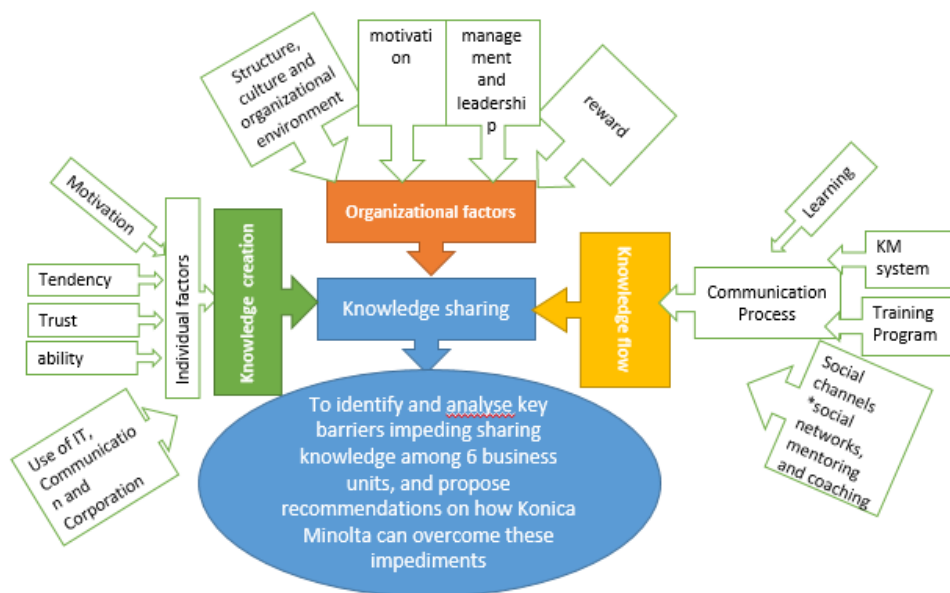


Figure 2.6: Success factors of inter-organizational knowledge sharing

(Source: Nooshinfard and Nemati-Anaraki, 2014)

### 2.4.1. Public sector and information-knowledge

Since this research focuses on the public sector, in this section literature on information-knowledge use in public sector is looked at. Management of information-knowledge in the public sector is very important and many writers have written about it. Sometimes, due to extra regulations and politics, the public sector repository of information, managing information and knowledge is an extremely problematic area to address (Milner, 2002). One of the complications is that such resources are



intangible, their impact and value cannot be measured through traditional accounting methods in the public sector. Milner (2002) introduces concepts of information and knowledge, and explores a variety of tools and techniques which may be usefully adopted in actively managing and developing these resources, even in the public sector. Others, like Theocharis and Tsihrintzis (2016), look at the role of information in the transition from traditional government to e-government and from there to open government. This is connected with the burgeoning data and the appearance of open public data. They present the concepts of knowledge, knowledge management and knowledge management systems.

On the other hand, Senthilkumar et al. (2018) look at how information from big data is used in healthcare as a public sector organisation. They focus on the definition of information, its process and use in healthcare management as a public provider. They argue that a use of unstructured data is growing faster than semi-structured and structured data, where 90% of the big data are in the form of unstructured data, major steps of big data management in healthcare industry are data acquisition, storage of data, managing the data, analysis on data and data visualization.

Rowley and Hartley (2017) look at the nature, structuring and description of knowledge; access to information in public organisations. Malik and Al-Toubi (2018) examine the role and impact of KM in public sector organisations. They look at this using theoretical and real-life practical experiences as KM experts and provide the challenges facing public sector organisations, together with opportunities where KM could provide significant benefits with refreshed and updated approaches. Within a public context, they note that there is a drive towards better preparation for the knowledge-based economy, there is a real opportunity for KM to raise its profile and become closely aligned with the human capital agenda, with support for people development as a key asset. They provide a list of KM related recommendations to help practitioners in building the in-house KM initiatives.

Vong et al. (2016) look at public sector organisations and hold that successful organisations share knowledge and they look at the influence of knowledge sharing on performance of public sector organisations. They have found that information quality, organisational commitment, and top management support play a pertinent role in public sector organisations. In fact, they found that government organisations place a greater emphasis on information quality than non-government organisations and the former exhibits greater knowledge sharing and better performance than government organizations. They also found that public sector organisations need to secure top

management support and employee commitment to facilitate knowledge sharing and ultimately improve organisational performance. Likewise, Gabryelczyk and Roztocki (2017) in their study of the Dutch public sector, in the context of a Dutch government agency responsible for the processing of European subsidy applications lodged by companies, focus more on operational excellence and having better management control. They advocate better that Business/IT alignment.

Matei and Savulescu (2016) look at the importance of the Romanian public sector in enabling greater innovation, such as the use of e-Governance, ICT and knowledge management. They believe that improvement can better public service quality, effectiveness, efficiency, transparency and citizen participation, strengthening trust and legality. Therefore, they believe that it is very important for organisations to comprehend KM. They believe that KM strategy and organisational strategy need to be aligned.

Michalopoulos (2016) focus on organisational learning in the public sector. He concludes that middle managers in Greek public organizations lack information-knowledge. He concludes that middle managers are simply conduits, and translate plans into actions, monitor and control activities. Manikam et al. (2017) focus on the public sector and its use of big data as part of Eleventh Malaysia Plan 2016–2020 and they state that big data allows one to use tremendous amounts of information from structure, semi-structured and un-structured data set. However, Paulin and Suneson (2015) noted that senior staff are reluctant to share knowledge with junior staff in the public sector. Käsäkoski (2017) believes that KM allows public health organisations like health care to achieve their targets and this paper provides a new model of health care information and KM framework in order to scrutinise the types of knowing the types of knowledge. They found that patients and family involvement is modest in the process. The authors present a new model of health care KM that enables participation of patients.

## **2.5. Human Intuition and Intelligence**

The purpose of focusing on information and knowledge is to enhance the intelligence and intuitiveness of the decision maker. Miller and Ireland (2005) write that many executives and managers embrace intuition as an effective approach to important decisions. Indeed, recent surveys and business press articles indicate broad support for the use of intuition when making strategic decisions. The need for quick decisions, the need to cope with demands created by complex market forces, and the assumed benefits of applying deeply held knowledge combine to create strong perceived value for the intuitive approach. Intuition, however, has not been subjected to sufficient review, particularly in a forum for executives and other managers. This

article responds to the need for critical evaluation. Utilising a holistic approach and automated expertise as two fundamental definitions, Miller and Ireland's (2005) review evaluates intuition's costs and benefits in light of an organisation's goals. They conclude that intuition is a troublesome decision-making tool. To contribute to effective managerial practice, we offer tactics that decision makers can use to make intuitive judgments and choices less troublesome.

Chilcote (2017) examined intuition and identified the importance of it in nursing education, clinical practice and patient care. They encourage acceptance of the use of intuition; and add to the body of nursing knowledge. Nurses often report using intuition when making clinical decisions. It is a rapid, unconscious process based on global knowledge that views the patient holistically while synthesizing information to improve patient outcomes. However, with the arrival of evidence-based practice the use of intuition has become undervalued in nursing and Walker and Avant's framework analyses this phenomenon. Chilcote (2017) states that the use of intuition is reported by nurses, but is not legitimized within the nursing profession. Attributes of intuition are defined as an unconscious, holistic knowledge gathered without using an analytical process and knowledge derived through synthesis, not analysis. Consequences include verification of intuition through an analytical process and translating that knowledge into a course of action. This research supports the use of intuition in nursing by offering clarity to the concept, and adds to the nursing knowledge base, encourages a holistic view of the patient during clinical decision making, and encourages nurse educators to promote the use of intuition.

Fowler (2016) found that there was widespread implementation of managerial intuition in choosing retail sites. Here, intuition is investigated in conjunction with the more quantitative variables and data was collected from 253 individuals responsible for leasing/real estate decisions in the U.S. retail sector and was subsequently analysed. The findings from the research were that there was a great deal of intuition used when making decisions for site selection; however, the decision makers were not familiar with the process of decision making. Counter to prior research, the use of intuition in this study does not differ based on the size of the retailer or the experience level of the decision-maker. The theoretical and managerial implications of these findings are discussed and ideas for future research are explained in the article.

The literature relating to knowledge in organisations is extremely vast and divergent. It explains how explicit knowledge developed by individuals within the context of an organisation is linked to the 'learning' process (March and Olsen 1976; Sim and Gioia 1986; Simon 1991). There are also discussions regarding whether the tacit knowledge of an individual can or cannot be used to the benefit of the organisation that they are a part of. Nonaka (1994); Nonaka and Takeuchi (1995); Spender (1996); and McPhee and Poole (2001) explain the knowledge distribution that occurs in organisations, through their formal structures. This form of knowledge sharing is achieved through the exchange of manuals and instruction books alongside other types of formal means (Nonaka 1994). On the other hand, Festinger (1950) describes informal knowledge sharing and communication, which is still evolving, as unplanned and voluntary, hence does not abide by 'normal' organisational formal structures.

As described previously, Choo (2002) believes sense making, knowledge creation and decision-making form the structure of the cycle of organisational knowing, which facilitates the flow of information in organisations. The key point that is made is that datafication is an IT driven sense-making process, whereas human sense making from the context of an organisation, is where the technology is organised through language. For instance, classifying in order to recognise and normalise memories into reasonable explanations and accounts (Brown et al. 2008).

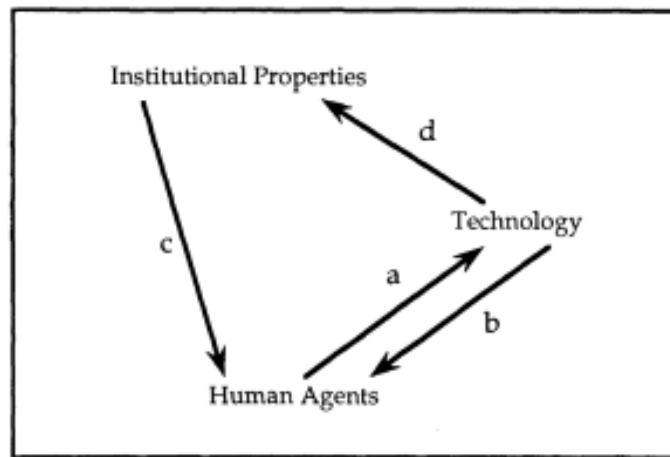
It examines the reason as to why and how certain aspects from an individual's personal experience are selected whilst simultaneously creating explicit interpretations. Thus, breaking down these interwoven processes further, the sense-making aspect of organisational knowing are activated by environmental stimuli leading to clearer information as an outcome, shared meanings and purpose. The creation of new knowledge comes around when the existing knowledge and capabilities of the organisation appear to be restricted or bottle necked. Choo (2002) explores this further by outlining that these very experiences are grounded on shared meanings that surface from the sense making processes. People within the organisation take an active role and mine the knowledge through means of sharing and linking the knowledge that already exists. This covers gaps and allows for creation of new knowledge. According to Choo (2002), this process not only generates new capabilities, but also enhances existing capabilities. This works as a catalyst and soon the channels for knowledge sharing become apparent, which increases the organisation's capabilities.

The organisation 'knowing' Choo (2002) describes is in agreement with previous research carried out in this field. Polanyi (1958, 1966), Kolb (1984) and Tsoukas (2009) all agree that the source of knowledge comes from individuals within the organisation who have the knowledge or experience distinctions (Kolb and Kolb 2005). These experiences are the base for monitoring and reflection, which then leads on to further attributable knowledge. Once the base has been built they become the foundation for new concepts and ideas which can be developed further by negotiations. These inferences can be measured and tested, therefore can be used as a learning manual by the organisations (Kolb and Kolb 2005).

Further supporting this, Tsoukas (2009) suggest that new distinctions are the basis, therefore, once they are recognised, accepted and implemented, the new knowledge begins to surface. Once they are actioned actively the organisation can reap the benefits. The new knowledge, however, needs to come from the individual with whom it resides. Only by engagement with the individual's' knowledge can it be accepted by the organisation community. It is these individualised elements from within the bigger Business Intelligence (BI) picture that have been overlooked in the literature. This knowledge has been overlooked from the literature that needs to be incorporated into BI. This study will look at just that, the interaction of individual's knowledge and the use of BI. It will also show what impact BI has on these actors and on their cognitive judgement, tacit retention of knowledge and overall professionalism.

### **2.5.1. Appropriation and Business Intelligence**

The ideology of individual intuition can be associated with the idea of appropriation by Orlikowski's (1992), who implements a structured model of technology. This piece of research investigates it from a BI point of view and, therefore, the relationship between the individuals and the BI tools will also be explored. Individuals do rely on the use of BI tools when making a decision; however, they also use their own intuition and knowledge, which can identify how much technology plays a role (Orlikowski, 1992).



ARROW	TYPE OF INFLUENCE	NATURE OF INFLUENCE
a	Technology as a Product of Human Action	Technology is an outcome of such human action as design, development, appropriation, and modification
b	Technology as a Medium of Human Action	Technology facilitates and constrains human action through the provision of interpretive schemes, facilities, and norms
c	Institutional Conditions of Interaction with Technology	Institutional Properties influence humans in their interaction with technology, for example, intentions, professional norms, state of the art in materials and knowledge, design standards, and available resources (time, money, skills)
d	Institutional Consequences of Interaction with Technology	Interaction with technology influences the institutional properties of an organization, through reinforcing or transforming structures of signification, domination, and legitimation

Figure 2.7: Structurational Model of Technology (Source: Orlikowski, 1992:410)

Figure 2.7 shows the effect that technology has on an organisation via individuals. Thus in this research, the relationship between BI tools and an individual’s ability to learn and develop tacit knowledge to increase efficacy will be investigated (Orlikowski 1995).

The study will quantify how much a BI tool generated knowledge is appropriated and codified by the BI decision maker and is then retained so it can be used in the future. The value the organisational actors generate in the organisation using BI is measured by the use of BI decision-making tools. This then reflects their capabilities as professionals from the use of BI. Shollo and Galliers (2016) have contributed greatly to the areas of technology and individual

interactions and have been able to show new takes and areas of BI research. The recent study by them seeks to understand how an organisation which uses BI is impacted by its use. The study found that BI allows for knowledge of the organisation by 'articulation' and 'data selection'. Shollo and Galliers (2016) focus more on the role of BI in decision-making rather than concentrating on the more historic views of BI use. They distinguish concepts of knowing the organisation not only by using the BI processes, but also the impact of having organisational actors. This study showed that BI and an individual's knowledge are connected, creating new insights/opportunities in the organisation. It is credit worthy to Shollo and Galliers (2016), that they are the first to look at BI from a knowledge and decision maker's perspective. Nevertheless, the main triggers that lead to knowledge are shown to be data selection and data expression between BI users and the BI system. Thus the individual's professionalism, skills and personal experiences are said to be crucial requirements.

These cognitive influences are involved in the decision-making of data aspects that are picked to describe a certain phenomenon and also in the influence on relationship and trends in the datasets. Although Shollo and Galliers (2016) show cognitive mechanisms of decision makers, the ability of the BI tools is continuously improving. Lycett (2013) also states that BI tools influence certain trends and relationships and allows for them to be identified, but an insight into the cause of this must be comprehended by the individuals in order for any worthy actions to be created.

Sharma et al. (2014) state that sometimes electronic algorithms can be used to identify trends but they can also be used to make decisions and implement actions, e.g. detection of credit card fraud. This corresponds to the decision-making relationship that Davenport (2010) outlined and described as 'automated decisions' (see 3.5). Lycett (2013) also uses this same theory to explain the Netflix recommendations algorithm as it is based upon the same principles. However, it is important to remember that inbuilt human insight has a huge role to play in the acceptance of electronically generated decisions and whether they hold any value or relevance, and also whether the electronically generated decisions should be automated without being overseen by a human being.

Sharma et al. (2014) said that these electronic decisions should be automated and implemented. Holsapple et al. (2014) however, stated that many BI functions, (for example, data

reporting, mining or even more complicated analysis), are carried out by the individual's choice. In addition to this, the way in which decision makers choose their data and their obligation to communicate their own knowledge into the BI process is the key to adding value into an organisation. This results in the selected data being able to be linked to the sense making of the individual and any automatic BI learning.

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### **2.5.2. Skills Sets of Decision Makers**

To gain an effective use and understanding of information and knowledge, firms need to be able to associate information and knowledge management with their own business strategies (Viaene, 2008; Robson, 1997; Ward and Peppard 2015; Cassidy, 2016). Other factors they must consider are an organisational culture, a strategic vision and also BI driven capabilities (McAfee and Brynjolfsson, 2012). The main use of BI is not only specific to data and the transfer of information, but also adapting the data into information and eventually knowledge (Negash, 2004: 180).

Further proving this, Sharma et al. (2014) emphasises that the modern day technology has enabled structured and unstructured data to be widely accessible for decision makers in management positions. Sharma et al. (2014) also say that 'first order effects' in relation to analysis is most liable to have an influence on decision makers and, therefore, greater than that from only the decision makers alone. It is surprising that, despite the existing literature identifying the actual role of individuals within an organisation and decision makers, the field of BI research is still not studied thoroughly enough. McAfee and Brynjolfsson (2012) support this and state that although technology has been able to produce many complicated and intricate systems, the influence of BI technology does not exclude the demand for human insight.

There is a strong drive to unify BI and make it universal (Watson and Wixom (2010). With the operationalisation of BI workload (Hosack et al. 2012), BI is being deployed at lower levels of the hierarchy, which leads to certain challenges (LaValle et al. 2011). Barton and Court (2012) showed that it is difficult to get all employees to work with BI and data analysis tools, highlighting, from a retail industry context, that employees neither relied upon nor understood BI. Therefore, it is proposed this area needs more attention in order to disseminate 'expert' level analytical skills to others in the organisation (Shah et al. 2012). BI Users are important to the



success of BI and they are arguably overlooked in many BI studies which concentrate on the technology rather than the user's perspective. Matthias et al. (2016) convey the importance of user skill and not of the technology. The increasing use and demand for BI has led to more advance users being produced. McKinsey Global Institute outlines the importance of the use of the expertise of BI users in deep data analytics (Manyika et al., 2011), whilst Chen et al., (2012) introduce specific skills in managing, descriptive, predictive, and prescriptive analytics. Due to a shortage of skilled workers BI cannot be used to its full potential, leaving an ever widening gap (Russom 2011).

There has been a statement outlining that by 2018, the USA will be in a deficit of between 140,000-190,000 BI users that are capable of analysing data sets alongside a deficiency of approximately 1.5 million managers who will be unable to make competent and effective decisions (Manyika et al. 2011). On top of that, the research carried out by Olszak and Ziembra (2012) showed that if BI is to be successful, then its users will need to have a well-developed process of decision-making and have the ability to recognise their own requirements. Also, the inbuilt knowledge and skillset of BI users are also an important factor in BI success. To support this statement, Masaros et al. (2016) showed that if a team was created from qualified BI users with experience of implementing BI then that increases the success rate. Although many studies show that having an advanced set of skills is an important requirement for gaining something from BI, Miller (2014) suggests that there is no set agreement between researchers as to exactly what the skillset is. Equally, Yeoh and Koronios (2010) state that non-technical, organisational and process-related factors are more involved in the BI success than the data related (i.e. technical) aspects.

Also supporting this is Davenport (2010), who reiterates the fact that a lot of non-technical factors facilitate the development of analytical capabilities. He also mentions that it is not specifically about the datafication, but rather about human factors, which can be overlooked and are just as significant. Having said that, big organisations like IBM and Accenture have realised this and take into account the non-technical capabilities. The media also states that over 100 analysts were said to have some sort of development coordination disorders. An interesting fact is also that individuals who suffer from dyslexia have been chosen by the British Intelligence Service as employees based on their enhanced skills to recognise patterns and analyse complex data which is not picked up by individuals who do not suffer from dyslexia (Philipson 2014).

The non-technical factors, e.g. creativity and the ability to generate new ideas, are said to be the answer to gaining an understanding of BI (Manyika et al., 2011). Thus, the non-technical factors of BI will be more extensively explored. McAfee and Brynjolfsson (2012) report that when data and intuition are conflicting, then decision makers are forced to override their personal intuition in order to gain more data. However, on the other hand, there are more people who rely on the internalised experience and intuition alone is not enough (McAfee and Brynjolfsson 2012).

Consequently, this piece of research tries to investigate the use of BI systems by BI users and also decision makers, bearing in mind the role of personal intuition and the effect it can have on taking over the technical skills. Philipson (2014) states that through the curiosity of the employees, new ideologies are more likely to rise and this will end the need to rely on technical algorithms and tools. Despite the fact that there is evidence to show the role of BI users in relation to the achievements in organisations, existing research that focuses on the BI user still remains very marginal.

## **2.6. Learning Organisations**

Learning is the way to progress and even survive in the present associations (Serrat, 2017). Information ought to be ceaselessly improved through both interior and outer learning. For this to happen, it is important to help and empower association, individuals, information, and innovation for learning. As indicated by Sarder (2016), a learning association is significant to building a more brilliant workforce and to develop and increment execution. In spite of the fact that scholars like Wick and Leon (1995) suggest that the meaning of learning associations is immaterial and cloudy in nature, in light of the fact that while a learning association is anything but difficult to remember, it is hard to depict and analyse. Thus Walker (2017) brings up that since the 1990 production of Senge, learning organization hypothesis has educated innumerable number of managers to create and structure learning. In any case, a developing number of progress administrators are perceiving the part of the physical condition in forming both individual and authoritative conduct. Meen and Keough (1992) purport that organizations find learning troublesome, and arranging to learn, more troublesome still. Senge notes, in *The Fifth Discipline*, his provocative record of the key trains on which powerful practice rests. Meen and Keough (1992) take note that Senge investigates what "realizing" truly implies in a corporate setting and depict the tried methodologies that administrators can take to construct

the vital capability and introduction for their associations. Senge noticed that in characterizing the learning association you first need to understand that the general concept of a "learning association" is a dream.

Wen (2014) proposes ten techniques to make a learning association: to build learning gathering of pioneers; to convey mission, empower goals and conquer self-amazing quality; to learn exhaustively and change mental models; to advance profound discourse and grow authoritative limit. Also to learn at work and work in learning and set learning in motion through taking care of issues; to dispense with the hindrances of learning and enhance the adequacy; to set up a dynamic model of learning – inquire about – development; to influence a long haul to design, move advances well-ordered and advance manageable improvement, to actualize assessment amid the entire procedure of development; to direct trial execution.

Senge (2014) states that learning is a key term given to an association which encourages the learning of its representatives with the goal that the association can persistently change itself. To him, a learning association is created because of the weights, which are being looked at by the associations nowadays to enable them to stay aggressive in the present day business condition. The learning association emphasises a more interconnected state of mind. Such association turns out to be more similar to a group for which representatives feel a pledge to. Representatives work harder for the association since they are focused on it. The idea of the learning association is usually hailed as a method for hierarchical achievement in a dynamic worldwide economy. The idea of learning association is increasingly significant, given the expanding multifaceted nature and vulnerability of the authoritative condition. The possibility of a learning association is attractive, albeit hard to actualize and demands profound change in the mentalities of representatives and also in the way of life of the association and the general public.

A learning association is one that can change its practices and outlooks because of experience. The part of a pioneer in a learning association is that of an architect, instructor, and steward, who can construct shared vision and test winning mental models. He is in charge of working in which the representatives are persistently extending their capacities to shape their future — that is, pioneers who are in charge of learning. The fundamental method of reasoning for a learning association is that in circumstances of fast change, only those that are adaptable, versatile and gainful will exceed expectations. For this to happen, it is contended, the association needs to 'find how to tap worker's dedication and ability to learn at all levels' The learning association plans to bring new thoughts, wrangle about issues, present creative strategies and offer contextual investigations to others. After some time, the thought of "learning association" as a

glorified and objective 'end-state', instead of as a procedure, has progressively gained greater uncritical acknowledgment (Senge, 2014)).

The key element of the learning association is how the association forms its administrative encounters. A taking in association gains from the encounters as opposed to being bound by its past encounters. In the learning association, the capacity of the association and its directors is not estimated by what it knows (that is the result of adapting), yet rather by how it learns — the way toward learning. Administration hones, energizes, perceives and compensates with transparency, inventiveness, a feeling of adequacy and compassion.

While every one of the representatives have the ability to take in, the structures in which they need to work are frequently not helpful for reflection and engagement. Besides, the workers may not have the apparatus and comprehension to understand the circumstances they confront. Consequently, the learning association is continually yearning for achievement in its task is to make a future that requires a crucial move in the mind set of workers.

### **2.6.1. Frameworks in Organisational Learning**

A learning association utilises this strategy for speculation while evaluating the association and has data frameworks that measure the execution of the association in both its totality and in its different parts (Argyris,1999; Senge, 1990). Frameworks thinking states that every one of the qualities must be obvious without a moment's delay in an association for it to be a learning association. In the event that some of these attributes are missing, then the association misses the mark regarding its objective. However, the attributes of a learning association are factors that are gained step by step, as opposed to all being apparent at the same time. Frameworks – believing is the applied foundation of a learning association. This teaching incorporates every one of the representatives of the association, combining them into a cognizant collection of hypothesis and practice. Frameworks thinking is the capacity to understand and deliver the entire learning association and to inspect the interrelationship between the parts. It accommodates both the motivating force and the way to incorporate different trains in the association.

The dedication by a person to the way towards learning is known as individual dominance. There is an advantage for an association whose workforce can take information in more rapidly than the workforce of different associations (Wang and Ahmed, 2003). Singular learning is procured through staff training, advancement and consistent self-improvement (McHugh et al., 1998). In any case, learning cannot be constrained upon a person who is not open to learning. Research demonstrates that most learning in the work environment is accidental, as opposed to the result of formal training (O'Keeffe, 2002). In this way it is imperative to build up a culture where individual authority is drilled in everyday life. [6] A learning association has been portrayed as the entirety of an individual's adapting, yet there must be instruments for specifically figuring out how one can be moved into authoritative learning (Wang and Ahmed, 2003).

Associations learn just through people who learn. Singular learning does not ensure hierarchical learning. In any case, without it no authoritative learning happens. Individual authority is the teaching of consistently clearing up and extending representative's close to home vision, of centralising their energies, of creating tolerance, and of seeing reality equitably. It goes beyond ability and aptitudes, in spite of the fact that it includes them.

## **2.6.2. Mental Models of Learning**

The beliefs held by people and associations are called mental models. To wind up a learning association, these models must be tested. People have a tendency to embrace speculations, which are what they expect to happen, and hypotheses being used, which are what they really do. Similarly, associations have a tendency to have 'recollections' which protect certain practices, standards and qualities (Easterby-Smith et al., 2000). In making a learning situation it is imperative to supplant fierce dispositions with an open culture (McHugh et al., 1998; O'Keeffe, 2002). To accomplish this, the learning association needs systems for finding and evaluating hierarchical hypotheses of action. Unwanted esteems should be disposed of in a procedure called 'unlearning'. Easterby-Smith et al. (2000) and Wang and Ahmed, (2003) allude to this as 'triple circle learning'.

The training of mental models begins with turning the mirror internally; figuring out how to uncover our inward photos of the world, to bring them to the surface and hold them thoroughly up to investigation. It, likewise, incorporates the capacity to bear on 'meaningful' discussions that adjust requests and promotion of thoughts and ideas, where individuals uncover their own

reasoning successfully and make that reasoning open to the impact of others. On the off chance that the association is to build up an ability to work with mental models, then it is essential for the representatives to learn new aptitudes. For this there should be institutional changes with a specific end goal to cultivate such change. There needs to be transparency in the association. It additionally included trying to convey authoritative association dependably and much more broadly while retaining coordination and control.

### **2.6.3. Building a Shared Vision**

The improvement of a mutual vision is critical in persuading the staff to learn. The best dreams expand on the individual dreams of the representatives at all levels of the association (McHugh et al., 1998). In this way the making of a mutual vision can be thwarted by customary structures where the organization vision is forced from above (O'Keeffe, 2002). Therefore, learning associations have a tendency to have level, decentralized hierarchical structures. The common vision is regularly to prevail against a contender (Wang and Ahmed, 2003). In any case, Senge states that these are passing objectives and recommends that there ought to, likewise, be long haul objectives that are inherent inside the company. At the point when there is an honest to goodness vision (rather than the natural 'vision explanation'), representatives exceed expectations and learn, not on the grounds that they are advised to, but rather in light of the fact that they need to. Yet, numerous pioneers have individual dreams that never get converted into shared dreams that stir the association. What has been missing is a way to make an interpretation of vision into shared vision – not a recipe, but rather an arrangement of standards and managing hones.

The act of shared vision includes the aptitudes of uncovering shared 'photos without bounds' that encourage veritable duty and enrolment instead of consistence. In achieving this goal, administration is to take in the counter-productiveness of endeavouring to manage a dream, regardless of how sincere it is. Visions spread due to a strengthening procedure. Expanded clearness, excitement and duty rub off on others in the association. 'As individuals talk, the vision develops clearer. As it gets clearer, energy for its advantages develop. There are 'points of confinement to development' in this regard, yet building up the sorts of mental models can essentially enhance matters.

#### **2.6.4. Organisational Learning and Public Sector**

The aggregation of individual learning constitutes group learning (O'Keeffe, 2002). The advantage of group or shared learning is that staff develop all the more rapidly (O'Keeffe, 2002) and the critical thinking limit of the association is enhanced through better access to and mastery of information (McHugh et al., 1998). Learning associations have structures that encourage group learning with highlights, for example, limit crossing and openness. Team learning expects people to take part in exchange and talk (O'Keeffe, 2002). Learning associations normally have brilliant information administration structures, permitting creation, securing, dispersal, and usage of this learning in the association (Wang and Ahmed, 2003).

Group learning is seen as 'the way toward adjusting and building up the limits of a group to make the outcomes its individuals really want. It expands on individual authority and shared vision – yet these are insufficient. Representatives should have the capacity to act together. At the point when groups learn together there are great outcomes for the association and the colleagues likewise develop all the more quickly, which could not have happened some other way. The train of group learning begins with 'discourse', the ability of individuals from a group to suspend suppositions and go into an honest to goodness 'thinking together'. The thought of discourse among colleagues causes them to end up open to the stream of a greater knowledge. At the point when the exchange is joined with considering frameworks, there is the likelihood of making a dialogue more suited for managing problems of a multifaceted nature, and of concentrating on profound situated basic issues and powers instead of being occupied by inquiries of identity and initiative style.

Massaro et al. (2015) researched into the writings on knowledge management practice in the public sector, which is within the remit of this research. They reviewed 180 KM papers from ten key journals. They found that there was insufficient international cooperation between authors, hence the literature is fragmented. Others like, Hislop et al. (2018), look at knowledge-base in organisations and in the service sector in order to highlight the requirement for information-knowledge in the public sector. Likewise, Masa'deh et al. (2015) look at factors that enable knowledge sharing capabilities and establish a link between enablers and capability. Webb (2017) looks at key considerations and provides guidance in developing and operating an effective KM function. They forward cases where different organisations engage in KM. They look at perceived differences between knowledge and information; key management considerations and influences; the role of knowledge management and staff consultation and involvement. They also look at consultant responsibility, access and control; systems and

procedures; skills required for day-to-day operation and maintenance. This is similar to this research where different stakeholders, as decision makers, are paid particular attention.

Massingham and Massingham (2014) believe that KM can generate a lot of value for organisations, including the public sector. They look at performance metrics to derive a criterion to measure the value of KM. They present the results from a longitudinal change project for a large Australian Research Council Linkage Project. The project was a transformational change program that aimed to evaluate KM in terms of financial and non-financial measures and seven practical outcomes from which to identify the organisational problems which may be addressed by KM. They write that investment decisions regarding KM can benefit from focusing on significant and on-going organisational problems. Similarly, Henttonen et al. (2016) examined the individual-level knowledge sharing to look at attitudes, benefit estimations, self-efficacy and actualised behaviours to see how this affects individual work performance. They found that knowledge-sharing propensity impacts positively on knowledge-sharing behaviour. They also found that knowledge-sharing behaviour mediates the relationship between knowledge-sharing propensity and individual performance. This paper provides insights into the knowledge-sharing–attitude–behaviour–work performance linkage. Therefore, they look at how the contentious aspects of KM concerned with individual knowledge and performance impact in the public sector.

In another public sector study, Tangaraja et al. (2015) look at KM among Malaysian public sector managers. They found three predictor groups of knowledge sharing behaviour: intrinsic motivational factors, extrinsic motivational factors and organisational socialisation factors. They propose organisational commitment as the mediating variable between the identified predictors and knowledge sharing behaviour. They found that it is important to have employee organisational commitment to engage them in knowledge sharing. They note that public service motivation is an intrinsic motivational factor that could provide new insights to the human resource practitioners to focus on sharing of knowledge.

In a UAE study, Alfaki and Ahmed (2017) discuss the importance of the knowledge economy, and they propose a comprehensive strategic planning exercise to transform the country's economic structure from relying heavily on hydrocarbon resources to becoming a knowledge-based economy. They predict that non-oil will account for 80% of the country's economy by 2021. There is to be a shift from oil to base in the Arab World to transform itself into a leader in the adoption of scientific innovations. They evaluate the UAE's success in diversifying its economy and implementing the principles and approaches of a knowledge economy.



Finally, Vassilopoulou et al. (2016) also undertook research into the UAE context and looked at talent management in non-Western contexts and believe that talent is crucial for UAE. They look at the foundation for evidence-based talent management for governmental policy makers and for organisations in the public and private sectors.

### **2.6.5. Advantages of a Learning Association**

A learning association does not depend on an uninvolved or specially appointed process with the expectation that hierarchical learning will happen through good fortune or as a side-effect of ordinary work. A learning association effectively advances, encourages, and remunerates aggregate learning. The fundamental advantages of a learning association are the following.

Keeping up levels of advancement and staying aggressive (McHugh et al., 1998)

Enhanced effectiveness (McHugh et al., 1998)

Having the information to better connect assets to client needs (Pedler et al.,1997)

Enhancing nature of yields at all levels (Pedler et al.,1997)

Enhancing the corporate picture by ending up with more individuals situated (Pedler et al.,1997)

Expanding the pace of progress inside the association (Pedler et al.,1997)

### **2.6.6. Obstructions to Achieving Learning Organisation**

Indeed, even inside or without learning association, issues can slow down the journey toward learning or make it relapse. The vast majority of such issues emerge from an association not completely grasping all the essential aspects. Once these issues can be distinguished, work can start on enhancing them. Senge et al. (1999) states there are numerous reasons why an association may experience difficulty in changing itself into a learning association. The first is that an association does not have enough time (Senge et al., 1999:66). Representatives and administration may have different issues that take priority over attempting to change the way of life of their association. The group will most likely be unable to submit the time if a foundation does not have the proper help or training. For an association to have the capacity to transform, it has to know the means to take care of the issues it faces. To assist, a tutor or mentor who is knowledgeable in the learning association idea might be fundamental.

Likewise, the change may not be pertinent to the association's needs. Time ought to be spent on the genuine issues of the association and its every day issues. A procedure must be put in place to address this. The association ought to figure out what its issues are before going into the change. Training ought to stay connected to business outcomes so it is less demanding for representatives to relate the training to regular issues.

Finally, some areas that learning associations were intended to address inside organizations are discontinuity, rivalry and sensitivity (Chawla and Renesch, 1995). Discontinuity is depicted as breaking an issue into pieces. For instance, every association has a book keeping division, IT and showcasing. Rivalry happens when representatives are attempting to improve the situation or 'beat' others in a task, as opposed to teaming up. Sensitivity happens when an association changes just in response to outside powers, as opposed to proactively starting change.

## 2.7. Summary of Literature

A great deal of literature has been reviewed surrounding the research of information and knowledge. The literature is summarised in Table 3.3 with a view to using it to formulate a data collection schema and data collection model. Hence a deductive inference will be made in the research situation and the theory will play a very pertinent role in this. Figure 3.26 shows a use of Boisot's (1995/1998) work to create a conceptual model and Figure 3.27 shows a data collection model derived from the work of Boisot (1995/1998), Boisot and Canals (2004) and Crossan (1990). Table 2.1. provides a summary of the literature referred to in this chapter.

Table 2.1: Literature Summary

Dimensi on	Construct	Writers
Data vs. Information	Data Information	Boisot, 1998, 2013; Boisot and Canals, 2004; Crossan et al., 1999; Singh and Singh, 2010; Devlin et al (2011); Chessell et al., 2013; Nicolaou et al., 2013; Davis et al, 2013; Kanehisa et al. 2014; Kenett and Shmueli, 2014; Shroff et al., 2014; Garvey, 2014; Bouras, 2015; Singh, 2015; Beadles et al., 2015; Dwivedi et al., 2015; Lee et al., 2016; Romano et al., 2016; Rasmussen et al., 2016; Silverstone, 2017; Khosrow-Pour, 2017.
	Knowledge	Festinger, 1950; Polanyi, 1958, 1966; Kraut, 1990; Nonaka's; 1991, 1994; Wiig, 1997a/b; Vedder et al.,1999; Boisot, 1998; Haldin-Herrgard, 2000; Bujak et al., 2012; McKnight 2002; Cody et al 2002; Cody et al. 2002; Choo, 1998: 2002; Chung et al 2003; Herschel and Jones 2005; Boxer, 2006; Kinsinger, 2007; Calof and Wright, 2008;

		Nonaka and Takeuchi, 2005; Neto et al, 2009, McPhee and Poole, 2001; Brown et al., 2008; Tsoukas, 2009; Rao and Dey 2012; Yiu, 2012; Schmitt, 2013; Boisot, 2013; Ihrig and Child, 2013; Spender, 2013; Child et al., 2014; Abeles, 2014; Pedrycz, 2014; Nonaka et al., 2014; Nonaka 2015a, 2015b; Nonaka and Toyama, 2015; Becerra-Fernandez and Sabherwal 2015; Spender, 2015; Schmitt, 2016; Onuoha and Godswill-Chinyere, 2016; Shollo and Galliers, 2016; Rothberg, 2017
	Information-Knowledge cycle	Nelson, 1982; Wernerfelt, 1984); Nonaka, 1994; Drucker, 1995; Boisot, 1995, 1998; Chase, 1998; Nonaka, 1994, 2001; David, 2000; McElroy, 2003; Hall, 2003; Van Hien, 2003; Wiig, 2004; Laihonon, 2006; Dalkir, 2017; Tynjälä 2012; Faucher. et al., 2008; Kanehisa et al., 2014; Siemens, 2014; Ronquillo et al. (2016).
Information Space	Uncodified vs. codified	Boisot, 1998, 2013; Boisot and Cox, 1999; Schmitt, 2013; Ihrig and Child, 2013; Spender, 2013; Child et al., 2014; Abeles, 2014; Spender, 2015; Schmitt, 2016; Onuoha and Godswill-Chinyere, 2016.
Information Types (information space)	Public knowledge (textbooks, and newspapers)	Boisot, 1998; Boxer, 2006; Yiu, 2012; Bujak et al., 2012; Shakespeare, 2012; Stair and Reynolds, 2013;
	Proprietary knowledge (patents and official secrets)	Boisot, 1998; Boxer, 2006; Yiu, 2012; Bujak et al., 2012; Shakespeare, 2012
	Personal knowledge (biographical knowledge)	Boisot, 1998; Boxer, 2006; Yiu, 2012; Bujak et al., 2012; Shakespeare, 2012
	Common sense (every body knows)	Boisot, 1998; Boxer, 2006; Yiu, 2012; Bujak et al., 2012; Shakespeare, 2012
	concrete vs. abstract	Boisot, 1998, 2013; Boisot and Cox, 1999; Schmitt, 2013; Ihrig and Child, 2013; Spender, 2013; Child et al., 2014; Abeles, 2014; Spender, 2015; Schmitt, 2016; Onuoha and Godswill-Chinyere, 2016.
	undiffused vs. diffused	Boisot, 1998, 2013; Snowden, 2002; Snowden, 2010; Dalkir, 2017; Schmitt, 2013; Ihrig and Child, 2013; Spender, 2013; Child et al., 2014; Abeles, 2014; Spender, 2015; Schmitt, 2016; Onuoha and Godswill-Chinyere, 2016.
	Social Learning Cycle (SLC)	Scanning
Problem Solving		Boisot, 1998, 2013; Boisot and Canals, 2004; Crossan et al., 1999; McLeod and Schell, 2007; Schmitt, 2013; Boisot, 2013; Ihrig and Child, 2013; Spender, 2013; Child et al., 2014; Abeles, 2014; Spender, 2015; Schmitt, 2016; Onuoha and Godswill-Chinyere, 2016
Abstraction		Boisot, 1998, 2013; Snowden, 2002; Snowden, 2010; Boisot, 2013); Boisot and Canals, 2004; Crossan et al., 1999 Schmitt, 2013; Ihrig and Child, 2013; Spender, 2013; Child et al., 2014; Abeles, 2014; Spender, 2015; Schmitt, 2016; Onuoha and Godswill-Chinyere, 2016.
Diffusion		Boisot, 1998; Snowden, 2002; Dalkir, 2017; Boisot, 2013); Boisot and Canals, 2004; Crossan et al., 1999 Schmitt, 2013; Ihrig and Child, 2013; Spender, 2013; Child et al., 2014; Abeles, 2014; Spender, 2015; Schmitt, 2016; Onuoha and Godswill-Chinyere, 2016
Absorption		Boisot, 1998, 2013; Boisot and Canals, 2004; Crossan et al., 1999 Schmitt, 2013; Ihrig and Child, 2013; Spender, 2013; Child et al., 2014; Abeles, 2014; Spender, 2015; Schmitt, 2016; Onuoha and Godswill-Chinyere, 2016
Impact		Boisot, 1998, 2013; Boisot and Canals, 2004; Crossan et al., 1999 Schmitt, 2013; Ihrig and Child, 2013; Spender, 2013; Child et al., 2014; Abeles, 2014; Spender, 2015; Schmitt, 2016; Onuoha and Godswill-Chinyere, 2016
Information Systems	Systems hierarchy	Remenyi, 1991; Boisot, 1998; Heeks, 2000; Clarke, 2001; Jessup and Valacich, 2003; Gordon and Gordon, 2004; McLean and Turban, 2005; O'Brien and Marakas, 2010; Laudon and Laudon, 2010; Dwivedi et al., 2012; Rainer and Cegielski, 2013; ADSIC, 2015; Yiu, 2012; Bujak et al., 2012; Shakespeare, 2012; Khosrow-Pour, 2017.
	Decision Support	March and Hevner, 2007; Arnott and Pervan, 2008; Lam and Schaubroeck, 2000; Mahdi and Alreshaid, 2005; Carter and Belanger, 2005;

	Systems	Power, 2002; Power, 2007; March and Hevner, 2007; Laudon and Laudon, 2010; McLeod and Schell, 2007; Hedgebeth, 2007; Grad, 2007; Power and Sharda, 2007; Srivardhana and Pawlowski, 2007; Riad et al., 2011; Bonczek et al., 2014; Hogenboom et al., 2016; Scholz et al., 2017; Power, 2016; Esmaili et al., 2016; Choo et al., 2016; Hernandez et al., 2017.
	Data mining systems	Fayyad et al., 1996; Witten, 1999; Chapman et al., 2000; Hand et al., 2001; Balutis, 2001; Keim, 2002; Shannon and Zwick, 2002; Tan et al., 2005; Han et al., 2006; Pan and Li, 2007; Lin et al., 2008; Kerby, 2009; O'Brien and Marakas, 2010; Witten et al., 2011; Larose, 2014; Chen et al., 2016; Shmueli et al., 2016; Witten et al., 2016; Patterson and Bickel, 2016; Heinemann, 2016; Li et al., 2016; Kennedy, 2016; Witten et al., 2016; Dillenberger et al., 2016; Wang et al., 2016; Roiger et al., 2017; Neagu et al., 2017; Murray et al., 2017
Learning organisation	Business Intelligence	Kahaner 1996; Vedder et al., 1999; Cook and Cook 2000; Choo 2002; McKnight 2002; Weiss, 2003; Vibert 2004; Kinsinger 2007; Calof and Wright 2008; Yermish et al., 2010; Watson and Wixom (2010; Davenport, 2010; Yeoh and Koronios, 2010; Steiger, 2010; Zheng et al., 2011; Chau and Xu, 2012; McAfee and Brynjolfsson, 2012; Lycett, 2013; Isik et al., 2013; Watson et al., 2013; Greco et al., 2013; Štefániková and Masárová, 2014; Sharma et al., 2014; Botha et al., 2014; Becerra-Fernandez and Sabherwal, 2015; Obeidat et al., 2015; Teece, 2015; Kasemsap, 2015; Watson, 2015; Shollo and Galliers 2016; Choo et al., 2016; Nawinna and Venable, 2016; Contractor et al., 2016; Trieu, 2017.
	Decision making	Elbashir and Willams 2007; Davenport, 2010; Chau and Xu 2012; Choo et al., 2016; Trieu, 2017; Oancea, 2017.
	Intuition	March and Olsen 1976; Sim and Gioia 1986; Simon 1991; Nonaka 1994; Nonaka and Takeuchi 1995; Spender 1996; Miller and Ireland (2005); Polanyi (1958, 1966), Kolb (1984) and Tsoukas, 2009; Fowler, 2016; Czerniak and Berkner, 2016; Chilcote, 2017
	Skills and decision maker	Negash, 2004; LaValle et al. 2011; Manyika et al., 2011 Russom 2011; Hosack et al 2012; McAfee and Brynjolfsson, 2012; Watson et al., 2013; Olszak and Ziemba, 2012; Sharma et al., 2014; Philipson, 2014.
	Organisational learning	Meen and Keough, 1992; Wick and Leon, 1995; Chawla and Renesch, 1995; Pedler, 1997; Hipsher et al., 1997; McHugh et al., 1998; Senge et al., 1999; Argyris, 1999; Easterby-Smith et al., 2000; O'Keefe, 2002; Wang and Ahmed, 2003; Serenko et al., 2007; Wen, 2014; Sarder, 2016; Senge, 1990, 2014; Serrat, 2017; Walker, 2017.

## 2.11 Chapter Conclusion

In this chapter relevant literature surrounding the topic of research was explored, which is concerned with exploring how information and knowledge can be used to help the decision makers in APF to gain a high degree of intuitiveness and intelligence in order to be more effective. The literature is reviewed to understand how information can be processed and converted into deeper level abstract knowledge, while at the same time how to get individuals to codify them in order to help them to externalise the knowledge that they hold.

The chapter discusses the importance of information quality in public sector organisations. It focuses on the business intelligence and knowledge. It then looks at the information space framework of Boisot (1998). Boisot (1998) states that data quality, information and ultimately knowledge are important aspects of an organisation's strategies for supporting decision makers

in reaching the best decisions possible and consequently attaining the organisation's objectives. Boisot distinguishes information from data by putting emphasis on the fact that information is what an individual will extract from a dataset based on their own knowledge or experience. Boisot (1998) purports that there is a Social Learning Cycle (SLC) that utilises the I-Space model to show the flow of knowledge through a series of phases. Finally, this chapter would lead to a development of a conceptual model and research data collection model that is to be used for data collection. These will help to create research collection apparatus, as will be explained in chapter 3.

# Chapter 3

## Research Framework Chapter

### 3.1. Chapter Introduction

This chapter provides a research framework for this research that is based on the works of Boisot (1995, 1998) and looks at how information and knowledge change state when interpreted and used by decision makers. It provides the research hypothesis, propositions and data collection schema and analysis to be carried out.

### 3.2. Research Framework Underpinning this Research

Data quality, information and, ultimately, knowledge are important aspects of an organisation's strategies for supporting decision makers in reaching the best decisions, consequently attaining the organisation's like APF's objectives while helping it to enter a learning process. In the case of public organisations, decisions ultimately concern the public and hence further diligence is required to make sure that these decisions do, for instance, preserve economic resources, maintain public well-being, and provide national security. The decision-making process requires a wealth of information in order to achieve efficient results.

Public organisations typically acquire great amounts of data generated by public services. However, the vast amount of data stored in public organisations' databases may be a major reason for inefficient decisions made by public organisations. Processing vast amounts of data and extracting accurate information are not easy tasks. Although technology helps in this respect, (for example, the use of decision support systems), it is not sufficient for improving decisions to a significant level of assurance. The research argues that a complete data quality framework is needed in order to improve data quality and consequently the decision-making process in civil protection/security organisation as a public organisation. The framework comprises elements found necessary to attain the quality of data reaching decision makers.

This research focuses on how to obtain and use, or “harness” knowledge from data and help APF, as a civil protection/security organisation to become more effective and enter into an organisational wide learning spiral through adopting an information space approach. Thus it is crucial to utilise the key concepts of information and knowledge. The information space model also relates to the actual structure of the knowledge, such as the level of codification and abstraction to its ability to diffuse as the knowledge develops. Tacit knowledge, which has a low codification and abstraction, takes time to diffuse and when it does, it is usually in face to face interactions. In contrast, codified and abstract knowledge can easily diffuse throughout a population, which inevitably means that extraction of the high quality knowledge is difficult. Overall, we can deduce that the correct structuring of knowledge can enhance the efficacy (by measuring the ability to diffuse).

The research model is based around the concept of an "information good" that is different to an actual physical asset. Boisot distinguishes information from data by putting emphasis on the fact that information is what an individual will extract from a dataset based on their own knowledge or experience. Boisot's (1998) model can be visualized as a three dimensional cube with the following dimensions:

- from uncoded to coded,
- from concrete to abstract,
- from undiffused to diffused.

Boisot (1998) argues that there is a Social Learning Cycle (SLC) that utilises the I-Space model to show the flow of knowledge through a series of phases, which include:

Scanning: insights are gained from generally available (diffused) data.

Problem-Solving: problems are solved giving structure and coherence to these insights (knowledge becomes 'codified').

Abstraction: the newly codified insights are generalised to a wide range of situations (knowledge becomes more 'abstract').

Diffusion: the new insights are shared with a target population in a codified and abstract form (knowledge becomes 'diffused').

Absorption: the newly codified insights are applied to a variety of situations producing new learning experiences (knowledge is absorbed and produces learnt behaviour and becomes 'uncodified', or 'tacit').

Impacting: abstract knowledge becomes embedded in concrete practices, for example in artefacts, rules or behaviour patterns (knowledge becomes 'concrete').

These aspects are used to create a research model depicted in Figure 3.4 that is explained using literary evidence in the narrative that follows.

The SLC is a means by which content, information, and knowledge management are linked very effectively. The codification aspect is linked to categorisation and classification, the abstraction of data is linked to the production of knowledge, and the diffusion of data is linked to transfer and accessibility of information and knowledge. Knowledge that is the least abstract and least codified but mostly diffused, has the highest level of deterioration and will, therefore, have the least potential for the effective production of work. In order for an organisation to work at an advantageous level, it needs to move the knowledge assets to a region of minimal entropy, as shown in Figure 3.1:

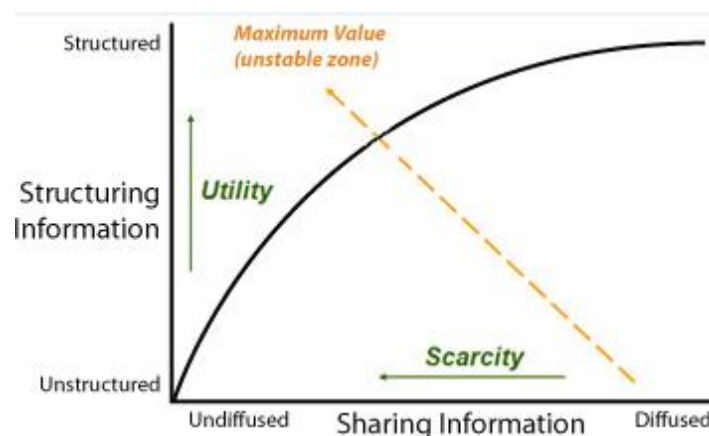


Figure 3.1: The correlation of structuring information and sharing information vs. utility and scarcity.

An important aspect of SLC is the ability to recognise the dynamic nature of knowledge. The data is filtered to produce important information, which is then abstracted and codified to produce valuable knowledge (Boisot and Cox, 1999) This is indicated in Figure 3.2.



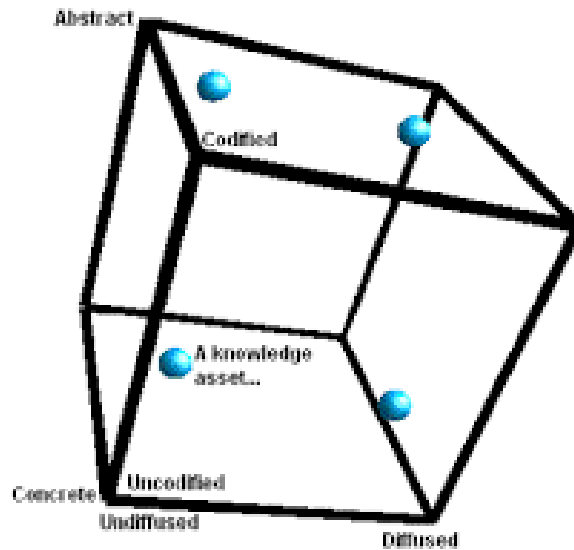


Figure 3.2: Boisot's Information Space model

Figure 3.2 shows information that is extrapolated from data and then communicated appropriately. Knowledge of abstract and codified types needs to be used effectively to facilitate effective decision-making and to generate intuition for the decision maker. Boisot (1998) suggests the dynamic flow of knowledge through a series of six phases known as the 'Social Learning Cycle', as shown in Figure 3.3. This model and its logic have inspired the researcher to develop the propositions and hypothesis that are to be tested in the primary research. Also they developed a research model provided in Figure 3.4.

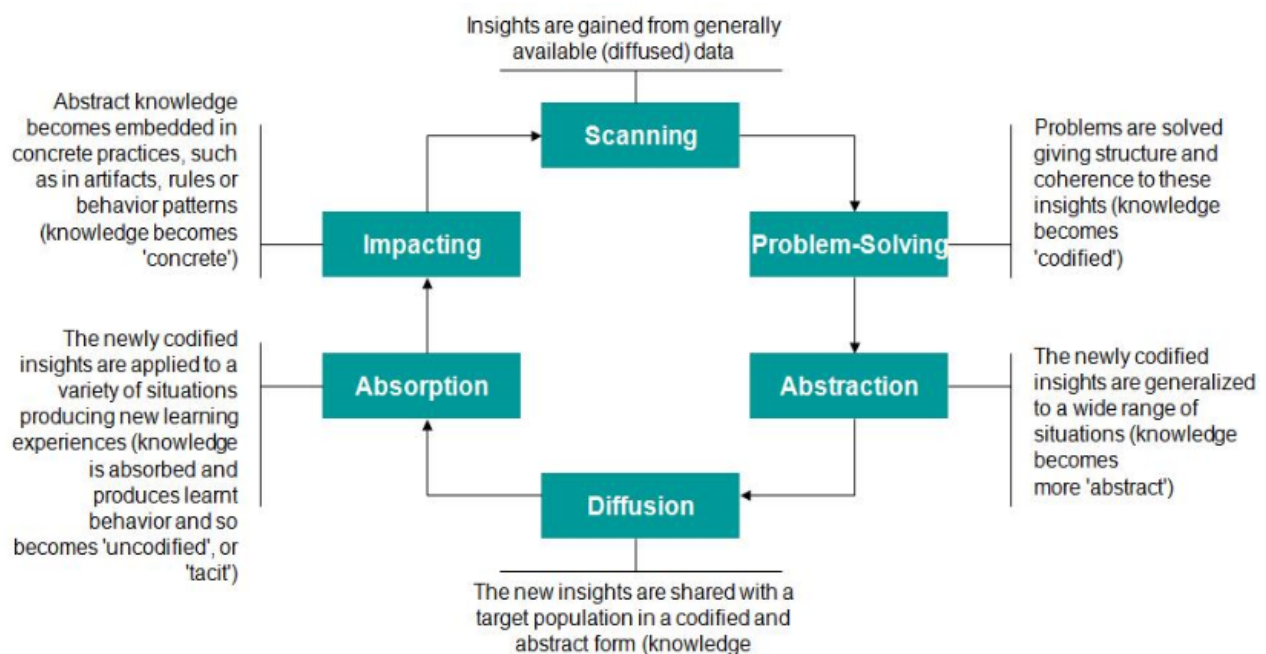
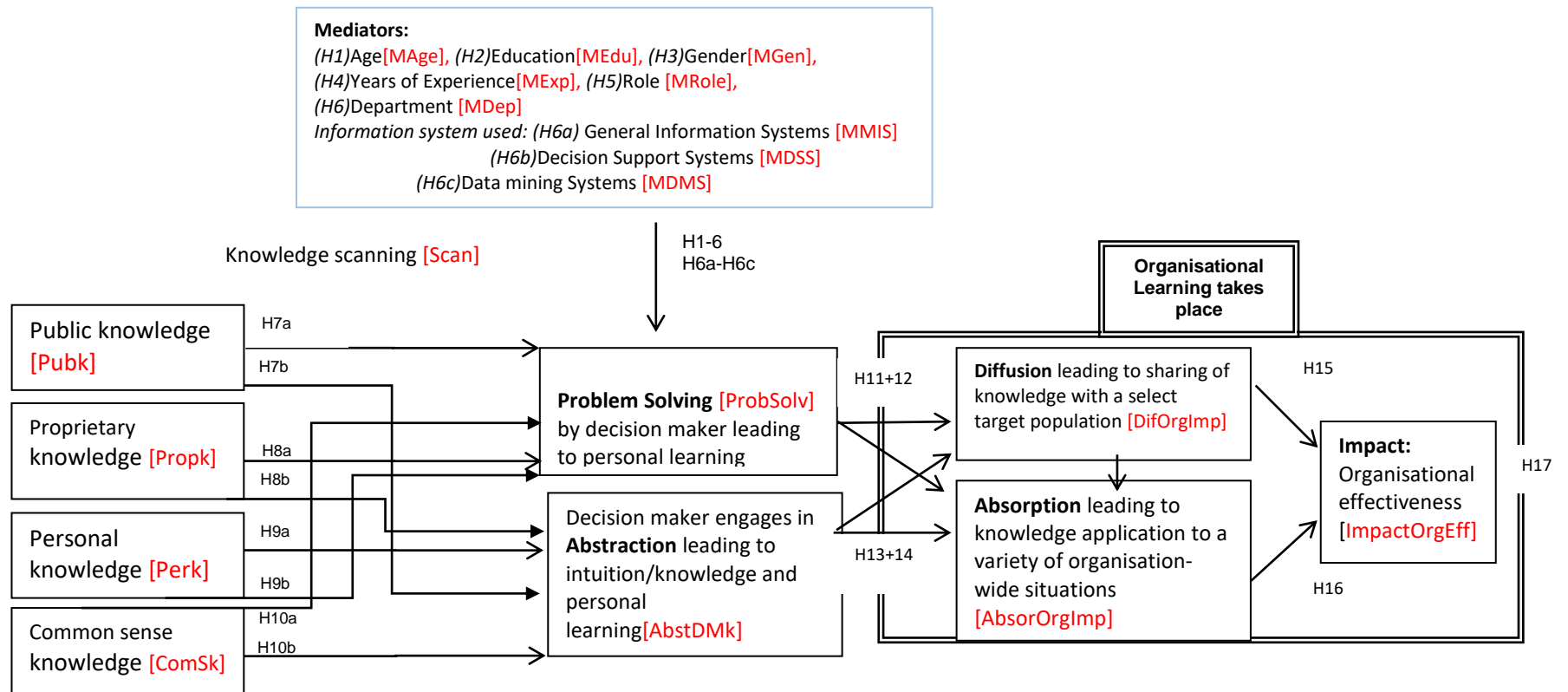


Figure 3.3: Boisot's (1998) Social Learning Cycle

This cycle is used to convert data into understandable information through filtration. This can then be used to generate useful knowledge that can then be used by the decision maker. In this cycle, data is filtered to produce meaningful information and this information is then abstracted and codified to produce useful knowledge. This knowledge can then be applied to different situations to produce new experiences and uncoded forms that can lead to new knowledge.

This means that organisations are constantly looking to improve methods to develop new knowledge and information in order to adapt and survive in a competitive environment. The rate at which this happens varies from sector to sector. Therefore, a conceptual model was derived from the works of Boisot (1998; 2013) Boisot and Canals (2004), Crossan et al. (1999) and many more writers, as shown in Table 3.1, and in Figure 3.1:

Figure 3.4: Research Model for quantitative data collection: interrelated dependence relationships



Figures 3.4 shows the research model, depicting the interrelated dependence relationships for assessing the value of information and its conversion into knowledge. It was adapted from Boisot's (1998) information space Model. As per the model, all knowledge assets can be located within a three dimensional space defined by the following axes:

1. "Uncodified" to "Codified" where "Codified" represents knowledge which is used to solve specific problems in a structured manner.
2. "Concrete" to "Abstract" where "Abstract" represents very generalised knowledge and "Concrete" represents knowledge which has taken the form of specific rules, artefacts or behaviour patterns.
3. "Undiffused" to "Diffused" where "Diffused" represents knowledge which is generally available.

### **3.2.1. Research Model Explained**

This research will focus on the transition and journey between information and knowledge. The processing, filtration, interpretations, and retaining of knowledge are pertinent aspects; however, little research has gone into this. This is where the organisations need to pay attention to the effective interplay between information and knowledge. Thus the individual parts of the research model, hypothesis and propositions are evidenced using literary evidence as in the subsections below:

*3.2.1.1. Knowledge scanning: insights are gained from generally available (diffused) information and knowledge.*

H7 Public information is important in problem solving and decision making.

H8 Proprietary information is important in problem solving and decision making.

H9 Personal information is important in problem solving and decision making.

H10 Common sense information is important in problem solving and decision making.

Information and knowledge are an important strategic resource in organisations (Shakespeare, 2012; Yiu, 2012; Bujak et al., 2012; Galliers and Leidner, 2014); Robson, 2015). Use of relevant information and its quality are crucial for organisations where the information has to be consistent, comprehensible and relevant to particular situations (Singh and Singh, 2010; Ronquillo et al., 2016). Boisot (1998) states that within the Social Learning Cycle (SLC) that utilises the I-Space model it is important to show the flow of knowledge through a series of phases, which include different types of information and knowledge: public, proprietary, personal and common sense. However, Boisot and Canals (2004) believe that information cannot be considered separately from the individual and explain this by showing the differences between information and knowledge. Conceptual filters extract *information bearing* data from what has been then registered. Filters get “tuned” by the agents’ cognitive and affective expectations (Clark, 1997; Damasio, 1999), shaped as these are by prior knowledge, to act selectively on both stimuli and data. Machlup (1980), purports information is basically a flow of messages and the amount of information, even it is too much, can be a problem too (Rowley and Hartley, 2017). However, one of the main discussions in firms is how to improve productivity and the flow of these messages (Epple et al., 1996). Structured data supports decision-making (Laihonen, 2006) and forms knowledge pyramids.

According to Bhatt (2001), knowledge creation is the first process to share knowledge. Boisot’s (1995) and Nonaka’s (1994) work was used by Hall (2003) (Figure 2.5) to outline the process, recognition and education in processing information and knowledge within an organisation. Three dimensions were identified as important: codification, diffusion, and mind-set. The Information Space or information space was developed by Boisot (1998) as a conceptual framework relating the degree of structure of knowledge (i.e. its level of codification and abstraction) to its diffusibility as that knowledge develops. This results in four different types of knowledge (Boxer, 2006): public knowledge, proprietary knowledge, personal knowledge, common sense knowledge – i.e. what ‘everybody knows’, which is not codified but widely diffused. The Information space (I-Space) model produced by Max Boisot (1995, 1998) is a concept around the structure of knowledge and its relationship to its ability to diffuse as the knowledge advances (i.e.

information is what an individual will take from a data set by means of their own knowledge/experience).

*3.2.1.2. Problem-Solving: problems are solved giving structure and coherence to these insights (knowledge becomes 'codified').*

H7a Public information is related significantly to decision maker in solving problems.

H8a Proprietary information is related significantly to decision maker in solving problems.

H9a Personal information is related significantly to decision maker in solving problems.

H10a Common sense information is related significantly to decision maker in solving problems.

P1. Information and knowledge leads to better everyday problem solving.

Effective use of information and knowledge helps to solve problems in organisations (Schön, 2017; Van Aken, and Berends, 2018). Boisot (1998) states that within the Social Learning Cycle that utilises the I-Space model, it is important to show the flow of information-knowledge through a series of phases, which include problem-solving. Here problems are solved giving structure and coherence to these insights (knowledge becomes 'codified'). The SLC is a means by which content, information, and knowledge management are linked very effectively. The codification aspect is linked to categorisation and classification, the abstraction of data is linked to the production of knowledge, and the diffusion of data is linked to transfer and accessibility of information and knowledge. Knowledge that is the least abstract and least codified but mostly diffused, has the highest level of deterioration and will, therefore, have the least potential for the effective production of work. In order for an organisation to work at an advantageous level, it needs to move the knowledge assets to a region of minimal entropy.

An important aspect of SLC is the ability to recognise the dynamic nature of knowledge. The data is filtered to produce important information, which is then abstracted and codified to produce valuable knowledge (Boisot and Cox, 1999). This

means that organisations are constantly looking to improve methods to develop new knowledge and information in order to adapt and survive in a competitive environment. The rate at which this happens varies from sector to sector. Therefore, a conceptual model was derived from the works of Boisot (1998; 2013) Boisot and Canals (2004), Crossan et al. (1999). Knowledge creation is defined as the process that allows an organisation to create/gain information which is then processed and organised so that it can result in new knowledge being generated through learning (Neto et al., 2009, p.595). The new knowledge generated then develops the organisation's abilities and capabilities, develops new products and services and allows for an improvement to the organisational processes. This is referred to as the "potential to act" (Neto et al., 2009, p.595).

To gain an effective use and understanding of information and knowledge, firms need to be able to associate information and knowledge management with their own business strategies (Viaene, 2008; Robson, 1997; Ward and Peppard 2015; Cassidy, 2016). Other factors they must consider are an organisational culture, a strategic vision and also BI driven capabilities (McAfee and Brynjolfsson, 2012). The main use of BI is not only specific to data and the transfer of information, but also adapting the data into information and eventually knowledge (Negash, 2004: 180).

*3.2.1.3. Abstraction (Decision making): the newly codified insights are generalised to a wide range of situations (knowledge becomes more 'abstract').*

H7b Public information is related significantly to decision maker in decision-making that leads to intuition.

H8b Proprietary information is related significantly to decision maker decision-making that leads to intuition.

H9b Personal information is related significantly to decision maker decision-making that leads to intuition.

H10b Common sense information is related significantly to decision maker decision-making that leads to intuition.

P2. Information and knowledge leads to better everyday decision making.

Organisations are constantly looking to improve methods to develop new knowledge and information for decision making and business intelligence in order to adapt and

survive in a competitive environment. This is where the decision maker makes effective decisions and becomes more intuitive and helps others. For example, they help organisational stakeholders and the organisation to enter a learning process. The rate at which this happens varies from sector to sector. According to Boisot (1998; 2013), Crossan et al. (1999), Boisot and Canals (2004) the content of information and knowledge are linked very effectively in order to help decision making and generation of intuition. This happens through codification that is linked to categorisation and classification, the abstraction of data is linked to the production of knowledge, and the diffusion of data is linked to transfer and accessibility of information and knowledge. Knowledge that is the least abstract and least codified but mostly diffused, has the highest level of deterioration and will, therefore, have the least potential for the effective production of work. In order for an organisation to work at an advantageous level, it needs to move the knowledge assets to a region of minimal entropy.

According to March (1978), decision-making processes within organisations are limited by the bounded rationality principle. A lot of different factors can influence the decision-making theory, as described by Choo (1998). These include the decision-making process, which is determined by the need for a better alternative instead of finding the best solution. The decision-making process ends in the organisation committing to a certain action and Choo's model focuses on how each piece of information is then chosen to be a part of these actions.

In terms of decision maker's intuition, according to Bhatt (2001), knowledge creation is the first process in sharing knowledge; however, David (2000) mentioned that culture forms major barriers in the form of value, practices, norms and interactions behaviour. Boisot's (1995) and

There are five processes: (1) externalization, (2) education, (3) internalization, (4) socialization, (5) radical transformation and the associated unlearning. It shows that not only culture and resource are needed, but also technology and tools need to be



considered as they may affect the overall outcome. In relation to the outcome, Tynjälä (2012) described the process of learning as an insight into academic space.

Chilcote (2017) examined intuition and identified its importance as it enhances knowledge and decision making. It is a rapid, unconscious process based on global knowledge that views the patient holistically while synthesizing information to improve patient outcomes. Chilcote (2017) states that the use of intuition is reported by nurses, but is not legitimized within the nursing profession. Attributes of intuition are defined as an unconscious, holistic knowledge gathered without using an analytical process and knowledge derived through synthesis, not analysis. Fowler (2016) found that there was widespread implementation of managerial intuition in choosing retail sites.

The purpose of focusing on information and knowledge is to enhance the intelligence and intuitiveness of the decision maker. Miller and Ireland (2005) write that many executives and managers embrace intuition as an effective approach to important decisions. Indeed, recent surveys and business press articles indicate broad support for the use of intuition when making strategic decisions. The need for quick decisions, the need to cope with demands created by complex market forces, and the assumed benefits of applying deeply held knowledge combine to create strong perceived value for the intuitive approach. Intuition, however, has not been subjected to sufficient review, particularly in a forum for executives and other managers. This article responds to the need for critical evaluation. Utilising a holistic approach and automated expertise as two fundamental definitions, Miller and Ireland's (2005) review evaluates intuition's costs and benefits in the light of an organisation's goals. They conclude that intuition is a troublesome decision-making tool. To contribute to effective managerial practice, we offer tactics that decision makers can use to make intuitive judgments and choices less troublesome.

The knowledge developed by individuals within the context of an organisation is linked to the 'learning' process (March and Olsen 1976; Sim and Gioia 1986; Simon 1991; Nonaka 1994; Nonaka and Takeuchi 1995; Spender 1996. McPhee and Poole (2001) explain the knowledge distribution that occurs in organisations, through their formal structures. This form of knowledge sharing is achieved through the exchange of manuals and instruction books alongside other types of formal means (Nonaka

1994). On the other hand, Festinger (1950) describes informal knowledge sharing and communication, which is still evolving, as unplanned and voluntary, hence does not abide by 'normal' organisational formal structures.

People within the organisation take an active role and mine the knowledge through means of sharing and linking the knowledge that already exists. This covers gaps and allows for creation of new knowledge. According to Choo (2002), this process not only generates new capabilities, but also enhances existing capabilities. This works as a catalyst and soon the channels for knowledge sharing become apparent, which increases the organisation's capabilities.

The purpose of focusing on information and knowledge is to enhance the intelligence and intuitiveness of the decision maker. Miller and Ireland (2005) write that many executives and managers embrace intuition as an effective approach to important decisions. Choo (2002) believes that sense making, knowledge creation and decision-making form the structure of the cycle of organisational knowing, which facilitates the flow of information in organisations. The key point that is made is that datafication is an IT driven sense-making process, whereas human sense making from the context of an organisation, is where the technology is organised through language. For instance, classifying in order to recognise and normalise memories into reasonable explanations and accounts (Brown et al. 2008).

*3.2.1.4. Diffusion: the new insights are shared with a target population in a codified and abstract form (knowledge becomes 'diffused').*

H11 Knowledge use by decision maker for solving problems increases knowledge diffusion (sharing insights with a target select population).

H13 Knowledge abstraction by decision maker for intuitiveness leading to some organisational positive implication(s) (sharing insights with a target select population).

P3. Well thought out decisions lead to developing good intuition.

Haldin-Herrgard (2000) note that it is difficult to diffuse knowledge within organisations. Knowledge management requires varying methods and can be based on Internal individual processes, such as experience, that acquires the tacit

knowledge; which is so difficult to code and therefore cannot be managed and shared as explicit knowledge. To rely on personal tacit knowledge alone is very risky and conversion of that knowledge to explicit, or at the least ability to share it, offers a much greater value to an organisation. However, there can also be difficulties in sharing that knowledge, such as perception, language, time, value and distance.

Perspective and purpose is an ideology whereby an individual has knowledge and uses this to organise their knowledge (Dalkir, 2011:77). Wiig's model defines the level of internalisation in relation to knowledge, which could actually be related to the fourth quadrant of internalisation by Nonaka and Takeuchi. The different levels of internalisation include varying stages, ranging from novice to master and include beginner, competent and expert. A novice is not aware of the knowledge that is available and in which manner it can be utilised. A beginner is aware of the knowledge and from where they can obtain it, but is unable to comprehend it. The competent individual is also aware of the knowledge and can also use it but only by means of external knowledge bases (i.e. documents and manuals). The expert individual is aware of the knowledge, can understand and apply it to where needed and holds this knowledge in their own memory without the use of external sources (Dalkir, 2017). Wiig (1997a/b) also proposed the idea that this hierarchical model including shared, public and personal knowledge sources. Knowledge flow is also defined as a channel to communicate with each other. The Informal channels influence the interaction within varying social interactions (Nissen, 2002).

Polanyi (1958, 1966), Kolb (1984) and Tsoukas (2009) all agree that the source of knowledge comes from individuals within the organisation who have the knowledge or experience distinctions (Kolb and Kolb 2005). These experiences are the base for monitoring and reflection, which then leads on to further attributable knowledge. These inferences can be measured and tested, and therefore can be used as a learning manual by the organisations (Kolb and Kolb 2005). Tsoukas (2009) suggests that new distinctions are the basis, therefore, once they are recognised, accepted and implemented the new knowledge begins to surface. Once they are actioned actively the organisation can reap the benefits. The new knowledge, however, needs to come from the individual with whom it resides. Only by

engagement with the individual's' knowledge can it be accepted by the organisation community.

*3.2.1.5. Absorption: the newly codified insights are applied to a variety of situations producing new learning experiences (knowledge is absorbed and produces learnt behaviour and becomes 'uncodified', or 'tacit').*

H12 Knowledge use by decision maker for solving problems increases knowledge absorption, leading to organisation-wide positive implication(s).

H14 Knowledge abstraction by decision maker for intuition increases knowledge absorption, leading to organisation-wide positive implication(s).

P4. Accurate decisions lead to positive organisational implication.

P5. Appropriate and good level of intuition increases organisational effectiveness and learning.

Knowledge as a strategic resource (Nonaka 1994; Nonaka and Takeuchi 1995; Kolb, 1984, Tsoukas, 2009; Fowler, 2016; Chilcote, 2017). According to Bhatt (2001), knowledge creation is the first process to share knowledge; however, David (2000) mentioned that culture forms a major barrier in the form of value, practices, norms and interactions behaviour when harnessing knowledge. Boisot's (1995) and Nonaka's (1994) literature was used by Hall (2003) (Figure 2.5) to outline the process, recognition and education in processing information and knowledge within an organisation. There are three dimensions, which are codification, diffusion, and mind-set as a new axis that is adaptive competency for disruptive technology. Nonaka discussed knowledge and its process of conversion; he also defined four phases (Figure 2.3); (1) from tacit knowledge to explicit, (2) from explicit knowledge to explicit knowledge, (3) from tacit knowledge to explicit knowledge, and (4) from explicit knowledge to tacit knowledge (Nonaka, 1994).

The Wiig KM model (1997a) argues that knowledge can only be effective and valuable if it is organised for a purpose and attention needs to be paid to its

completeness, connectedness, congruency, perspective and purpose (Dalkir, 2017). Organisational action is a result of the concentration and absorption of that feed into each cycle and within each of these phases is the involvement of an external stimulus (Dalkir, 2017). Hence, an aggregation of individual learning through their knowledge can then help them to engage in group learning (O'Keeffe, 2002). The advantage of group or shared learning is that staff develop all the more rapidly (O'Keeffe, 2002) and the critical thinking limit of the association is enhanced through better access to and mastery of information (McHugh et al., 1998). Learning associations have structures that encourage group learning with highlights, for example, limit crossing and openness. Team learning expects people to take part in exchange and talk (O'Keeffe, 2002). Learning associations normally have brilliant information administration structures, permitting creation, securing, dispersal, and usage of this learning in the association (Wang and Ahmed, 2003).

*3.2.1.6. Impacting: abstract knowledge becomes embedded in concrete practices, for example in artefacts, rules or behaviour patterns (knowledge becomes 'concrete').*

H15 Knowledge diffusion to a small select team by the decision maker leads to positive impact on organisational effectiveness and organisational learning.

H16 Organisation-wide knowledge absorption leads to positive impact on organisational effectiveness and organisational learning.

H17 Organisation-wide knowledge use leads to positive impact and increased organisational effectiveness and organisational learning.

P6. Appropriate and good decision-making and organisation wide implication of it increase organisational effectiveness and organisational learning.

Rothberg (2017) aims to bring together the existing theory from knowledge management (KM), competitive intelligence and data analytics to develop a more comprehensive view of the full range of data, information, knowledge and intelligence that can increase organisational effectiveness and learning. The ideology of individual intuition and knowledge that can then be passed on to others can be associated with the idea of appropriation by Orlikowski's (1992), who implements a structured model of technology. The workers also use their own intuition and

knowledge which can identify how much technology plays a role (Orlikowski, 1992). So appropriate learning in the organisation starts to take place. As Senge et al. (1999) state, there are numerous reasons why an association may experience difficulty in changing itself into a learning association. The first is that an association does not have enough time (Senge et al., 1999:66).

Watson (2015) states that the names, concepts and ideologies are always being changed by decision makers and professionals in order to attract consumers and other company propositions. The study of Steiger (2010) is based on Nonaka's (1991, 1994) knowledge spiral, a BI theory known as knowledge creation, indicating how BI can focus on the decision-makers in order to uncover and enrich their mental model, whilst improving the quality of decisions. These can be taken to be the first indications of knowing. Choo (1998) outlines the process by which an insight to these factors can be achieved and how they can then be used to assist in decision-making and links them to the organisational knowing processes. Shollo and Galliers (2016) address the role that intelligence plays in the creation of organisational knowledge and organisational learning through articulation. In order to improve and learn, organisations need to be able to associate information and knowledge management with their business strategies (Viaene, 2008; Robson, 1997; Ward and Peppard 2015; Cassidy, 2016).

Further proving this, Sharma et al. (2014) emphasise that the modern day technology has enabled structured and unstructured information-knowledge to be widely accessible for decision makers in management positions. Sharma et al. (2014) also say that 'first order effects' in relation to analysis is most liable to have an influence on decision makers and, therefore, greater than that from only the decision makers alone. It is surprising that, despite the existing literature identifying the actual role of individuals within an organisation and decision makers, the field of BI research is still not studied thoroughly enough. McAfee and Brynjolfsson (2012) support this and state that although technology has been able to produce many

complicated and intricate systems, the influence of BI technology does not exclude the demand for human insight.

However, there is a need for more attention in order to disseminate 'expert' level analytical skills to others in the organisation (Shah et al. 2012). This will facilitate learning, where the learning is the way to progress and even survival in the present associations (Serrat, 2017). Information ought to be ceaselessly improved through both interior and outer learning. For this to happen, it is important to help and empower association, individuals, information, and innovation for learning. As indicated by Sarder (2016), a learning association is significant to building a more brilliant workforce and to develop and increment execution. In spite of the fact that scholars like Wick and Leon (1995) assert that the meaning of learning associations is immaterial and cloudy in nature, in light of the fact that while a learning association is anything but difficult to remember, it is hard to depict and analyse. Thus Walker (2017) brings up that since the 1990 production of Senge, learning organization hypothesis has educated an innumerable number of managers to create and structure learning. In any case, a developing number of progress administrators are perceiving the part of the physical condition in forming both individual and authoritative conduct. Meen and Keough (1992) purport that organizations find learning troublesome; and arranging to learn, more troublesome still.

#### *3.2.1.7. Mediating factors*

There are many mediating factors that influence the problem solving and decision making process. They would also affect the accumulation and sharing of intuition and knowledge.

H1 Age is related significantly to information abstraction of the decision maker in solving problems and decision-making that leads to intuition.

H2 Education is related significantly to decision maker in solving problems and decision-making that leads to intuition.

H3 Gender is related significantly to decision maker in solving problems and decision-making that leads to intuition.

H4 Experience is related significantly to decision maker in solving problems and decision-making that leads to intuition.

H5 Role-based authority is related significantly to decision maker in solving problems and decision-making that leads to intuition.

H6 Department is related significantly to decision maker in solving problems and decision-making that leads to intuition.

H6a Information systems are related significantly to decision maker in solving problems and decision-making that leads to intuition.

H6b Decision support Information systems are related significantly to decision maker in solving problems and decision-making that leads to intuition.

H6c Data mining Information systems are related significantly to decision maker in solving problems and decision-making that leads to intuition.

To gain an effective use and understanding of information and knowledge, firms need to be able to associate information and knowledge management with their own business strategies (Viaene, 2008; Robson, 1997; Ward and Peppard 2015; Cassidy, 2016). They must also consider the organisational culture, including the individual characteristics of decision makers, a strategic vision and also knowledge driven capabilities (McAfee and Brynjolfsson, 2012). The main use of knowledge is not only specific to data and the transfer of information, but also adapting the data into information and eventually knowledge (Negash, 2004: 180).

One has to check where knowledge is being deployed in the organisational hierarchy, which leads to certain challenges (LaValle et al. 2011). Barton and Court (2012) showed that it is difficult to get all employees to work in an aligned way. Therefore, it is proposed this area needs more attention in order to disseminate 'expert' level analytical skills to others in the organisation (Shah et al. 2012). Users are important to the success and they are arguably overlooked in many studies which concentrate on the technology rather than the user's perspective. Matthias et al. (2016) conveys the importance of user skill and not of the technology. McKinsey Global Institute outlines the importance of the use of the expertise of users in deep data analytics (Manyika et al., 2011), whilst Chen et al., (2012) introduce specific skills in managing, descriptive, predictive, and prescriptive analytics. Due to a shortage of skilled workers cannot be used to its full potential, leaving an ever widening gap (Russom 2011).



Also supporting this is Davenport (2010), who reiterates the fact that a lot of non-technical factors facilitate the development of analytical capabilities. He also mentions that it is not specifically about the datafication, but rather about human factors, which can be overlooked and are just as significant. Having said that, big organisations like IBM and Accenture have realised this and take into account the non-technical capabilities. The media also states that over 100 analysts were said to have some sort of development coordination disorders. An interesting fact is also that individuals who suffer from dyslexia have been chosen by the British Intelligence Service as employees based on their enhanced skills to recognise patterns and analyse complex data which is not picked up by individuals who do not suffer from dyslexia (Philipson 2014).

The non-technical factors, e.g. creativity and the ability to generate new ideas, are said to be the answer to gaining an understanding (Manyika et al., 2011). Thus, the non-technical factors of BI will be more extensively explored. McAfee and Brynjolfsson (2012) report that when data and intuition are conflicting, then decision makers are forced to override their personal intuition in order to gain more data. However, on the other hand, there are more people who rely on the internalised experience and intuition alone is not enough (McAfee and Brynjolfsson 2012).

However, at the same time different types of systems, including data mining and decision support systems are crucial in helping decision makers in solving problems and making decisions (Riad et al., 2011; Bonczek et al., 2014; Robson, 2016; Pearlson et al., 2016; Laudon and Laudon, 2016; Hogenboom et al., 2016; Scholz et al., 2017). Information systems are believed to help decision makers in solving problems and decision-making that leads to intuition (Laudon and Laudon, 2010; Dwivedi et al., 2012; Rainer and Cegielski, 2013; ADSIC, 2015; Yiu, 2012; Bujak et al., 2012; Stair and Reynolds, 2013). Likewise, Decision support Information systems are believed to help decision makers in solving problems and decision-making that leads to intuition (Laudon and Laudon, 2010; Dwivedi et al., 2012; Riad et al., 2011; Bonczek et al., 2014; Hogenboom et al., 2016; Scholz et al., 2017; Power, 2016; Esmaili et al., 2016; Choo et al., 2016; Hernandez et al., 2017). Lastly, Data mining Information systems are believed to help decision makers in solving problems and

decision-making that leads to intuition (Witten et al., 2011; Larose, 2014; Chen et al., 2016; Shmueli et al., 2016; Witten et al., 2016; Patterson and Bickel, 2016; Heinemann, 2016; Li et al., 2016; Kennedy, 2016; Witten et al., 2016; Dillenberger et al., 2016; Wang et al., 2016; Pearlson et al., 2016; Roiger et al., 2017; Neagu et al., 2017; Murray et al., 2017).

### 3.2.2 Summary of hypothesis and propositions

The hypothesis (listed in Table 3.1 (also see Appendix B)) and propositions (discussed towards the end of this subsection) are listed together with appropriate references.

Table 3.1.: Research Hypothesis

No	Hypotheses and sources underpinning them
H1	Age is related significantly to information abstraction of the decision maker in solving problems and decision-making that leads to intuition.
H2	Education is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H3	Gender is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H4	Experience is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H5	Role-based authority is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H6	Department is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H6a	Information systems are related significantly to decision maker in solving problems and decision-making that leads to intuition.
H6b	Decision support Information systems are related significantly to decision maker in solving problems and decision-making that leads to intuition.
H6c	Data mining Information systems are related significantly to decision maker in solving problems and decision-making that leads to intuition.
H7	Public information is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H8	Proprietary information is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H9	Personal information is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H10	Common sense information is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H11	Knowledge use by decision maker for solving problems increases knowledge diffusion (sharing insights with a target select population).
H12	Knowledge use by decision maker for solving problems increases knowledge absorption, leading to knowledge application to a variety of organisation-wide

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	situations.
H13	Knowledge abstraction by decision maker for intuitiveness leading to some organisational positive implication(s) (sharing insights with a target select population).
H14	Knowledge abstraction by decision maker for intuition increases knowledge absorption, leading to organisation-wide positive implication(s).
H15	Knowledge diffusion to a small select team by the decision maker leads to positive impact on organisational effectiveness and organisational learning.
H16	Organisation-wide knowledge absorption leads to positive impact on organisational effectiveness and organisational learning.
H17	Organisation-wide knowledge use leads to positive impact and increased organisational effectiveness and organisational learning.

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The key research propositions, the sources underpinning them and the research questions in the conceptual framework are (also see Appendix B):

- P1. Information and knowledge leads to better everyday problem solving.
- P2. Information and knowledge leads to better everyday decision making.
- P3. Well thought out decisions lead to developing good intuition.
- P4. Accurate decisions lead to positive organisational implication.
- P5. Appropriate and good level of intuition increases organisational effectiveness.
- P6. Appropriate and good decision-making and organisation wide implication of it increase organisational effectiveness.

The use of these hypothesis and propositions for collecting the data is discussed in the next subsection.

### **3.3. Data Collection and Conceptual Framework**

The data collection was planned systematically using a conceptual framework and research model that were derived from the works of Boisot (1998; 2013), Boisot and Canals (2004), Crossan et al. (1999) and many more writers in Figure 3.4.

In order to allow the most relevant collection of data, a questionnaire will be administered to managers who are based in APF (Questionnaire provided in Appendix D). The survey questions will focus on the use of knowledge by decision makers based on comprehensive literature around the subject. The relationship between decision maker and intuition will be

identified by creating each question from the existing literature. This will all be done in an effort to achieve the research objectives. Constructs were created by the researcher from the literature to answer the research question and fill the research gap. For this reason, the data will be collected by a survey questionnaire. This survey questionnaire will be collected from service providers and the public (as service recipients) in APF. There are two parts to the survey questionnaire. Part One gathered all the demographic information about the respondents, including position in the APF, gender, age, nationality and education level. In the second part the respondents were questioned about their use of information and its dissemination.

Consideration has to be given to the questionnaire so it may achieve the required research objectives, which are to investigate service quality. After identification, for those who have responded, a pack containing research related information and an invitation to participate in the study will be sent. Within the research explanation there will be a description of the study purpose and the questionnaire. Confidentiality will be assured for all the correspondents taking part in the survey to allow for an unrestricted view and objectivity. The code of conduct for ethics will be initiated for the protection of the respondents. The questionnaire is provided online on the Qualtrics software. Questionnaires will be issued in a large number and will be sent to APF workers, as well as the public (as customers) and from there only the valid responses will be used. The aim is to ensure that the levels of errors are kept to a minimum and that the study population is represented. Although the software is able to link the survey to the identity of the respondent and this will take place, the confidentiality of respondents will be preserved.

The quantitative research aspect will involve a number of hypothesis and questions for quantitative data collection, as shown in Table 3.2 (also see Appendix D):

The questions for the questionnaire are:

Question 1 – What is your age range?

Question 2 – What is your education background?

Question 3 – Which gender group do you belong to?

Question 4 – How many years of job experience do you hold in your area of employment?

Question 5 – What is your current role in the organisation?

Question 6 – Which department do you work in?

Question 6a – Do you use general information systems for your daily decision making?

Question 6b – Do you use Decision support information systems for your daily decision making?

Question 6c – Do you use data mining information systems for your daily decision making?

Question 7 - Does publically available knowledge (such as books, newspapers and professional reports) help you in problem solving?

Question 8 - Does publically available knowledge (such as books, newspapers and professional reports) lead to decision-making and greater intuition?

Question 9 –Does proprietary knowledge (such as APF secrets and actions) help you in problem solving?

Question 10 - Does proprietary knowledge (such as APF secrets and actions) lead to decision-making and greater intuition?

Question 11 – Does personal knowledge (such as biographical knowledge) help you in problem solving?

Question 12 - Does personal knowledge (such as biographical knowledge) lead to decision-making and greater intuition?

Question 13 - Does common sense knowledge (such as everybody's awareness) help you in problem solving?

Question 14 - Does common sense knowledge (such as everybody's awareness) lead to decision-making and greater intuition?

Question 15 – Does your use of knowledge for solving problems increase your knowledge diffusion involving sharing knowledge with a target select group?

Question 16 - Does your use of knowledge for solving problems lead to an increase in knowledge application to a variety of situations in APF?

Question 17 – Has your use of knowledge for intuitiveness in decision-making led to sharing knowledge with a target select group?

Question 18 - Has your use of knowledge for intuitiveness in decision-making led to an increased in knowledge application to a variety of situations in APF?

Question 19 – Has your release of knowledge to small target APF groups led to positive impact and organisational learning?

Question 20 - Has your sharing of new knowledge insights with many groups across the organisation led to positive impact and organisational learning?

Question 21 – Have new knowledge insights related to your decision-making led to a positive impact and made the organisation more effective and helped organisational learning?

Table 3.2: Research Hypothesis vs Questions

Question	H1	H2	H3	H4	H5	H6	H6 a-c	H7	H8	H9	H 10	H 11	H 12	H 13	H 14	H 15	H 16	H 17
1	/																	
2		/																
3			/															
4				/														
5					/													
6						/												
6a-c							/											
7								/										
8								/										
9									/									
10									/									
11										/								
12										/								
13											/							
14											/							
15												/						
16													/					
17														/				
18															/			
19																/		
20																	/	
21																		/

The approved ethics list is provided in Appendix D.

**Interview questions:**

Question 1. What types of information do you use for your everyday problem solving at work? Also discuss information systems

Question 2. What types of information do you use for your everyday decision-making at work? Also discuss information systems

Question 3. How does your problem-solving and decision-making lead to your intuition?

Question 4. How does your problem-solving and decision-making lead to organisational implications?

Question 5. How does your intuition increase organisational effectiveness?

Question 6. How does your decision-making and its organisation wide implication increase organisational effectiveness?

These are shown in Table 3.3:

Table 3.3: Propositions vs. Interview Questions

Open Question	Proposition 1	Proposition 2	Proposition 3	Proposition 4	Proposition 5	Proposition 6
1	X					
2		X				
3			X			
4				X		
5					X	
6						X

The confidentiality will be protected where the interviews will be tape-recorded; however, the research subjects' names will not be recorded in the recordings. Any information for identification will not be associated with any part of the written report of the research. All information and interview responses will be kept confidential. The researcher will not share individual responses with anyone other than the research supervisors.

### **3.5. Chapter Conclusion**

This chapter provides the research framework acquired through literature search. The research instrument is then created using literature based schema, followed by a research model, research propositions and hypothesis. The analysis using statistical tests and interpretative approach are then explained. The chapter serves as a map to primary data collection.

## Chapter 4

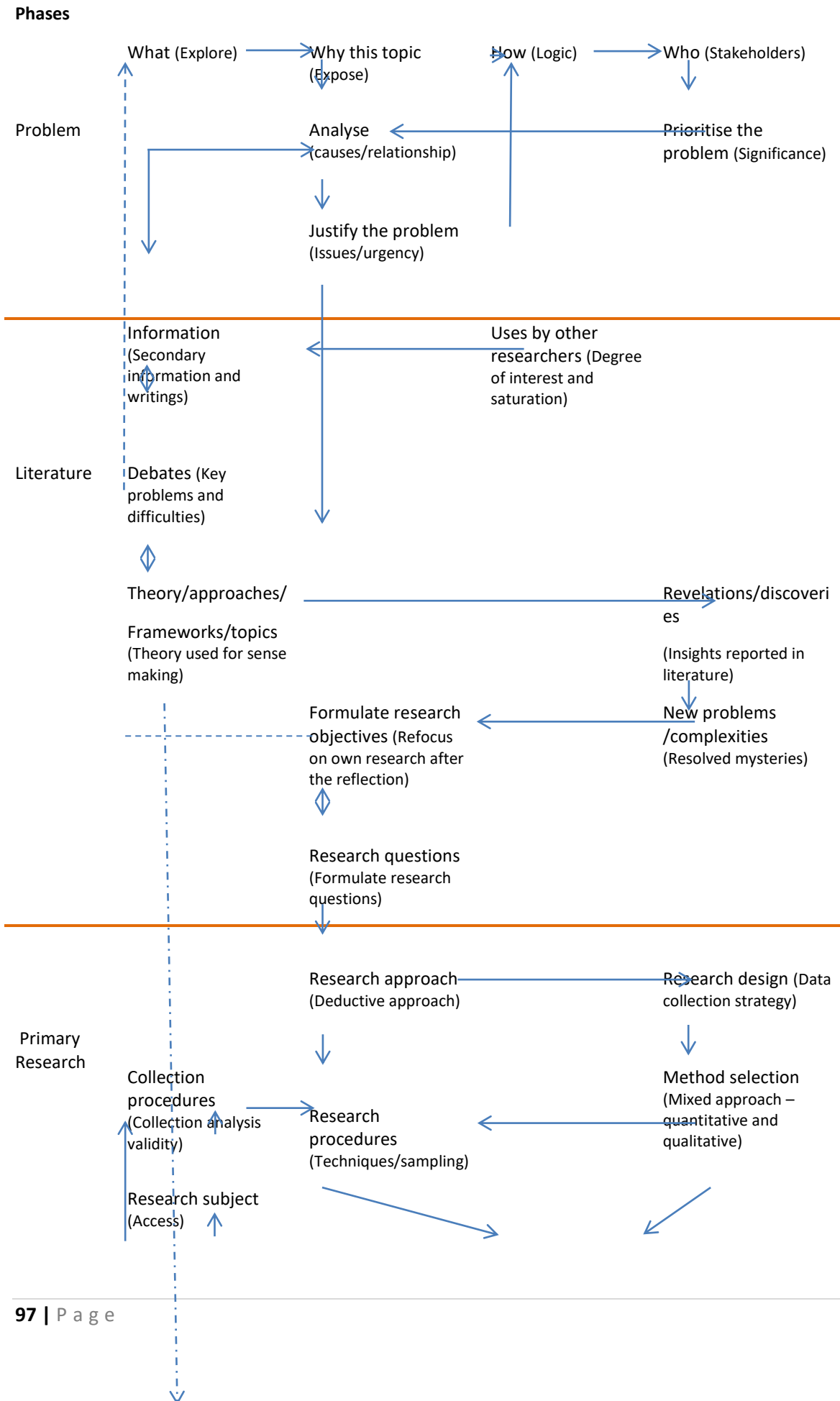
### Methodology Chapter

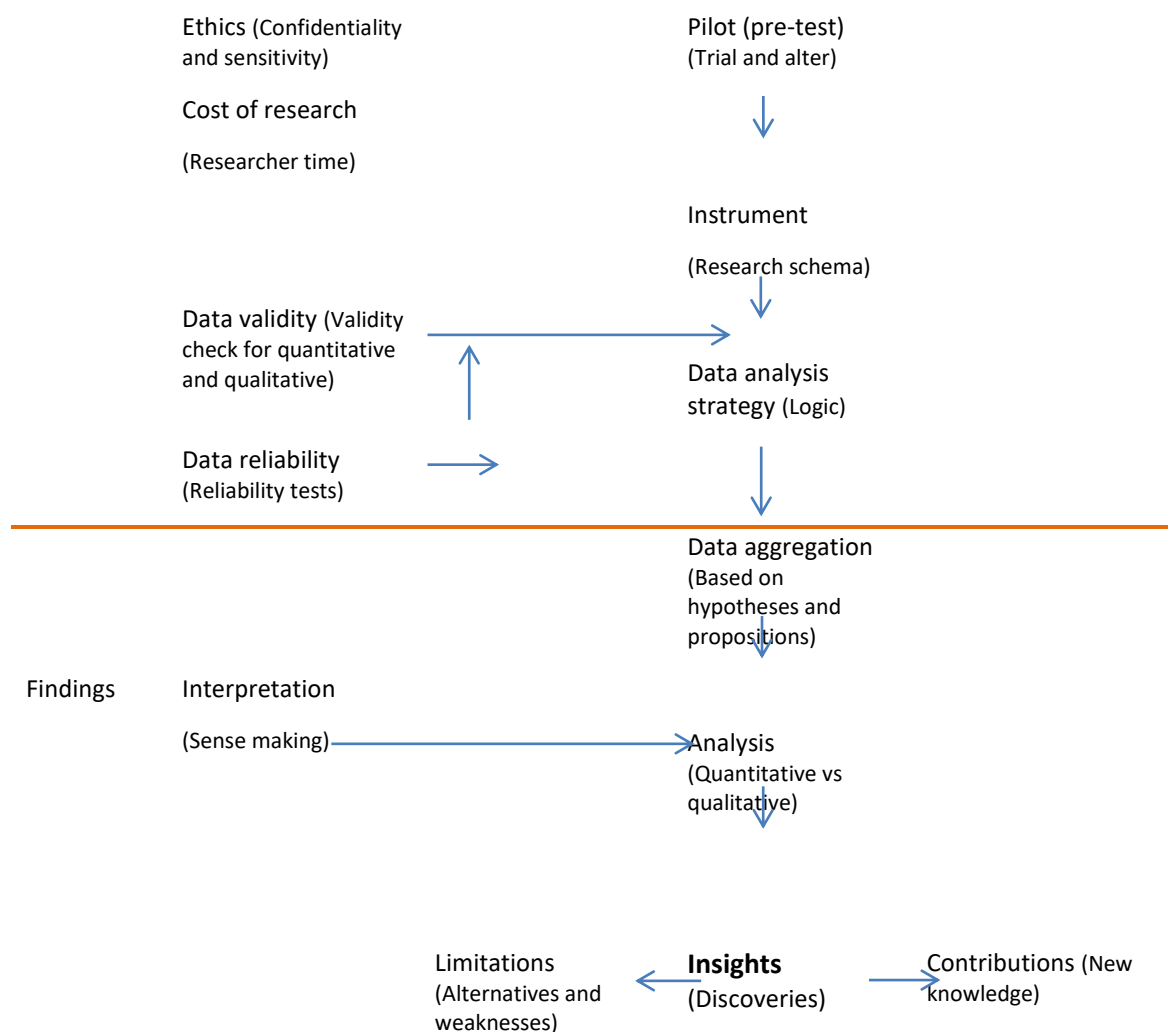
#### 4.1. Chapter Introduction

This chapter provides the research methodology and explains the data collection process. This research aims to explore how information and knowledge can be used to help the decision makers in civil protection/security organisations to gain a high degree of intuitiveness and intelligence to be effective with the ultimate aim of helping the organisation to enter the learning process. To increase the amount of information that can be processed and converted into deeper level abstract knowledge, while at the same time exposing the way to codify in order to help them to externalise the knowledge that they hold.

Therefore, the aim of this research is to make a contribution towards capturing and internalising valuable knowledge and intelligence by scanning, codifying, diffusing and impacting the organisation. Also it will explore how to use the information space approach to increasing intuitiveness, decision quality and to enter an organisational learning spiral. It will discuss the method of research, research strategy, the reason why this design was selected, the method of data collection, and the data analysis methods used to conduct this research at APF. The study will also enable the reliability and validity to be established, and discuss the limitations of the study, and any issues of ethicalness linked to researching with human subjects. Saunders et al. (2015) provide a comprehensive set of approaches and techniques for conducting management research: explanatory, exploratory, descriptive, predictive, quantitative, qualitative, inductive, deductive, and basic research. The researcher used appropriate research approaches to measure the use of information and knowledge by decision makers. The methodology to be followed in this research is case study, within which two approaches are used: a survey, which is a quantitative approach involving a number of questionnaires to test hypothesis of the study within APF, and interviews, to check the use of information and knowledge by decision makers at APF. This is shown in Figure 4.1, which depicts the entire research journey.







**Figure 4.1 Research Process**

Figure 4.1 depicts the entire research journey from brainstorming and stating the problem to finding the insights. The journey will be explained in this subsection to show the entire process followed by the researcher. Figure 4.1 is sectionalised into four key phases of the research, where phase 1 is concerned with exploring and exposing the research problem, phase 2 involves seeking further information through undertaking necessary literature search and looking at the published materials. Phase 3 is concerned with exposing the processes followed in collecting primary data to obtain the true perspective. Phase 4 concerns the reporting of findings and insights and checking them against the existing sources. Also it involves exploring any research limitation.

Firstly, phase 1 is concerned with exploring the problem by paying detailed attention to looking at the research issues by asking what the problem is and exposing it. It focuses on why the problem exists and how did/does it come about. Attention is also paid to who is involved and reflects on the situation. Once the problem is sufficiently clear, it is then

prioritised in terms of the significance, to the researcher and academic merit. The problem is then analysed to facilitate its exposure and mapping it out more transparently. It is then justified in order to work out the initial research purpose, objectives and to formulate research questions. These are revamped once the second phase of the research involving literature has been done.

The second phase of the research involves undertaking a thorough literature search that involves gathering information on the topic, problem and existing solutions proposed by other scholars. It involves discovering the existing debates in different contexts. It involves discovering the use of theories, approaches and frameworks that are used to understand the situation or the research context. Hence, the approaches adopted and tested by others are looked at to see if they have made any discoveries and findings that are of particular interest. During the course of this, further problems and complexities could also be discovered. Also learning how such discussions were made, and using which research methods, would assist the research to formulate an appropriate mind set of undertaking the primary research and to reformulate the research question and focus on the practicalities of undertaking the research.

The third research phase (shown in Figure 4.1) involves determining the approach that a researcher could take in investigating the research questions posed and to achieve the research objective of the research project. This involves deciding on the research approach that could be taken, and the methods that could be used in collection of the required data to solve the problem in question. Then appropriate research procedures and sampling techniques will be used for data collection, requiring the use of data collection procedures that would help to elicit information from research subjects.

Once a sample (of research subject) is clearly identified for the purpose of this research, relevant negotiation will be undertaken with APF management to gain access to the research subject. Then the ethics procedures (also see Appendix E) were followed and approval was gained and costs associated with data in terms of expenses and time were assessed. A lot of effort will be then dedicated to designing a suitable research data collection instrument in time with data collection schema and research questions.

Two instruments are designed (see Chapter 3): a structured questionnaire, based on clearly defined hypothesis, and interviews, based on clearly defined propositions. Both instruments were piloted and the feedback from subjects was used to revamp the instruments and final instruments were prepared. The data analysis approach is then planned to present the findings of the research. Once this was gathered, the data was then analysed.

The fourth research phase (shown in Figure 4.1) then involves analyses of the research as planned. In analysing the research, the data reliability and validity are to be checked for both the quantitative and qualitative data using separate criteria. The quantitative data was collected using an online questionnaire and was aggregated using statistical and objectivist measures and the qualitative data was measured using subjective measures. Once the data was gathered it was aggregated based upon the original research hypothesis. The interviews were then interpreted. A full set of analysis are then carried out and the emerging themes are highlighted. Key insights are reported and detailed discussion comparing the primary findings with the existing literature is then presented. The contributions are then worked out and whether the purpose of the research has been achieved is checked. Any research limitations of this are then highlighted.

#### **4.1.1. Research Context and Background**

Abu Dhabi, AL-Ain City, Western and the External Region are all areas of operation for Abu Dhabi Police Force. APF, as a civil protection/security organisation, works alongside other UAE police departments via the Ministry of Interior to achieve a safer society. APF serves four major UAE districts: Abu Dhabi, Al-Ain City, the External Region, and the Western Region. APF has several units, which include police patrol, emergency response, crime investigation, and traffic control (Alqahtani, 2017). The primary objective of the organisation is to become an intelligence-led learning organisation, a proactive police force that reacts to the needs of society with the highest level of integrity and training. For this aim, APF has constantly undergone approaches to improve its use of information. DPF has established the “Decision-Making Support Centre” to help the organisation explore future challenges rather than just conduct research on current phenomena. The centre also helps in quality assessment and control.

APF has continuously developed its information systems to allow for process changes to be integrated. This includes the physical human input alongside software and hardware improvement. All this development has been undertaken for APF to meet its main aim, which is to serve the society with the upmost integrity and training by becoming a proactive and intelligence led police force. All this can be achieved by improving decision making. This need was realised by this organisation and a “Decision-Making Support Centre” was created to allow APF to be future orientated rather than just research into current conditions and occurrences. This department acts also as a quality and improvement process.

The main responsibility of the civil protection/security organisation is to enforce the law and increase public safety. Maintaining order and keeping the peace throughout the Emirate under the command of Saif bin Zayed Al Nahyan, Deputy Prime Minister and Minister of Interior (Alqahtani, 2017). The Abu Dhabi police is constantly working alongside local, national and even international police agencies to contribute to world safety and peace. It represents the Ministry of the Interior whilst doing this. Integrity, honesty and respect for human rights are the core values of the Abu Dhabi Police, while the notion of public service is a central pillar in Abu Dhabi police thinking (Alqahtani, 2017). APF, as a civil protection/security organisation, has many specialised units that help it to achieve its mission, such as: Criminal Investigations Department (CID), Department of Vehicles and Licensing, Security Inspection Department and Iris Technology.

The Middle East police forces are very reliant upon foreign methods, specifically in the Saudi, American and Egyptian Police. The study showed that the police forces of Saudi and Egypt view the relationships below them as very important. They also are very much focused on the inherent value, which is the service to the society they are providing through their crime stopping tactics.

Due to Afghanistan and Iraq being invaded by America and its Western allies, these countries now show a special relationship between the police and military. One of the reasons for this is it is the best way to implement change after an overhaul of a whole country. This makes police forces in these countries a reflection of the Western policies which we know are highly effective and efficient. In conclusion, the Western powers will be implementing their own policies (Kéchichian, 2010). The UAE holds good ties with the UK and this acts as a catalyst for training programs, not just in the UAE but also in other Middle Eastern States (Kéchichian, 2010). Many of its military officers are also based in Pakistan and neighbouring countries.

The police force has access to the West's advanced methods and technology, as well as the capacity to train abroad. This has bought about a strong cross-cultural impact on the department. The police force like to benchmark themselves against their Western counterparts. However, when implementing Western techniques, the UAE strives to accommodate Islamic and Arab Culture. The UAE, over the past few decades, has developed its own academy for the training of the police force in the latest technology and

strategies. This is all a drive to develop Human Resource, which is inclusive of leadership strategies.

Abu Dhabi, over time, could give resources to facilitate the modern techniques from the great wealth and relationships obtained from oil distribution. They have access to Western techniques and can learn freely, allowing for the free flow of information. Abu Dhabi has the vision of not only matching the modern countries in its fight for justice, but it also wants to show the world it regards justice as its utmost responsibility and show it has the transparency and the willingness to work with other countries for peace.

## **4.2. Research Paradigms and Design**

One has to be mindful of their own assumptions and beliefs which influence the research process and research design and have a consequential effect on the conclusions, as planned in Figure 4.1. In order to do this, the ontological and epistemological dimensions need to be taken into consideration, as both ontology and epistemology help to define the researcher's view of reality and knowledge (Hatch and Cunliffe, 2012). Table 4.1 presents the differences in the research quadrants. It is important to focus on the researcher's assumptions to be successful in achieving the research outcomes. Thus, here the researcher defines their philosophical stance used in choosing the research design (Hatch and Cunliffe, 2012).

Table 4.1: Research Paradigms

<b>Metatheoretical Assumptions About</b>	<b>Positivism</b>	<b>Interpretivism</b>
Ontology	Person (researcher) and reality are separate.	Person (researcher) and reality are inseparable (life-world).
Epistemology	Objective reality exists beyond the human mind.	Knowledge of the world is intentionally constituted through a person's lived experience.
Research Object	Research object has inherent qualities that exist independently of the researcher.	Research object is interpreted in light of meaning structure of person's (researcher's) lived experience.
Method	Statistics, content analysis.	Hermeneutics, phenomenology, etc.
Theory of Truth	Correspondence theory of truth: one-to-one mapping between research statements and reality.	Truth as intentional fulfillment: interpretations of research object match lived experience of object.
Validity	Certainty: data truly measures reality.	Defensible knowledge claims.
Reliability	Replicability: research results can be reproduced.	Interpretive awareness: researchers recognize and address implications of their subjectivity.

A researcher's belief can determine whether the reality is subjective or objective by taking the ontological position. The importance of this difference allows for identification and questioning of the assumptions held by the researcher and this is all to eliminate bias. One of the differences between ontology and epistemology is that ontology is more concerned with knowing the reality, whilst epistemology is more concerned with ways of researching into natural settings. It is important to gather knowledge from the appropriate sources and present it in a manner consistent with the research problem (Easterby-Smith, et al. 2008). It is important to identify the most appropriate research method to generate knowledge which is credible and will provide a true and fair view on reality. Writers such as Hatch and Cunliffe (2012), state that it is not enough to know what to know, but to know how to know.

There are three dimensions that the ontological paradigm is concerned with in regards to the nature. They are subjective realism, objective realism, and inter-subjective realism. The understanding of knowledge requires a framework which is established by the researcher, by answering the research question, which is more important than the specific worldview or ontology used to guide the development and implementation of the research methodology. The researcher has to work out the status of the knowledge when using epistemology and then organise it, either quantitatively and qualitatively. Both

dimensions are epistemologically useful, despite being at the opposite ends of the spectrum.

“The researcher has selected to use positivism and interpretive, but not constructivism, advocacy-participatory or critical theory scientific paradigms. The reason for this is the pure fact that they are not suitable for research investigating service quality. The positivist and post-positivist paradigms believe that reality is built up of constituent parts that reflect that object under investigation due to their objective realist ontological position. The constructivist paradigm takes a social relativist ontology, where social actors create knowledge that is non-normative and subjective. It does not permit the use of an epistemology for organising knowledge based on objective reality. The advocacy-participatory and critical theory paradigm follows an ontological perspective where ‘marginalised’ groups have a different understanding of reality than majority or mainstream groups. It follows an epistemology where the reality is bounded by values (Berry, 2002:289). This is not a suitable paradigm, as it does not consider the small unrepresented minority in society.”

The consequences of these differences lead to paradigms having their own strengths and weaknesses, as shown in Table 4.2 and Figures 4.1 and 4.2. Selecting one paradigm over many will reduce the researcher’s flexibility in the research process through the ontological and epistemological boundaries inherent in the paradigm. In this research the post-positivist paradigm will guide the quantitative phase of the research.

	<b>Constructive Realism/Pragmatism</b>	<b>Interpretivism/Constructivism</b>
<b>Ontology</b>	Symbolic realism	Constructivism
<b>Empirical Focus</b>	Action and changes	Beliefs are grounded on socially constructed cognition
<b>Type of Knowledge</b>	Constructive knowledge	Understanding
<b>Role of Knowledge</b>	Useful for action	Interesting
<b>Type of Investigation</b>	Inquiry	Field study
<b>Date Generation</b>	Data through assessment and intervention	Date through interpretation
<b>Role of Researcher</b>	Engaged in change	Engaged in understanding

Table 4.2: Realism vs. Interpretivism

(Source: Goldkuhl, 2012:12)



### **4.3. Deductive vs. Inductive Research**

As Figure 4.1 shows, in this research a deductive approach will be followed. However, an inductive explanation will also be offered to show the reasons for this choice. The deductive approach aims to find the impact of processes on service quality. Since the study is quantitative by nature, it is easier to generalise the findings. Deductive research methods generally adopt a positivist or post-positivist paradigm in which the researcher formulates a theory concerning the phenomenon under investigation, develops hypotheses concerning some measurable aspect of the phenomenon, and uses empirical data relevant to the hypotheses to test the theory. This method is known as the deductive approach because the analysis of the data either supporting or refuting the hypothesis grants the researcher the tools to make a deduction concerning the validity of the hypothesis. The deductive approach allows the researcher to form a possible law taken from theory that explains past observations and predicts future observations. The research method for deductive studies is aimed at formulating a theory by collecting focused data.

The deductive approach is used to answer research questions with clear boundaries for the investigation, where the outcome is clearly specified at the start of the research project. It can be used for experimental research where the researcher can change the variables of interest to determine its impact on a population. It can also be used with a non-experimental research design, where the impact can be observed on a population but variables cannot be changed to determine the implications of different treatments.

However, regardless of the research design that has been used for the deductive research, the theoretical concepts in questions need to be operationalised as measurable variables. Bryman and Bell (2012) state that in order to identify the concepts that make up a hypothesis, a researcher needs to verify the data which has to be collected. The independent and dependent variables have a correlation between them, hence this is important in determining the presence of any relationship.

On the contrary, firstly observing a situation and then getting a feel for the key issues and observations tallies with the inductive research approach. The data from this observation can then be converted into a theory to give a definition to the observed situation. Inductive research methods begin with a specific perspective based on which data is sought. The questions the researcher asks are rather open-ended, making them inductive research; the questions in inductive research are rather open-ended with the subject of the investigation establishing the boundaries for the research.

The methods mentioned usually involve the research paradigms which are related to constructivism and advocacy-participation. These methods require observation of the object or situation under investigation rather than experiment. This is so the researcher's theory cannot influence the investigation. The data consists of narratives and comparisons, and identifiable patterns can be analysed by the critical thinking approach which is initiated by the methods mentioned. This approach to empirical and subjective data collection/analysis can be used to achieve the objective of formulating a grounded theory based on data (Lancaster, 2005:26) because of the absence of a theory at the outset of an investigation. These methods are particularly useful when the situation involves interaction of many variables and, therefore, there is no easy measure. They are also useful when the underpinning or the antecedent variables cannot be identified with ease.

#### **4.4. Quantitative and Qualitative Research Methods**

Quantitative research methods are based on empirical data where several variables are used and operationalised as a measure. These method's purpose is to test a hypothesis which has been formed to look at the relationship between the variables in question. This method uses random sampling with an aim to generalise the findings from the study population to the general population; this also eliminates bias (Creswell, 2009). A researcher using quantitative research has to think of the remit of the research before initial

investigations and then collate the data on the variables found within the boundaries. This leads to the researcher creating dependent and independent variables and he will seek to see the relationship between them. Consideration needs to be given to mediating the variables which have an effect on the relation. Any misperceiving variables that cannot be justified for can directly impact the research, leading to false positive and false negative finds. The researcher is to behave impartially, to maintain an open mind and objectivity. The research has the capability to manipulate the variables so the effects can be seen within the situation and respondents. This leads to quantitative research taking place in a controlled environment. Regardless of this, quantitative research can be experimental because of its selection and design in its participant method.

A quantitative approach will be used in this research as a non-experimental research design. This will have no control group and will be only used for the collecting of post-test data concerning the variables of interest. In this phase of quantitative research, the variables are as follows: independent variable, which is the perception of the services provided by APF, with the moderation of variables which consists of different demographic factors and cultures of the work force. Questionnaire instruments are developed at the quantitative research phase to gather cross-sectional data about cross-cultural leadership and service quality from the Abu Dhabi bank leaders. There is a pilot test on the questionnaire instrument before it is released to the study population. The research design will still be non-experimental even though the participants are selected at random from the study population of all the bank leaders in Abu Dhabi. The variables are not controllable by the researcher and are only able to administer a post-test related to the service quality within the study population. The data is analysed by using inferential statistical methods.

Conversely, within qualitative research more emphasis is put initially on verbal description of the phenomenon being studied. This type of research helps phenomenon's being experienced by the subject and their perceptions to be investigated and a theory to be formed on the observations. Compared to

quantitative research, the remit of the investigation alongside the direction is established by the subjects. This type of research is done in the subject's natural environment, therefore there is no influence on the subject or environment by the researcher. The researcher engages in dialogue with the subjects whilst the collection/analysis is being done, which leads to a certain degree of subjectivity, unlike in quantitative methods. This then makes the results context specific and it cannot be generalized easily. Once the research approach has been identified, importance has to be given to the research method so the goal of the research can be met and also to ensure the method is suitable for the research context identified. It should also take the research question and objective into consideration. Qualitative methods are used for a wider research and when generalising can be allowed, for example for a whole community or society (Gering, 2012).

Each of the chosen research designs has its own strengths and weaknesses. The key research designs to choose from are:

- i. Descriptive: This is when research simplifies the phenomenon in question. It seeks to describe the characteristics by describing data patterns highlighting the phenomenon. It answers simple questions on who, what, where, when and how.
- ii. Relational: as the name suggests, the research has been designed to ascertain a relation.
- iii. Exploratory/Causal: This design determines the effect of one or more variables on the outcome. This research gives more clarity around a problem, especially when the issue is not clear. The nature and the environment in which it happens is looked at in detail with this design.

The research which has been done is based on surveys that are derived from employees within the Security Media Department. This approach will allow for any ethical issues to be considered, as well as using both the intranet and social media to run the surveys. The aim of the study is to see what impact, whether negative or positive, of the process has on service delivery and quality and the testing of the hypothesis is linked with positivist position. By nature, this study is deductive and the

main aim is to find the impact of processes on service quality. It should be noted that for this study it is very important to understand what the citizens think about the service quality and test the hypothesis. Hence the research currently relies upon quantitative data analysis.

## **4.5. Justification of the Research Methodology**

This research involves the use of a mixed methods approach due to its many benefits, such as cross checking the validity of findings. Overall the mixed method approach has many benefits because mixing both quantitative and qualitative research and data one gets the gains in breadth and depth of understanding and corroborations. This offsets the weaknesses inherent to using each approach by itself. This also offers an opportunity to use triangulation where several means (methods, data sources and researchers) are applied to investigate the same phenomenon. This also enables one to identify facts more accurately through looking at them from different angles using different methods and techniques.

The mixed approach combines quantitative and qualitative methods into one study and provides a broader perspective. It uses mixed methods to thoroughly investigate the research problem and understanding. It allows a researcher to collect, analyse and integrate quantitative and qualitative research. The former data includes closed-end information that undergoes statistical analysis and results in a numerical representation. The latter is concerned with subjective and open-ended research instruments. In other words it allows for the 'voices' of the participants to be heard, and interpret observations (Duffy, 1987; Choy, 2014; Sekaran and Bougie, 2016) within a case study approach (Yin, 2017) in order to triangulate the findings to gain a more accurate picture of information-knowledge use and its implications in a civil protection/security organisation (Stake, 2005; Hesse-Biber et al. 2010). The major advantages of the mixed approach are:

- It overcomes the weaknesses of quantitative and qualitative research, as the former is weak in context setting and the latter may include biases. The weaknesses of both can be minimised through exploration and analysis.
- Most research tools can be used for the comprehensive data collection; thus the results have a broader perspective of the issue or problem.
- The research outcome can then contain observations and statistical analyses that better validate the research, as they together provide holistic evidence.
- A researcher can use either inductive or deductive strategy.

However, there are challenges too, such as a higher degree of time consumption; more resources; more complicated procedures.

In this research the researcher aimed to corroborate the results obtained from other methods and wanted to use one method to inform another method. Also, due to the uniqueness of the information space theory, the researcher wanted to continuously look at a research question from different angles, and clarify unexpected findings and/or potential contradictions. Also the researcher aimed to increase the chances of research generalizability, especially from the qualitative part of this research, hence the mixed methods based case study was used as an in-depth investigation that can be extrapolated to a “real life” setting (Hesse-Biber et al. 2010). Case study research is more suitable for looking at the social and organisational aspects (Walsham, 1993).

Galliers (1992) writes that there is a debate as to whether the case study should be based on scientific or interpretive research methods. In reality it could be both: (Cavaye, 1996); for example, it can conform to Vicker’s (1980) appreciative system (positivist) and to Simon’s (1978) cognitive filter (interpretivist). Therefore, a case study can be conducted in a variety of ways; it can be used to study a situation or to build a new theory over a variable period of time. For instance, Eisenhardt (1989/91) looks at building a theory by using a case study approach. Dyer and Wilkins (1991) write that Eisenhardt’s work is a response to a decade of strong and repeated calls for more qualitative, contextual and interesting research (Sanday, 1979; Van Maanen, 1979a/b). There are three types of case studies involved in generating new theories:

- 1) In-depth study of a single case context or of multiple-case contexts.
- 2) Deep or surface description to get a rich insight into the organisation (if it is used as interpretivist).
- 3) Helps to tell stories or create constructs in order to evaluate existing theories for their usefulness.

A use of case study approach is historically beneficial in information management area (Benbasat, 1987; Walsham, 1993).

The main advantages from a case study analysis are its applicability to realistic situations and how they enable the development of analytical and problem resolving skills (Wanba et al., 2015; Meyers, 2015; Yin, 2017). Some other advantages are that the data is gathered from practices and personal experiences, therefore the data is deemed very reliable and it can, therefore, be generalised. Also, case studies act as a source of data that can either be archived or, more importantly, be subjected to further analysis if required to do so (Lewis, 2015). The questionnaires that have been used to obtain the data have been developed in such a way that they contribute to the qualitative aspect of the research as well as providing an analytical approach to exploring the influences on the culture around the research topic (Yin, 2015; Shekhar et al., 2018).

Firstly, a use of quantitative survey in this research will help to assess the correlation of variables, measured numerically, and then analysed by various statistical methods (Rumpe and Schröder, 2014). This enables a measured approach against controls to ensure a high validity and quality of data (Saunders et al., 2015). In this study the effect of different information use stages can be revealed as a quantitative approach which is very efficacious when running a large-scale survey or needs assessment as it is most useful to assess any trends (Richter et al., 2016).

On the other hand, in this research the qualitative approach will also be used as it helps to understand more aspects of the subject involved in information management (Kaplan and Maxwell, 2005). It will involve semi-structured interviews,

which will help to collect data regarding decision-making processes from decision makers. This will help to explore the decision making processes in much greater depth and bring out more dynamic aspects involved (Schutz, 1994; Kahlke, 2014). This will take place in the subject's natural environment, therefore there will be no influence on the subject or environment by the researcher. The researcher engages in dialogue with the subjects whilst the collection/analysis is being done, which leads to a certain degree of subjectivity, unlike in quantitative methods. This then makes the results more context specific and limits their generalisation.

Figure 4.1 explains how research objectives can be achieved by using the mixed approach involving quantitative and qualitative methods as part of a case study methodology. The quantitative approach is used to improve the understanding of the phenomenon under investigation (Teddlie and Tashakkori, 2009: 163). The research phenomenon looked at in this research is concerned with exploring how information and knowledge can be used to help the decision makers in civil protection/security organisations to gain a high degree of intuitiveness and intelligence to be effective. To increase the amount of information that can be processed and converted into deeper level abstract knowledge, while at the same time learn how to get them to codify in order to help them to externalise the knowledge that they hold. In order to capture a wide range of decision makers, one would primarily use the quantitative research methodology for collecting and analysing data, and to enhance the understanding and context. The approaches taken by decision makers in civil protection/security organisation is explored in research.

Therefore, the gathering of the quantitative data from the sample is a necessary step to establish if the process employed by the civil protection/security organisation has influence on the information quality. It is essential for the researcher to choose the quantitative research method in order to get meaningful and computable results from a large population (Abeyasekera, 2005:1). The results obtained by quantifiable research are of high importance in order to analyse the efficiency of the service quality of the civil protection/security organisation. This is why it is important to obtain a large number of samples so that the data can be more accurate.



United States Institute of Peace manual (2013) recommends that quantitative research is a lot more useful when there is a large number of baseline surveys that need to be assessed and when trends need to be established. The data derived from quantitative methods is not only objective, but is also easily computable, which in turn makes it simpler to present the desired perspective against the research. The approach mentioned uses numerical analysis, fitting statistical techniques. The aim is to derive statistically reliable information, which shows useful insights into how respondents perform something, for example, in the form of average or range (United States Institute of Peace, 2013:5). This in turn sets the establishment for a causal relationship, which allows the generalisation of similar environments and circumstances.

As Table 4.3 shows, the difference between the quantitative approach and the qualitative approach is that the quantitative approach allows the separation of large numbers of confounding factors, whereas the qualitative approaches cannot help or are unclear as these factors are difficult to analyse (Abeyasekera, 2005:1). It is also easier with a quantitative approach to gather great amounts of data. Table 4.2.1. below summarises some of the key advantages and disadvantages of qualitative and quantitative research, adapted from Creswell (2015:5).

On the other hand, the use of qualitative research will help to obtain deeper insights into the use of information and knowledge and how this help in making decisions. It helps to investigate decision-making by the decision makers. This method will help to contextualise the subject's natural environment, hence there is no influence on the subject or environment by the researcher. It will help the researcher to engage in dialogue with the civil protection/security organisation decision makers, although there will be a degree of subjectivity, unlike in quantitative methods. This then makes the results context specific and they cannot be generalised easily.

QUALITATIVE RESEARCH	
<b>Advantages</b>	<b>Disadvantages</b>
<ul style="list-style-type: none"> <li>• Provides detailed perspectives of a few people</li> <li>• Captures the voices of the participants</li> <li>• Is based on the views of participants and not those of the researcher</li> <li>• Appeals to people's enjoyment of stories</li> <li>• Allows participants' experiences to be understood in context</li> </ul>	<ul style="list-style-type: none"> <li>• Has limited generalizability</li> <li>• Provides only soft data and not numbers</li> <li>• Is highly subjective</li> <li>• Studies few people</li> <li>• Minimizes use of the researcher's expertise due to reliance on participants</li> </ul>
QUANTITATIVE RESEARCH	
<b>Advantages</b>	<b>Disadvantages</b>
<ul style="list-style-type: none"> <li>• Draws conclusions for large numbers of people</li> <li>• Analyses data efficiently</li> <li>• Investigates relationships within data</li> <li>• Examines probable causes and effects</li> <li>• Controls bias</li> <li>• Appeals to people's preference for numbers</li> </ul>	<ul style="list-style-type: none"> <li>• Is impersonal and dry</li> <li>• Does not record the words of the participants</li> <li>• Provides limited understanding of the context of participants</li> <li>• Is largely researcher driven.</li> </ul>

Table 4.3: Key advantages and disadvantages of qualitative and quantitative research

(Source: Creswell, 2015:5)

This overview of the advantages and limitations of both qualitative and quantitative research is of particular relevance to the scope of the present research. Using quantitative research can also be captured in a numerical and quantifiable manner and generalised to a large population; thus making it more 'objective'. A non-biased random sampling approach will be taken to select a population from the civil protection/security organisation's employees. The population will include citizens from seven areas of the UAE, including Abu Dhabi and Al Ain.

The data collection phase is one of the most crucial stages in the research and will heavily influence the validity of the results. The methods used to collect the data will include questionnaires, surveys, self-assessments and interviews (Suhonen, 2009). The Primary data is collected via the questionnaire, which has been developed in such a way as to capture all of the variables of the study. Prior to the data being collected, a pilot study will be carried out in order to rid the research of any underlying or unforeseen issues and also to ensure reliability and validity of the data. The pilot study will be carried out on 10 participants, including normal citizens and employees.

The data will be analysed using various statistical methods, including SPSS and chi-square test. According to Kirch (2008), the chi-square test is a significance test based on the chi-square distribution. This type of test is commonly used for testing homogeneity, a test of

independence, contingency table analysis, and as a goodness-of-fit test for analysis or observed frequency distribution. The study will also apply inferential analysis to evaluate the quantitative data gathered as it will be very useful to compare and contrast the knowledge and behaviour of the population, to find out the gaps in the current process and their expectations. Frequency distribution will be used to explore the differences among different variables against demography. The relationship between the research variables will be drawn, analysed and broken down to unearth the conclusion.

There are distinctive research procedures distinguished in the literature. In any case it should be accentuated that no one research strategy is superior to another (Saunders et al., 2015). The selected methodology will be a case study; this is on the grounds that the researcher is an employee in the APF and the main point of this research was at first in view of cases he observed.

By using an online questionnaire, substantial time, money and effort will be saved. One advantage is that a large data set can be collected in a relatively short space of time. As mentioned by Popper (2004), questionnaires provide the flexibility to collect the required amount of information within the allotted timescales and without incurring any substantial costs, making them a much more attractive and cost-effective option compared to methods such as face to face interviews, which had predominantly been used in past research projects. Another advantage is that by distributing the questionnaires online, it ensures that respondents are able to complete the survey at a convenient time, meaning that there would be much less likelihood of the questionnaire being answered in a superficial and non-biased manner.

One of the disadvantages of the questionnaires is that they can be very objective as the questions will be standardised through the multiple-choice questions, which may present as a barrier to attaining a complete and correct picture of leadership. Another drawback is that the participants may respond in a superficial manner if there are a lot of questions. In order to overcome this weakness, the questionnaire was designed to ensure that the questions were worded correctly so that they could be easily understood and that a manageable amount of questions were included. Also a structured flow of questions was created in a logical sequence that kept the respondent interested and engaged. The way in which the questionnaire is designed is in an attitude and opinion based practice and an ideology of the approach can be seen in Figure 4.2 (Saunders, et al., 2012: 419):

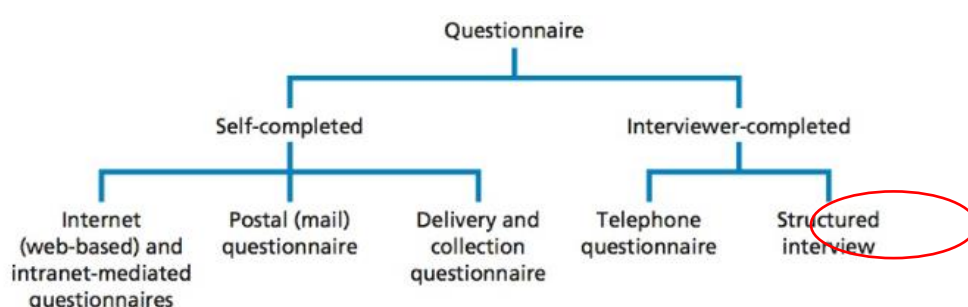


Figure 4.2. Types of questionnaire (Source: Saunders, et al., 2012:420)

The type of questionnaire adopted is an “interviewer-administered questionnaire” which can be seen in Figure 4.3.

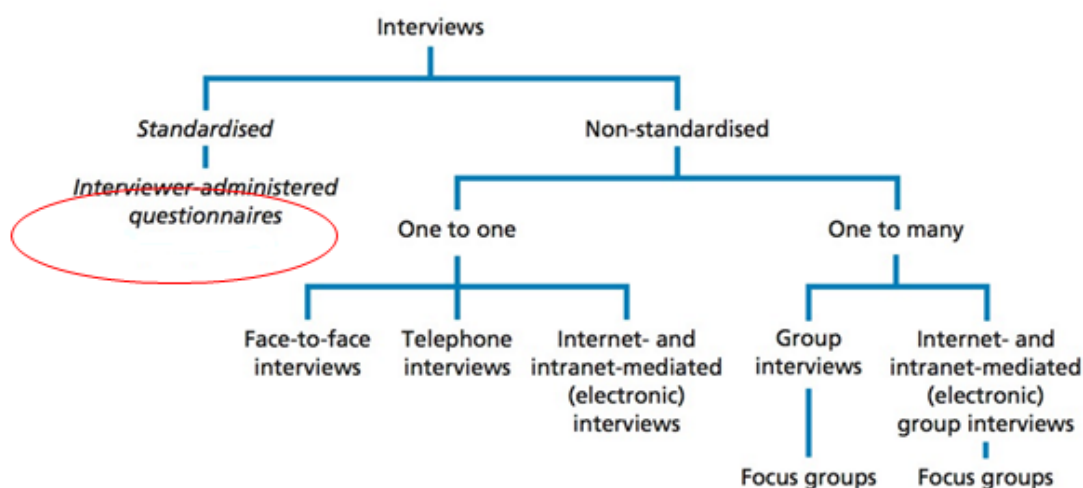


Figure 4.3: Forms of interview (Saunders, et al., 2012: 375)

## 4.6. Data Collection Approach Used

The target population for the purpose of this study include:

- a) Key decision makers working at the APF. People will be selected from each centre as an indicative number. This should give a good representation of what people think across the departments.
- b) 300 key individuals with decision-making responsibilities will be contacted; however, it is estimated around one third will accept and this is considered to be statistically acceptable and significant.
- c) Around ten key individuals with decision-making responsibilities will be chosen for interviews.

In sampling for both qualitative and quantitative methods a rigorous process needs to be followed, as stated by Creswell (2012). It is important to address the sample size, the identification of the participants and also to give consideration to what questions to ask them through instruments or even via more open ended procedures, such as interviews.

Due to ethics, permissions need to be obtained (see Appendix E). Sampling can also take the form of random sampling, simple sampling or snowball sampling, where people can recommend or refer people to the study (Creswell, 2012). The sample must be obtained from within the population where the research will be focused. The drawback of this study is it is not possible to sample such a large population, for example, all the citizens. This is why a smaller population is chosen to make it feasible and it will ensure reliability. According to Johnston and Sabin (2010:38-39), a sample is considered as a restricted part of a statistical population whose aspects are examined in order to get information about the whole. When people are involved in the sampling process it is known as a group of respondents and they are chosen from a bigger population. Subsequently the characteristics or parameters of the whole population depends on the process and technique of choosing the sample.

There are different methods to arrive at a sample and these include probability and non-probability sampling. There are two other methods of selecting the sample size, which are probability and non-probability. Probability sampling will allow the entire population the same chance to be selected; however non-probability sampling is the opposite, a less systematic

method and a select sample can be selected. Non-probability sampling seeks to ask the nearest and most readily available respondents. In some situations, a quota is dedicated to a particular type of sample. The most common method used is probability sampling. Saunders et al. (2012) recommend that one should select a sampling method in line with the purpose of the research and the target population chosen. Furthermore, for a large population they suggest that probability sampling is used.

Selecting an unbiased sample is also an important consideration. The data needs to be gathered from the citizens of the UAE from various areas of the APF and the services that it delivers, as this is the main research study. Deriving findings that can be generalised requires an unbiased sample, which will mean more accurate results. It is therefore important to select a sampling method that fits the characteristics of the entire population so that the results can be generalised and applied to the entire population.

The study population was finite and it will be used to identify the study population within the APF. The formula to be used for determining sample size is  $n=(pqN)/(SE^2 * N+p+q)$ . Here p is the population with the attribute under investigation, and, q is 1-p, N is the total population and SE is the standard error. For normal distributions p will be set at 0.5, and for a confidence level of 95%, the standard error will be set at  $0.05/1.95=0.02564$ . The confidence level indicates the responses will fall within the average range of +/-5 for 95% of the answers. In other words, the main study will require a minimum number of respondents which will be needed to conduct all the statistical tests in an authentic manner. A relatively sizable number of respondents will minimize the risk of Kurtosis and Skewness in the data. Therefore, the number of respondents of the questionnaire will gain particular attention in order to achieve sizeable and be a reliable data set.

## **4.7. Preparing the Data for Analysis**

The data has to be screened, cleaned and filtered and any missing data has to be looked at. The entire data has to be looked at to see if it is fit to analyse Missing results also need to be considered as they can reduce the size available to analyse the statistical result. Missing data needs to be “treated” to rid it of bias to reduce the chances of invalid results. When there is a large sample any questionnaire which is less than 10% complete can be

disregarded. Questionnaires which have repeat answers can also be omitted from the analysis.

Codes will be used in this research to code each variable by assigning character symbols to enter the information into the SPSS software. Each item has its unique name; further the data will be screened to make sure scores are in the categories range.

## **4.8. Data Analysis Undertaken in This Research**

In this research two types of data are to be collected: quantitative and qualitative, as explained earlier. The former will be analysed using descriptive and inferential statistical analysis. These test the hypotheses of the relationship between variables in the empirical data using deductive reasoning. The primary findings for the quantitative tests, the analysis provided support for either accepting or rejecting each type of data. (Creswell and Clark, 2007: 107). A coding system is created for this survey questionnaire. The initial data will be analysed using SPSS 22 for which codes were created and this will produce descriptive statistics. Secondly, the qualitative data will be analysed using clustering analysis.

### **4.8.1. Data Preparation and Assumptions of Normality**

The first step in any analysis practice is examining the data (Hair et al. 2010). Therefore, the data collected was inspected by the researcher for consistency and completeness before performing the analysis. Furthermore, every single statistical test serves the researcher in providing answers to the research questions and attaining the objectives of the current study. The importance and objective of each test has been explained. Also, descriptive statistics have been conducted to determine whether the data is normally distributed.

### **4.8.2. Screening and Coding the Data**

After collecting the data and presenting it in SPSS data view, the dataset will be checked for errors before the analyses. Three key stages are involved in the data screening procedure: screening for errors; pinpointing errors in the worksheet; and, finally, correcting the errors in the worksheet (Pallant 2013). Consequently, abiding by the stages suggested by Pallant (2013), the dataset was screened for errors and rectified. Additionally, the responses of the participants are coded into numerical values as is demonstrated in the data view of the SPSS file. For instance, the responses of the gender question, "Female and Male", were

coded into numbers “1 for male and 2 for female”. Coding data is the practice of allocating a particular number to a particular response in a construct (Hair et al. 2015). Moreover, to make sure that the participants answered the questionnaire genuinely and faithfully, questions will be negatively worded in the questionnaire. After re-coding the items and aligning them with other items in the construct, the Cronbach’s Alpha of the scale will increase and the item’s total correlation has to be a positive value.

#### **4.8.3. Missing Values in the Data**

In order to perform analysis on the data and the conceptual framework using Structural Equation Modelling (SEM), data has to be complete; any missing values need to be removed to run multivariate methods (Hair et al. 2015; Kline 2015). The main cause of missing data is issues that occur throughout data entry and data collection (Hair et al. 2010). In the current research, there is a significant number of missing data because the participants have not answered all the items. The researcher will allow the freedom to the participant to skip and answer the questions s/he wants with no obligations due to ethical concerns. The online application Qualtrics that will be used for data collection allowed respondents to go over the survey and answer the questions they want with no restrictions. Therefore, a considerable number of the respondents skipped a number of questions required for the analysis. However, all respondents who did not provide a valid answer for the dependent variables are to be excluded from the data used to run SEM.

During data collection, information on some of the variables in the dataset will be shown as missing values due to actions applied by the respondents answering the survey (Howitt and Cramer 2008). In order to solve the problem of missing values, it is desirable to simply abolish the respondents so that it will not affect the reliability and validity of the data. The most common method used in processing missing values in a dataset is referred to as case deletion; known as complete-case analysis and listwise deletion (Schafer and Graham 2002). Through the use of listwise deletion, a complete case is omitted from the analyses if any particular value is missing. Therefore, the researcher will implement the listwise deletion method in order to handle the missing data in the dataset. Additionally, when using SPSS 22.0 for advanced modelling procedures, such as correlations, regression, factor, and ANOVA, the software will automatically perform listwise deletion of records with missing data. Listwise deletion is an “*ad hoc method of dealing with missing data in that it deals with the missing data before any substantive analyses are done. It is considered the easiest and*



*simplest method of dealing with missing data*" (Carter 2006: p.4). This method excludes all the records that contain variables with missing data from the dataset. The technique is forthright and involves the elimination of incomplete cases. Since the current study obtained a considerable sample size for data analysis, excluding incomplete cases and eliminating missing records on any variables has no impact on the result (Hair et al. 2010).

#### 4.8.4. Screening for Outliers

Outliers are cases representing observation points that are substantially distant (higher or lower) from the rest of the observation points in a specific dataset (Byrne 2008; Kline 2015). An outlier case signifies values that are different from other cases in the same sample. According to Grubbs (1969: p.1) "*An outlying observation may be merely an extreme manifestation of the random variability inherent in the data. ... On the other hand, an outlying observation may be the result of gross deviation from prescribed experimental procedure or an error in calculating or recording the numerical value*". Dataset with cases flagged as outliers are expected and normal in considerably sizable data sample as the one used for the current research (N=647). However, outliers can have a negative impact on the quality of data analyses. Osborne and Overbay (2004) stated three deleterious effects of outliers on statistical analyses: first, they can extremely influence or bias evaluations that may be of fundamental interest. Second, they normally act to decrease the power of statistical tests and maximize error variance. Third, if non-randomly distributed, they can reduce normality (and in multivariate analyses, violate assumptions of sphericity and multivariate normality), altering the odds of making both Type I and Type II errors. In order to detect the outlier and abstract them from other cases, the researcher computed the Mahalanobis Distance  $D_2$  through SPSS 22.0. The Mahalanobis distance  $D_2$  measures the distance between the mean of a distribution of cases and a case in the distribution; it measures the number of standard deviations from a point P to the mean of a distribution D (Field 2009).

$\underline{x} = (x_1, x_2, x_3, \dots, x_N)^T$  Or Point P (The Mahalanobis distance of an observation)

$\underline{\mu} = (\mu_1, \mu_2, \mu_3, \dots, \mu_N)^T$  (The mean of a set of observations)

$$D^2 = (N - 1)\left(h - \frac{1}{N}\right).$$

Multivariate outliers are conditioned as Mahalanobis distance at  $p \leq 0.001$  (Zaouali et al. 2005). A case is said to be a multivariate outlier if the probability allied with its  $D_2$  is equal to or less than 0.001.  $D_2$  trails a chi-square distribution with degrees of freedom equal to the

number of variables included in the calculation (De Maesschalck et al. 2000). After running the Mahalanobis distance test in SPSS 22.0 the result indicates the presence of univariate outliers among the data. As a result, 13 cases were abandoned from the dataset through applying multiple regressions.

#### 4.8.5. Assessing Univariate Normality

In order to find out whether the data is normally distributed, the researcher will perform descriptive statistics. Since normal data is a fundamental notion in parametric testing, valuation of the normality of data is essential for many statistical tests. Normality discusses the shape of the data distribution for a single metric variable and its equivalence with normal distribution (AlKhatib 2013). However, a normality test is not compulsory in SEM where the sample size is considerably big, as in the current study, and the outcomes of statistical tests would be declared unacceptable (Hair et al. 2010).

Kurtosis and Skewness measures are executed in the present study to provide a characterization of the data and describe the shape of its distribution. Skewness is a measure of symmetry, or more specifically, the lack of symmetry. A distribution is symmetric if the right side from the centre point looks exactly the same as the left side of the centre point (Mardia 1970). Moreover, Kurtosis is a measure of whether the data are heavy-tailed or light-tailed relative to a normal distribution. Specifically, datasets with small kurtosis incline to lack outliers and have light tails, while datasets with big kurtosis incline to have outliers and heavy tails (Mardia 1970).

For univariate data  $Y_1, Y_2, \dots, Y_N$ , the formula for skewness is:  $g_1 = \frac{\sum_{i=1}^N (Y_i - \bar{Y})^3}{N s^3}$   
 $\bar{Y}$  is the mean,  $s$  is the standard deviation, and  $N$  is the number of data points. Note that in computing the skewness, the  $s$  is computed with  $N$  in the denominator rather than  $N - 1$  (NIST 2003).

For univariate data  $Y_1, Y_2, \dots, Y_N$ , the formula for kurtosis is:  $kurtosis = \frac{\sum_{i=1}^N (Y_i - \bar{Y})^4}{N s^4}$   
 $\bar{Y}$  is the mean,  $s$  is the standard deviation, and  $N$  is the number of data points. Note that in computing the kurtosis, the standard deviation is computed using  $N$  in the denominator rather than  $N - 1$  (NIST 2003).

Skewness and Kurtosis may happen either together or independently in a particular variable (Kline 2015). Therefore, the distribution of the variables in the current study was evaluated for normality through the calculation of skewness and kurtosis values. Also, the histogram is

a real graphical practice to show the skewness and kurtosis of each of the items and visually assess their normality.

#### **4.8.6. Assessing Multivariate Homoscedasticity, Linearity, and Normality**

The ultimate stage in examining the data is running analyses for the norms inspiring the statistical roots for multivariate analysis; for instance, homoscedasticity, linearity and normality (Hair et al. 2010). Multivariate statistical approaches regularly involve the postulation of multivariate normality because of the convolution of the relations that process a big number of variables (Hair *et al.*, 2010). Before undertaking any analyses of the variables in the data set, it is vital to make sure that multivariate normality has been encountered. Multivariate normality indicates that all variables used in a particular study are scattered normally in relation to each other. Multivariate normality of data is one of the most fundamental requirements for the application of SEM analyses; especially if SmartPLS 3 is deployed in the general conduct (Byrne 2013). In the current study, the research used SPSS 22 regression program in order to consider multivariate normality. The assumption of multivariate normality is fulfilled when the standardized residuals are scattered normally and the dots are bundled near the line in a normal probability plot (Norusis 2008).

#### **4.8.7. Structural Equation Modelling**

Furthermore, Structural Equation Modelling (SEM), which takes a confirmatory approach to data analysis (Byrne, 2001), will be used in this study as a multivariate technique. A combined use of multiple regression and factor analysis will enable one to determine the interrelated dependence relationships simultaneously. SEM helps to look at relationships between measured variables and latent constructs (Hair et al, 2010). SEM integrates techniques such as path analysis, principal component analysis, and ANOVA, which depict the relationship between constructs (Hayduk, 1987).

Regression analysis will be used to test the hypotheses. Correlation analysis and path analysis will also be used as inferential statistical methods. The independent and dependent variables of the study will be tested by the regression analysis. Factor analysis is another method used to analyse the data, which involves multiple regression analysis to assess the amount of variance which accounts for the various factors examined in the study that functioned as multiple independent variables.

The independent and dependent variables relationship is tested by correlation analysis to show the statistical significance. The coefficient relation acts as a predictor to show the relationship. The coefficient of determination is to be used to assess the amount of variation in the dependent variables accounted for by changes in the independent variable (Bethea, 1995:363). By using regression and correlation analyses it is assumed the relationship is linear. For all the inferential statistical tests, the alpha level will be set at  $p < 0.05$ . With psychometric data involving attitudes and perceptions of individuals, an alpha level of 0.05 is appropriate to avoid a Type I error of accepting a null hypothesis when it is in fact false (Gravetter and Wallnau, 2016)."

*Confirmatory factor analysis (CFA) is a statistical technique used to verify the factor structure of a set of observed variables. CFA allows the researcher to test the hypothesis that a relationship between observed variables and their underlying latent constructs exists. The researcher uses knowledge of the theory, empirical research, or both, postulates the relationship pattern a priori and then tests the hypothesis statistically (Suhr 2006: p.231). The latest approach in piloting CFA in social science is the deployment of SEM (Worthington and Whittaker 2006). The majority of statistical approaches only use single statistical test to conclude the connotation of the analysis. On the other hand, Structural Equation Modelling (SEM), CFA in particular, depends on a number of statistical tests in order to conclude how well the model fits to the data (Suhr 2006). Listed below are a number of statistical tests determined by CFA:*

- **Chi-squared test**

*"The chi-squared test indicates the difference between observed and expected covariance matrices. Values closer to zero indicate a better fit; smaller difference between expected and observed covariance matrices" (Suhr 2008: p.2).*

- **Root mean square error of approximation**

*Root mean square error of approximation (RMSEA) tells us how well the model, with unknown but optimally chosen parameter estimates would fit the population's covariance matrix. RMSEA of between 0.08 to 0.10 provides a mediocre fit and below 0.08 shows a good fit. However, more recently, a cut-off value close to .06 or a stringent upper limit of 0.07 seems to be the general consensus amongst authorities in this area (Hooper et al. 2008: p.54; Kenny et al. 2015).*

- **Goodness of fit index and adjusted goodness of fit index**

The goodness of fit index (GFI) is a measure of fit between the hypothesized model and the observed covariance matrix. The adjusted goodness of fit index (AGFI) corrects the GFI, which is affected by the number of indicators of each latent variable (Baumgartner and Homburg 1996).

- **Comparative fit index**

The comparative fit index (CFI) analyses the model fit by examining the discrepancy between the data and the hypothesized model, while adjusting for the issues of sample size inherent in the chi-squared test of model fit (Gatignon 2010), and the normed fit index (Bentler 1990). CFI values range from 0 to 1, with larger values indicating better fit; a CFI value of .90 or larger is generally considered to indicate acceptable model fit (Hu and Bentler 1999).

The aim of the current SEM is not to show if the consigned items measure one factor or a number of factors as the items are constrained to load on a single factor in CFA (Worthington and Whittaker 2006). However, CFA intends to test the hypothesis that shows the existence of a relationship between latent constructs and observed variables. It confirms the extent to which the theoretical model, derived from unified theory of acceptance and use of technology and other theories, of the research is valid in the new sample data (Suhr 2006). As a result, CFA is performed in this study to approve academically-driven factors without the necessity of using EFA.

#### **4.8.9. Measurement Model Tests**

In order to evaluate the proposed theoretical model, two fundamental bundles of statistical approaches are utilized. The first one is goodness of fit (GOF) criteria indices; the next one is the validity and reliability of the theoretical model (AlKhatib 2013). The goodness of fit index (GFI) is a measure of fit between the estimated population covariance matrix or the hypothesized model and the observed covariance matrix; corrected GFI results the AGFI (adjusted goodness of fit index). This is influenced by the number of items related to each latent variable (Baumgartner and Homburg 1996; Levine, 2016). GOF indices reveal the discrepancies between the expected values in the proposed theoretical model and the observed values. Consequently, the primary mission of model fit practice is to indicate the GOF between the sample data collected and the theoretical model specified for the current

research (Byrne 2013). CFA is applied on the proposed theoretical model before performing the path analysis.

The test shows that the eight constructs used in the study were reliable and valid. Missing data were aborted from the survey results through listwise deletion process after collecting data using paper and online survey (Qualtrics) for data collection. Additionally, Mahalanobis distance was utilized in SPSS 22 in order to check for outliers. 16 univariate outliers were dropped from the dataset based on the multiple regression tests. Also, in order to assess the univariate normality, the researcher will use skewness and kurtosis results. The measurement and the structural model in the current research will be assessed using SmartPLS 3 for structural equation modelling. Latent constructs will be evaluated for validity and reliability.

#### **4.9. Qualitative Data**

This subsection explains the data analysis of the data collected through application of information space in using interpretive approach. The data collected using I-Space to model (Boisot, 1995, 1998) Social Learning Cycle (SLC) uses the dynamic flow of knowledge through a series of six phases:

- Scanning: insights are gained from generally available (diffused) data
- Problem-Solving: problems are solved giving structure and coherence to these insights (knowledge becomes 'codified')
- Abstraction: the newly codified insights are generalized to a wide range of situations (knowledge becomes more 'abstract')
- Diffusion: the new insights are shared with a target population in a codified and abstract form (knowledge becomes 'diffused')
- Absorption: the newly codified insights are applied to a variety of situations, producing new learning experiences (knowledge is absorbed and produces learnt behaviour and so becomes 'uncodified', or 'tacit')
- Impacting: abstract knowledge becomes embedded in concrete practices, for example in artefacts, rules or behaviour patterns (knowledge becomes 'concrete')

The data is then visualized as a three dimensional cube with the following dimensions:

- from uncodified to codified,
- from concrete to abstract,

- from undiffused to diffused.

To determine whether an information-knowledge transformation has taken place and whether knowledge has been used the following were performed in this research:

1. Gain knowledge of organisational context through observations, interviews and meetings.
2. Investigate the motives, beliefs and values of stakeholders through interviews, participation in project meetings and questionnaires.
3. Observation of stakeholder behaviour and actions and the resulting outcomes.

Therefore, the data associated with these sets is analysed by referring to particular decisions taken by the key decision makers. For practical reasons six decision makers were chosen and six major decisions made by them were chosen for further interrogation. Overall, the use of I-Space in the qualitative data analysis would help to keep the following issues in mind:

- 1) Can I-Space help to make sense of the problem solving action and decisions taken by a stakeholder?
- 2) Can I-Space show the degree and types of intuition and influence held by a decision maker?
- 3) Can I-Space show how a decision maker gains knowledge and intuition to influence others?
- 4) Can I-Space show how a decision maker gains approval of others and helps the rest of the organisation to enter a learning process/spiral?

Finally, the results analysis chapters containing the research results will show that a majority of 'voices' represented in the analysis are those of decision makers and not of lower-level workers. Although the results can also usefully be interpreted by lower-level workers. They appear managerialist for the following reasons:

- The wording used in these chapters appears to be concerned with management issues, such as the use of words like efficiency, effectiveness and quality of service.
- Most of those involved in this research were fairly senior in their organisations.
- A lot of quotes taken were from senior stakeholders.
- The research insights made, the research questions generated and the recommendations for practice have a greater appeal to senior stakeholders, although lower-level workers can also use them just as effectively.

Overall, this orientation mainly resulted from only having better access to senior stakeholders. Other reasons are that this thesis would be read by the senior management of the research organisations and by practitioners who are most likely to be working with/for management.

Interview data will be analysed by clustering the data manually and then undertaking analyses based on the research conceptual map and clustering the responses. The data emerging from interviews will be analysed based upon what information it reveals about the decision-making process. Specifically, it will look at how information was collected; the sources of information used and reasons for their use; scanning of these sources for information and knowledge; problem solving using this information and making decisions. It will also focus on how the decision makers diffused this learning and intuition to a defined number of knowledge individuals and then, eventually, how they educated or absorbed or disseminated the information throughout the organisation. It will then focus on the degree of impact of their decision-making on the organisation in terms of making it more effective.

The data will be clustered by looking at words, phrases, sentences and sections. The transcript will be labelled based upon action, activities, concepts, differences, processes and interpretations. Particular attention will be paid where something is repeated several times, or it surprises the researcher, or when the interviewee explicitly related to its impact, or where the researcher has read something in the literature. A lot of reference will be made to the theory. A lot of attention will be made to remaining unbiased. The words will be clustered to code the data. The codes will be grouped as categories, which could be closely or loosely related to the chosen subjects. Depending on how the responses some categories may be ranked higher in the hierarchy than others.



## **4.9. Reliability and Validity Aspects**

To establish if the respondent meets the inclusions criteria, Cronbach's alphas is used. It is assumed that variance is indicative of error variance, with the sum of the error variance substituted for true error variance (Dunn-Ranking, 2016). The Cronbach's is above the level of 0.70, thus it is sufficient to indicate good reliability.

In order to check the extent of the casual inferences of the variables being investigated, the internal validity has to be assessed and this can be done by looking at the instrument and research design (Crano and Brewer, 2002:22). The face validity will be tested by a peer review whilst the construct validity is established by examination of empirical measures in order to show the theoretical construct.

The internal validity can be adversely affected by confounding variables influencing the apparent relationship between the in/dependent variables investigated in the quantitative phase of the study. The ability to generalise or external validity depends on the adequacy of the sampling procedure and the ecological validity of the research design (Gliner and Morgan, 2000:159). External validity was established by the use of random sampling for the quantitative phase of the study whilst using a sample population that represents the study population. The external validities threats from the ecological factors is reduced by the collection of data.

## **4.10. Ethical Considerations Taken in This Research**

This research does not expose any contentious issues that could have physical or psychological connotations in this research. There is, however, a possible risk, i.e. the breach of confidentiality, and this is due to rise of negative views by service providers. This could in turn be conveyed to APF management, which could have serious consequences for the respondents. The way around this is to invite each respondent individually and by the use of Qualtrics to complete the survey. Each individual respondent will be kept anonymous by being issued a unique reference number that will be assigned.

In order to meet ethical procedures, all the respondents will be asked for their consent. In this consent the purpose of the study is listed, alongside the risk to the participant and

emphasis placed on the breach of confidentiality to participants. It gives the method and information on how the data will be analysed once it is collected. They will clearly be told that this is a request for participation and that it is not compulsory to participate, as this is the norm in this part of the world. The participants who wish to respond are provided with all the contact details of the researcher if they require any further information or reassurance.

## **4.11. Chapter Conclusion**

In this chapter we see how the research flows logically. The chapter describes how the use of the quantitative approach helps achieve the objectives of the research. It has a focus on information quality, which is used to make decisions in APF. A deductive approach is established, which includes the newly created theoretical model. The quantitative phase of the research was based in positivist paradigm and a non-experimental research design. The data phase will use a survey questionnaire which has been issued to the APF management providers and the public (as service recipients). The data collection instrument will be tested by the use of a pilot test to establish its reliability. The reliability and validity of the qualitative data are assessed by the use of the trustworthiness approach. Appropriate descriptive and inferential statistics will be used to make sense of the quantitative data. Even though multiple methods are used, the findings could still have bias but all possible ways have been used to minimise this. The qualitative data will be analysed in stages described by Bosiot (1998) in the social learning cycle, and appropriate summaries will be provided. The qualitative approach will help to reveal how decisions makers at APF obtain and use, or “harness” information knowledge during their strategic decision-making activities much more closely.

## Chapter 5A

### Results Quantitative Data Analysis Chapter

#### 5A.1. Chapter Introduction

This chapter provides the results of the quantitative data collection part of case study. It uses the Statistical Parcel for the Social Sciences (SPSS) in order to present description for the raw data collected from the survey and the statistical software for structural equation modelling (SmartPLS) to present the Structure Equation Modelling (SEM). The major statistical findings of the current study are presented in this chapter. It will discuss the results of a pilot study, the main survey. In the latter, detailed discussion of demographic aspects is provided, common methods variance and SEM.

#### 5A.2. Results Generated from Quantitative Research

##### 5A.2.1. Results of the Reliability Test

A pilot study is well-defined as a transitory initial survey (Bryman 2012). In order to evaluate the validity and reliability of the complete constructs used in the survey, a pilot study was conducted. Based on the outcomes of the pilot study, some of the items were revised, whereas others were totally abolished. Cronbach's alpha or coefficient alpha ( $\alpha$ ) is used to measure the class of internal consistency. It is not difficult to figure and it is the most popular method employed in assessing the reliability of a construct (Churchill 1979; Nunnally and Bernstein 1994). According to Tavakol and Dennick (2011), there are dissimilar views around the satisfactory values of Cronbach's  $\alpha$ , ranging from 0.70 to 0.95 (Table 5A.1). The value of  $\alpha$  is affected by the item dimensionality and inter-relatedness and the number of test items; the value of alpha could be small if the construct is heterogeneous, items are poorly related, and/or the number of questions is low (Tavakol and Dennick 2011). Some of the Items should be discarded or revised if alpha shows a low value due to poor correlation. The simplest technique to revise or discard some items is to calculate the correlation of the total score test with each test item; items with low correlations (approaching zero) are removed. A

high value of coefficient alpha indicates that some of the items in the construct are very similar to each other as they are addressing the same question but in a different format.

Table 5A.1: Cronbach's alpha

<b>Cronbach's alpha</b>	<b>Internal consistency</b>
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

The internal reliability of all constructs needed for the study is tested using IBM SPSS Statistics 22 software. The test of reliability produces the number and percentage of valid cases considered for the test. Additionally, the Cronbach's alpha is calculated for the given number of items in a particular construct. The mean, standard deviation and number of respondents of each item is also found. Also, the item-total statistics table including scale mean if item deleted, scale variance if item deleted, corrected item total correlation, and Cronbach's alpha if item deleted; and the scale statistics table including mean, variance, standard deviation, and number of items are demonstrated in the reliability test.

Table 5A.2: Case Processing Summary

<b>Case Processing Summary</b>		<b>N</b>	<b>%</b>
Cases	Valid	135	98.5
	Excluded <sup>a</sup>	2	1.5
	Total	137	100.0

a. Listwise deletion based on all variables in the procedure.

As is revealed in Table 5A.2, the number of respondents who provided valid answers to the survey questions is 135. 2 respondents were excluded because they did not complete the survey.

**Table 5A.3: Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.925	.925	2

**Table 5A.4: Item Statistics**

	Mean	Std. Deviation	N
Q7 - Does publically available knowledge (such as books, newspapers and professional reports) help you in problem solving?	3.43	1.162	135
Q8 - Does publically available knowledge (such as books, newspapers and professional reports) lead to greater intuition?	3.70	1.210	135

Table 5A.4 shows the reliability of two questions asked in the survey. Since Cronbach's Alpha is greater than 0.9 it means the reliability of Q7 and Q8 is excellent. This ratio is applied to all the questions representing the constructs in the survey. As is demonstrated in the tables from Table 5A.3 to Table 5A.14, all the items are statistically valid.

**Table 5A.5: Item-Total Statistics**

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q7 - Does publically available knowledge (such as books, newspapers and professional reports) help you in problem solving?	3.70	1.464	.861	.741	.
Q8 - Does publically available knowledge (such as books, newspapers and professional reports) lead to greater intuition?	3.43	1.351	.861	.741	.

Table 5A.6: Reliability Statistics

Cronbach's Alpha	N of Items
.807	2

Table 5A.7: Item Statistics

	Mean	Std. Deviation	N
Q9 - Does proprietary knowledge (such as APF secrets and actions) help you in problem solving?	3.16	1.003	123
Q10 - Does proprietary knowledge (such as APF secrets and actions) lead to greater intuition?	3.28	1.089	123

Table 5A.8: Reliability Statistics

Cronbach's Alpha	N of Items
.899	2

Table 5A.9: Item Statistics

	Mean	Std. Deviation	N
Q11 - Does personal knowledge (such as biographical knowledge) help you in problem solving?	2.61	1.191	135
Q12 - Does personal knowledge (such as biographical knowledge) lead to greater intuition?	2.50	1.343	135

Table 5A.10: Reliability Statistics

Cronbach's Alpha	N of Items
.936	2

Table 5A.11: Item Statistics

	Mean	Std. Deviation	N
Q13 - Does common sense knowledge (such as everybody's awareness) help you in problem solving?	2.23	1.203	135
Q14 - Does common sense knowledge (such as everybody's awareness) lead to greater intuition?	2.13	1.248	135

Table 5A.12: Reliability Statistics

Cronbach's Alpha	N of Items
.978	4

Table 5A.13: Item Statistics

	Mean	Std. Deviation	N
Q15 - Does your use of knowledge for solving problems increase your knowledge diffusion involving sharing knowledge with a target select group)?	1.96	1.221	135
Q16 - Does your use of knowledge for solving problems increase in knowledge application to a variety of situations in APF.	1.92	1.222	135
Q17 – Has your use of knowledge for intuitiveness in decision-making led to sharing knowledge with a target select group)?	1.92	1.234	135
Q18 -Has your use of knowledge for intuitiveness in decision-making led an increase in knowledge application to a variety of situations in APF?	1.93	1.247	135

Table 5A.14: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q15 - Does your use of knowledge for solving problems increase your knowledge diffusion involving sharing knowledge with a target select group)?	5.77	13.104	.921	.977
Q16 - Does your use of knowledge for solving problems increase in knowledge application to a variety of situations in APF.	5.81	12.843	.959	.966
Q17 - Has your use of knowledge for intuitiveness in decision-making led to sharing knowledge with a target select group)?	5.81	12.754	.960	.966

Table 5A.14: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q15 - Does your use of knowledge for solving problems increase your knowledge diffusion involving sharing knowledge with a target select group)?	5.77	13.104	.921	.977
Q16 - Does your use of knowledge for solving problems increase in knowledge application to a variety of situations in APF.	5.81	12.843	.959	.966
Q17 - Has your use of knowledge for intuitiveness in decision-making led to sharing knowledge with a target select group)?	5.81	12.754	.960	.966
Q18 - Has your use of knowledge for intuitiveness in decision-making led an increased in knowledge application to a variety of situations in APF?	5.79	12.837	.934	.973

Table 5A.15: hypothesis and constructs

Construct	No of items	Cronbach's (α) Before Item Deletion	Cronbach's (α) After Item Deletion
H1	2	0.975	0.975
H2	2	0.807	0.807
H3	2	0.899	0.899
H4	2	0.936	0.936
H5	2	0.978	0.978
H6	2	0.961	0.813
H7	2	0.957	0.917
H8	2	0.953	0.966
H9	2	0.968	0.835
H10	2	0.935	0.950
H11	2	0.941	0.887
H12	2	0.939	0.847
H13	2	0.814	0.922
H14	2	0.929	0.936
H15	2	0.897	0.944
H16	2	0.877	0.948
H17	1	-----	----



### **5A.2.2. Exploratory Factor Analysis**

Exploratory Factor Analysis (EFA) technique is used in the assessment and development of scales; in specific, scales that are used to collect data for the first time. It is a statistical technique deployed to disclose the fundamental structure of a relatively large set of variables (Hair et al. 2010). According to Finch and West (1997) EFA must be performed when the examiner has no former hypothesis about patterns or factors of measured variables. EFA techniques are extra precise when every factor is signified by several measured variables in the analysis. However, the constructs of the current research were postulated to be measured as single-item indicators founded on the literature. Therefore, there is no need to use EFA on the constructs of the study as all of them were adapted from the literature and used in other studies.

### **5A.3. Results of The Main Survey**

*Descriptive statistics* are a statistical method that defines the basic characteristics of the information collected from a survey in a study; they offer brief summaries and describe data about the measure and sample (Kremelberg 2011). In the following sub-sections, the demographic characteristics of the respondents of the survey are presented.

#### **5A.3.1. Demographic Variables Considered**

The percentages and frequencies of the demographic variables (gender, tenure, age group, and position) associated with the sample of the population studied are displayed in this section.

Table 5A.16 presented below shows the demographic variables that are obtainable from the survey and provides the number of people who responded to each variable. “Valid” indicates the number of people who chose a usable option and “Missing” indicates the number who offer either no response or unfeasible option. For example, 127 of the contributors show a gender either male or female and 3 chose not to respond to the question.

Frequency Table for each demographic variable:

Table 5A.16: Statistics

	What is your rank in Abu Dhabi Police Force?	How long have you worked here?	Which department are you based in?	What is your gender group?
N Valid	129	128	130	127
Missing	1	2	0	3

Table 5A.17: Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	111	81.0	81.6	81.6
	Female	25	18.2	18.4	100.0
	Total	136	99.3	100.0	
Missing	System	1	.7		
Total		137	100.0		

Table 5A.18: Evaluation of knowledge using data mining system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Poor	11	8.3	8.3	8.3
	Poor	11	8.3	8.3	16.6
	Moderate	11	8.3	8.3	24.9
	Good	34	25	25	49.9
	Very Good	68	50	50	99.9
	Total	136	99.3	99.9	
Missing	System	1	.7		
Total		137	100.0		

Table 5A.18: Age Group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	21-34	42	30.7	30.9	30.9
	35-44	32	23.4	23.5	54.4
	45-54	46	33.6	33.8	88.2
	55-64	16	11.7	11.8	100.0
	Total	136	99.3	100.0	
Missing	System	1	.7		

Table 5A.18: Evaluation of knowledge using data mining system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Poor	11	8.3	8.3	8.3
	Poor	11	8.3	8.3	16.6
	Moderate	11	8.3	8.3	24.9
	Good	34	25	25	49.9
	Very Good	68	50	50	99.9
	Total	136	99.3	99.9	
Missing	System	1	.7		
Total		137	100.0		

Table 5A.19: Education Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secondary or Primary School	6	4.4	4.4	4.4
	University Degree	86	62.8	63.2	67.6
	Higher Education	37	27.0	27.2	94.9
	others	7	5.1	5.1	100.0
	Total	136	99.3	100.0	
Missing	System	1	.7		
Total		137	100.0		

Table 5A.20: Length of Service at Abu Dhabi Police force

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-5 years	78	56.9	57.4	57.4
	6-10 years	24	17.5	17.6	75.0
	11-15 years	14	10.2	10.3	85.3
	16-20 years	10	7.3	7.4	92.6
	20+ years	10	7.3	7.4	100.0
	Total	136	99.3	100.0	
Missing	System	1	.7		
Total		137	100.0		

Table 5A.21: Rank at Abu Dhabi Police Force

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lieutenant-General	2	1.5	1.5	1.5
	Major General	4	2.9	2.9	4.4
	Brigadier-General	7	5.1	5.1	9.6
	Colonel	11	8.0	8.1	17.6
	Lieutenant-Colonel	14	10.2	10.3	27.9
	Major	13	9.5	9.6	37.5
	Captain	10	7.3	7.4	44.9
	First-Lieutenant	12	8.8	8.8	53.7

	Second-Lieutenant	15	10.9	11.0	64.7
	Sergeant-Major	22	16.1	16.2	80.9
	First-Sergeant	13	9.5	9.6	90.4
	Corporal	5	3.6	3.7	94.1
	Private	8	5.8	5.9	100.0
	Total	136	99.3	100.0	
Missing	System	1	.7		
Total		137	100.0		

Table 5A.22: Information System use

			Frequency	Percent	Valid Percent	Cumulative Percent
Valid	General Information Systems		39	28.5	28.7	28.7
	Decision Support System		66	48.2	48.5	77.2
	Data Mining System		27	19.7	19.9	97.1
	None of Them		4	2.9	2.9	100.0
	Total		136	99.3	100.0	
Missing	System		1	.7		
Total			137	100.0		

Table 5A.23: Evaluation of knowledge using Decision Support System

			Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Poor		24	17.5	17.6	17.6
	Poor		27	19.7	19.9	37.5
	Moderate		46	33.6	33.8	71.3
	Good		22	16.1	16.2	87.5
	Very Good		17	12.4	12.5	100.0
	Total		136	99.3	100.0	
Missing	System		1	.7		
Total			137	100.0		

The respondents of this survey are divided into 5 age groups, as is represented in Table 5A.19. The age group 45-54, which represents mostly employees who are in the middle age is the dominant group in the survey constituting 46 respondents or 33.8%. As represented in figure 1, the distribution of the age group is as following: the age group 21-34 represents 30.9% of the population, the age group 35-44 represents 23.5% of the population, the age group 45-54 represents 33.8%, and the age group 55-64 represents 11.7%. The number of the respondents of each age group is written on the bar of each category in Figure 5A.1.

**Figure 5A.1: Age group**

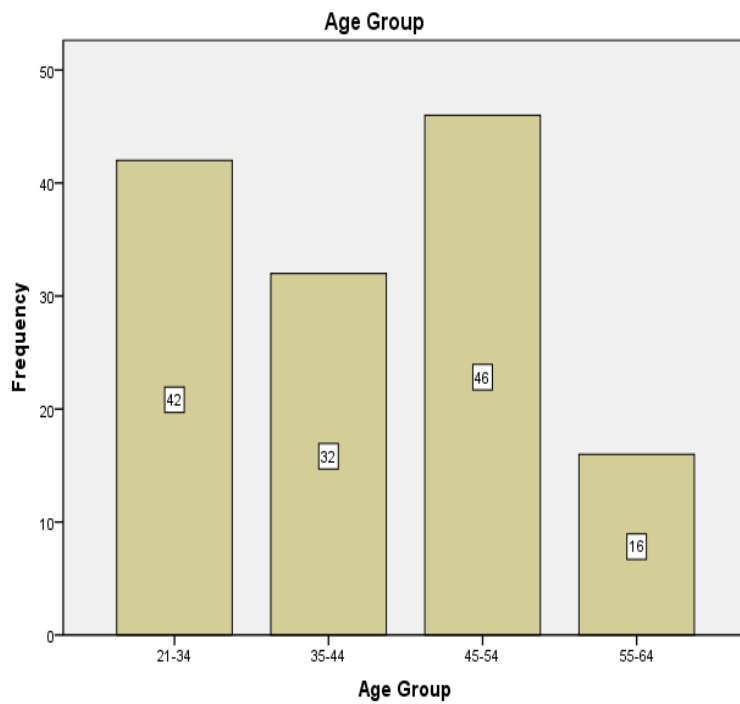
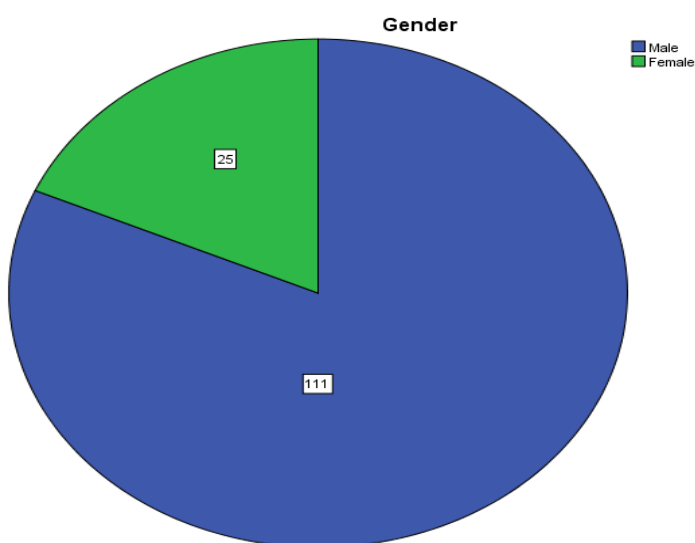


Figure 5A.2 and Table 17 shows that males constitute 81.6% of the whole population and females 18.4%. The total number of male respondents is 111 and the number of female respondents is 25. The number of people who did not give a valid answer for this question is 1. The percentage considered is the valid percentage which is calculated by ignoring the missing respondents.

**Figure 5A.2: Gender Division**



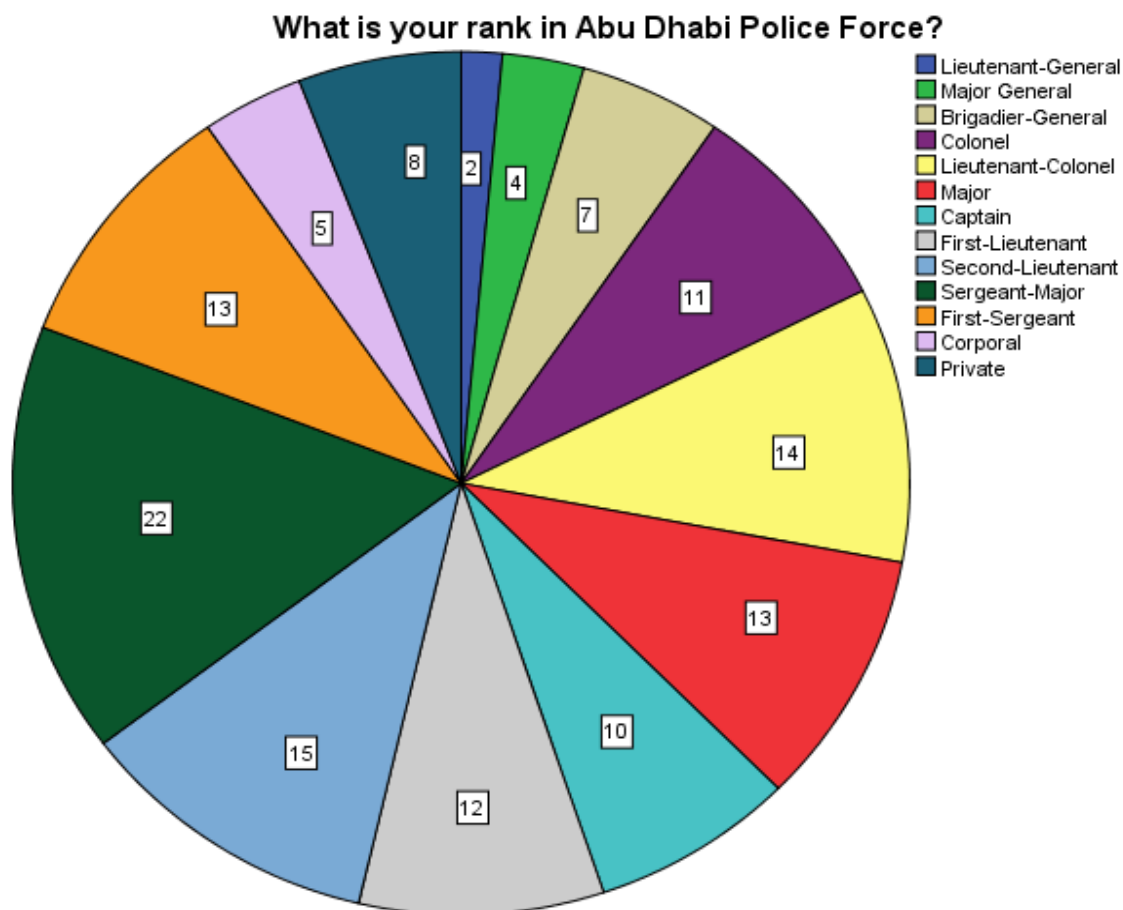
### 5A.3.2. The Formal Rank of Respondents

The findings in the table below show that the mainstream of participants are Sergeant-Major (22 participant or 16.2%). Followed by 11% Second-Lieutenant and 11.3% Lieutenant-Colonel. 1 person did not give a valid answer and 137 answered the question.

Table 5A.25: Rank at Abu Dhabi Police Force

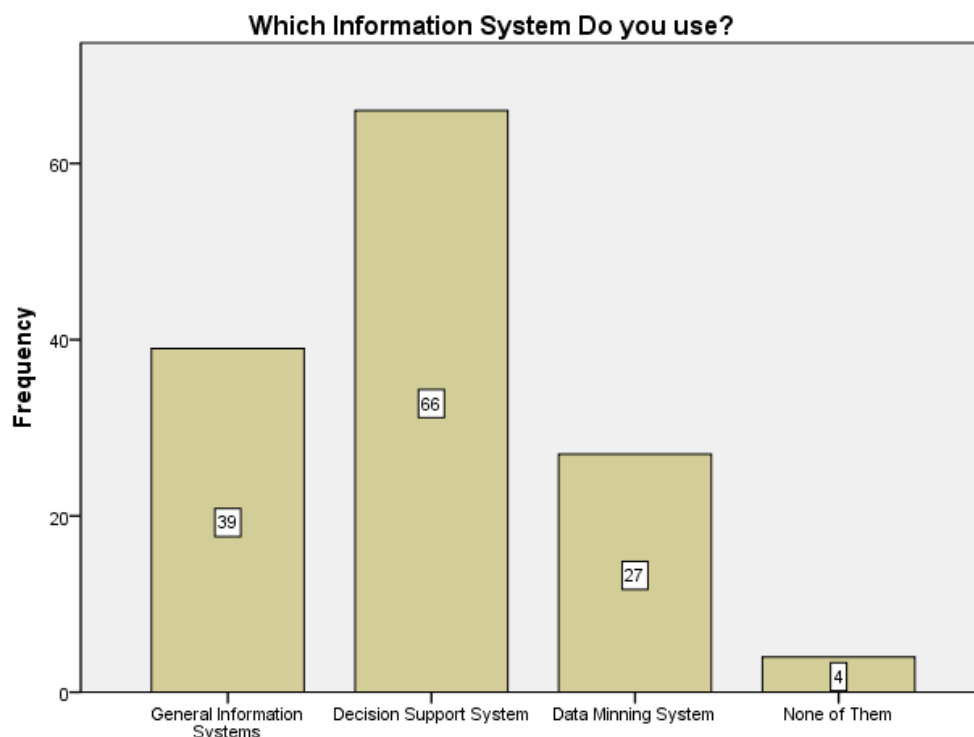
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lieutenant-General	2	1.5	1.5	1.5
	Major General	4	2.9	2.9	4.4
	Brigadier-General	7	5.1	5.1	9.6
	Colonel	11	8.0	8.1	17.6
	Lieutenant-Colonel	14	10.2	10.3	27.9
	Major	13	9.5	9.6	37.5
	Captain	10	7.3	7.4	44.9
	First-Lieutenant	12	8.8	8.8	53.7
	Second-Lieutenant	15	10.9	11.0	64.7
	Sergeant-Major	22	16.1	16.2	80.9
	First-Sergeant	13	9.5	9.6	90.4
	Corporal	5	3.6	3.7	94.1
	Private	8	5.8	5.9	100.0
	Total	136	99.3	100.0	
Missing	System	1	.7		
Total		137	100.0		

Figure 5A.3 Respondent Jobs Rank



The Figure below (Figure 5A.3) demonstrates the type of information systems used by respondents in Abu Dhabi. 48.5% of the respondents use a decision support system. The use of decision support system constitutes the majority of the respondents, more than any other system.

**Figure 5A.4: Use of information systems**



## 5A.4. Common Variance Method

Common method variance (CMV) is a method that refers to the extent of spurious covariance pooled amongst variables because of the common method deployed in collecting data (Malhotra et al. 2006). The method biases linked to CMV are considered problematic as the specific research under investigation becomes very difficult to distinguish from measurement items (Avolio et al. 1991). The common method bias means that “*the covariance among measured items is driven by the fact that some or all the responses are collected with the same type of scale*” (Hair et al., 2006:833). Data are likely to be subject to CMV in classic survey research tools for data collection since the participants respond to the questions in a particular survey at the same period of time. As a result, CMV is one of the most regularly cited concerns among researchers in general and particularly among information system researchers (Malhotra et al. 2006).

In this research Harman’s (1967) single factor test is conducted through SPSS 22 in order to test the presence of CMV bias among the measures in this survey. The process entails that an un-rotated factor analysis be applied on all items asked in the survey using Principal



Component Analysis (PCA). The test reveals the existence of CMV among variables if most of the covariance or 50% of variance is explained by one general factor. Harman's single factor test showed that there is no significant existence of CMV among variables in the current study. As is indicated in Table 5A.26, the percentage of variance for one component is 22.676%, which is less than 50%. Therefore, the results of Harman's single factor test showed that the variables have no substantial presence of CMV. Accordingly, there is no worry about CMV bias in this study.

Table 5A.26 Common Method Variance

<b>Total Variance Explained</b>						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.338	22.676	22.676	11.338	22.676	22.676

The two key data analysis phases conducted in the current research will be revealed next. The first phase includes the data preparation and assumptions of normality; whereas the second phase demonstrates the use of SEM as a tool for data analysis.

## **5A.5. Data Preparation and Assumptions of Normality**

The first step in any analysis practice is examining the data (Hair et al. 2010). Therefore, the data collected was inspected by the researcher for consistency and completeness before performing the analysis. Furthermore, every single statistical test serves the researcher in providing answers to the research questions and attaining the objectives of the current study. The importance and objective of each test have been explained. Also, descriptive statistics have been conducted to determine whether the data is normally distributed.

### **5A.5.1. Screening and Coding the Data**

After collecting the data and presenting it in SPSS data view, the dataset was checked for errors before the analyses. Three key stages are involved in the data screening procedure: screening for errors; pinpointing errors in the worksheet; and, finally, correcting the errors in the worksheet (Pallant 2013). Consequently, abiding by the stages suggested by Pallant (2013), the dataset was screened for errors and rectified. Additionally, the responses of the participants were coded into numerical values as demonstrated in the data view of the SPSS

file. For instance, the responses of the gender question “Female and Male” were coded into numbers “1 for male and 2 for female”. Coding data is the practice of allocating a particular number to a particular response in a construct (Hair et al. 2015). Moreover, to make sure that the participants answered the questionnaire genuinely and faithfully, four questions were negatively worded in the questionnaire. After re-coding the items and aligning them with other items in the construct, the Cronbach’s Alpha of the scale will increase and the item total correlation has to be a positive value.

### **5A.5.2. Missing Values in the Data**

In order to perform analysis on the data and the conceptual framework using Structural Equation Modelling (SEM), data has to be complete and clear of missing values so the researcher is able to run multivariate methods (Hair et al. 2015; Kline 2015). The main causes of missing data are the issues that occur throughout data entry and data collection (Hair et al. 2010). In the current research, there is a significant number of missing data because the participants have not answered all the items. The researcher kept the freedom of the participant to skip and answer the questions he/she wants with no obligations due to ethical concerns. The online application Qualtrics that was used for data collection allowed respondents to go over the survey and answer the questions they want with no restrictions. Therefore, a considerable number of the respondents skipped a number of questions required for the analysis. However, all respondents who did not provide a valid answer for the dependent variable were excluded from the data used to run SEM.

During data collection, information on some of the variables in the dataset are shown as missing values due to actions applied by the respondents answering the survey (Howitt and Cramer 2008). In order to solve the problem of missing values, it is desirable to simply abolish the respondents in case it will not affect the reliability and validity of the data. The most common method used in processing missing values in a dataset is referred to as case deletion; known as complete-case analysis and listwise deletion (Schafer and Graham 2002). Through the use of listwise deletion, a complete case is omitted from the analyses if any particular value is missing. Therefore, the researcher implemented listwise deletion method in order to handle the missing data in the dataset. Additionally, when using SPSS 22.0 for advanced modelling procedures, such as correlations, regression, factor, and ANOVA, the software will automatically perform listwise deletion of records with missing data. Listwise deletion is an “*ad hoc method of dealing with missing data in that it deals with*

*the missing data before any substantive analyses are done. It is considered the easiest and simplest method of dealing with missing data*" (Carter 2006: p.4). This method excludes all the records that contain variables with missing data from the dataset. The technique is forthright and involves the elimination of incomplete cases. Since the current study obtained a considerable sample size for data analysis, excluding incomplete cases and eliminating missing records on any variables has no impact on the result (Hair et al. 2010).

### 5A.5.3. Screening for Outliers

Outliers are cases representing observation points that are substantially distant (higher or lower) from the rest of the observation points in a specific dataset (Byrne 2008; Kline 2015). An outlier case signifies values that are different from other cases in the same sample. According to Grubbs (1969: p.1) "*An outlying observation may be merely an extreme manifestation of the random variability inherent in the data. ... On the other hand, an outlying observation may be the result of gross deviation from prescribed experimental procedure or an error in calculating or recording the numerical value*". Dataset with cases flagged as outliers are expected and normal in considerably sizable data samples such as the one used for the current research (N=647). However, outliers can have negative impact on the quality of data analyses. Osborne and Overbay (2004) stated three deleterious effects of outliers on statistical analyses: First, they can extremely influence or bias evaluations that may be of fundamental interest. Second, they normally act to decrease the power of statistical tests and maximize error variance. Third, if non-randomly distributed, they can reduce normality (and in multivariate analyses, violate assumptions of sphericity and multivariate normality), altering the odds of making both Type I and Type II errors. In order to detect the outlier and abstract them from other cases, the researcher computed the Mahalanobis Distance  $D_2$  through SPSS 22.0. The Mahalanobis distance  $D_2$  measures the distance between the mean of a distribution of cases and a case in the distribution; it measures the number of standard deviations from a point P to the mean of a distribution D (Field 2009).

$$\underline{x} = (x_1, x_2, x_3, \dots, x_N)^T \text{ Or Point P (The Mahalanobis distance of an observation)}$$

$$\underline{\mu} = (\mu_1, \mu_2, \mu_3, \dots, \mu_N)^T \text{ (The mean of a set of observations)}$$

$$D^2 = (N - 1)(h - \frac{1}{N}).$$

Multivariate outliers are conditioned as Mahalanobis distance at  $p \leq 0.001$  (Zaouali et al. 2005). A case is said to be a multivariate outlier if the probability allied with its  $D_2$  is equal to

or less than 0.001. D2 trails a chi-square distribution with degrees of freedom equal to the number of variables included in the calculation (De Maesschalck et al. 2000). After running the Mahalanobis distance test in SPSS 22.0 the result indicates the presence of univariate outliers among the data. As a result, 13 cases were abandoned from the dataset through applying multiple regressions.

#### 5A.5.4. Assessing Univariate Normality

In order to find out whether the data is normally distributed, the researcher performed descriptive statistics. Since normal data is a fundamental notion in parametric testing, valuation of the normality of data is essential for many statistical tests. Normality discusses the shape of the data distribution for a single metric variable and its equivalence with normal distribution (Alkhatib 2013). However, a normality test is not compulsory in SEM because the sample size is considerably large, as in the current study, and the outcomes of statistical tests would be declared unacceptable (Hair et al. 2010).

Kurtosis and Skewness measures are executed in the present study to provide a characterization of the data and describe the shape of its distribution. Skewness is a measure of symmetry, or more specifically, the lack of symmetry. A distribution is symmetric if the right side from the centre point looks exactly the same as the left side of the centre point (Mardia 1970). Moreover, Kurtosis is a measure of whether the data are heavy-tailed or light-tailed relative to a normal distribution. Namely, Datasets with small kurtosis incline to lack outliers and have light tails, while datasets with bug kurtosis incline to have outliers and heavy tails (Mardia 1970).

For univariate data  $Y_1, Y_2, \dots, Y_N$ , the formula for skewness is:  $g_1 = \frac{\sum_{i=1}^N (Y_i - \bar{Y})^3}{N s^3}$

$\bar{Y}$  is the mean,  $s$  is the standard deviation, and  $N$  is the number of data points. Note that in computing the skewness, the  $s$  is computed with  $N$  in the denominator rather than  $N - 1$  (NIST 2003).

For univariate data  $Y_1, Y_2, \dots, Y_N$ , the formula for kurtosis is:  $kurtosis = \frac{\sum_{i=1}^N (Y_i - \bar{Y})^4}{N s^4}$

$\bar{Y}$  is the mean,  $s$  is the standard deviation, and  $N$  is the number of data points. Note that in computing the kurtosis, the standard deviation is computed using  $N$  in the denominator rather than  $N - 1$  (NIST 2003).

Skewness and Kurtosis may happen either together or independently in a particular variable (Kline 2015). Therefore, the distribution of the variables in the current study was evaluated for normality through the calculation of skewness and kurtosis values.

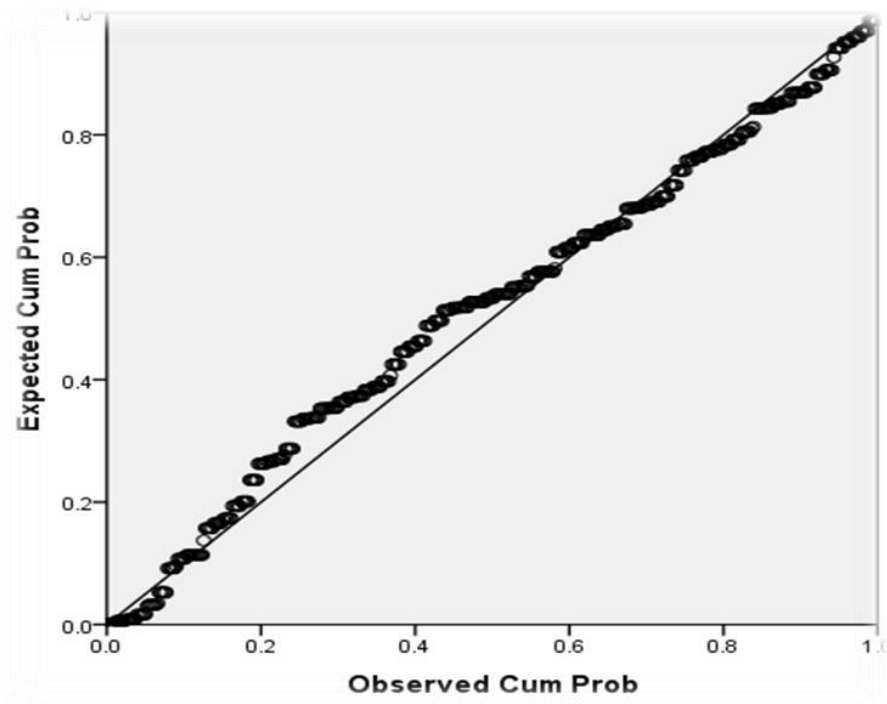
Also, the histogram is a real graphical practice to show the skewness and kurtosis of each of the items and visually assess their normality. Table 5.19 reveals the skewness, kurtosis, mean, and standard deviation for each of the items and their latent variables used in the study.

#### **5A.5.5. Assessing Multivariate Homoscedasticity, Linearity, and Normality**

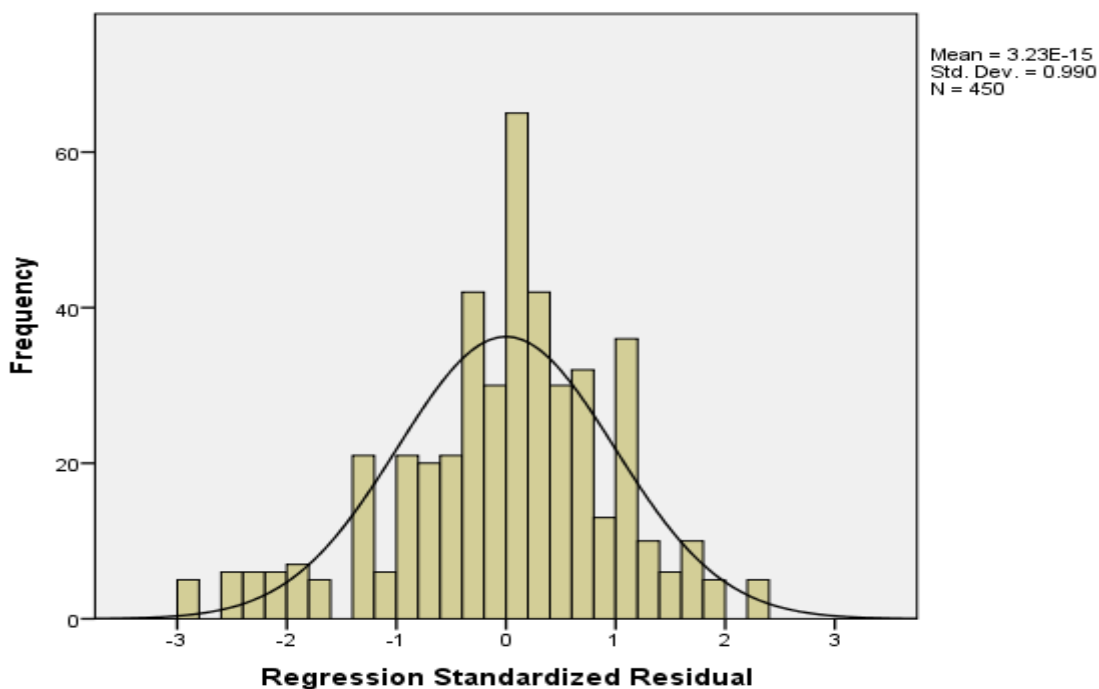
The ultimate stage in examining the data is running analyses for the norms inspiring the statistical roots for multivariate analysis; for instance, homoscedasticity, linearity and normality (Hair et al. 2010). Multivariate statistical approaches regularly involve the postulation of multivariate normality because of the convolution of the relations that process a big number of variables (Hair *et al.*, 2010). Before undertaking any analyses of the variables in the data set, it is vital to make sure that multivariate normality has been encountered. Multivariate normality indicates that all variables used in a particular study are scattered normally in relation to each other. Multivariate normality of data is one of the most fundamental requirements for the application of SEM analyses; especially if SmartPLS 3 is deployed in the general conduct (Byrne 2013). In the current study, the research used SPSS 22 regression program in order to consider multivariate normality. The assumption of multivariate normality is fulfilled when the standardized residuals are scattered normally and the dots are bundled near the line in a normal probability plot (Norusis 2008).

As presented in the normal probability plot, Figure 5A.18, the standardized residuals are clustered towards the line in the graph. Additionally, the standardized residuals are distributed normally, as shown in Figure 5A.19. Therefore, the rule of multivariate normality is confirmed. The rules of homoscedasticity and linearity are evaluated by implementing a regression method. In both Figures 5A.18 and 5A.19, behavioural intention was considered the dependent variable and culture, social influence, facilitating conditions, trust, perceived ease of use, perceived usefulness, information quality, attitude, and perceived risk were considered independent variables. The analyses were conducted after selecting regression and then linear via SPSS. Because the plot produces a random scatter (rather than a funnel-like shape or u-shaped), the norms of homoscedasticity and linearity are fulfilled (Norusis 2008).

**Figure 5A.41 Normal P-P Plot of Regression Standardized Residual**



**Figure 5A.5 Histogram of the Standardized Residuals**



## 5A.6. Structural Equation Modelling

The current study adopted a two-step approach in order to apply SEM analysis shadowing the commendation of Anderson and Gerbing (1988). The first step encompasses the

measurement model of the current research; whereas the structural model associated with the dependent and independent variables is incorporated in the next step. In the first step of this chapter, the researcher provided a basis for assessing the validity of the factor structure through performing a confirmatory factor analysis (CFA) relying on the interdependencies between latent variables and observed indicators. One of the main qualities of SEM is the illustration of latent variables established on their relativity to detected indicator (Garson 2012). In the second step of the chapter, the hypotheses listed in the model are tested in relation to the dependent and independent variables in the study.

### **5A.6.1. Confirmatory Factor Analysis**

*“Confirmatory factor analysis (CFA) is a statistical technique used to verify the factor structure of a set of observed variables. CFA allows the researcher to test the hypothesis that a relationship between observed variables and their underlying latent constructs exists. The researcher uses knowledge of the theory, empirical research, or both, postulates the relationship pattern a priori and then tests the hypothesis statistically”* (Suhr 2006: p.231). The latest approach in piloting CFA in social science is the deployment of SEM (Worthington and Whittaker 2006). The majority of statistical approaches only use single statistical test to conclude the connotation of the analysis. On the other hand, Structural Equation Modelling (SEM), CFA in particular, depends on a number of statistical tests in order to conclude how well the model fits to the data (Suhr 2006). Listed below are a number of statistical tests determined by CFA:

- **Chi-squared test**

*“The chi-squared test indicates the difference between observed and expected covariance matrices. Values closer to zero indicate a better fit; smaller difference between expected and observed covariance matrices”* (Suhr 2008: p.2).

- **Root mean square error of approximation**

*Root mean square error of approximation (RMSEA) tells us how well the model, with unknown but optimally chosen parameter estimates would fit the population’s covariance matrix. RMSEA of between 0.08 to 0.10 provides a mediocre fit and below 0.08 shows a good fit. However, more recently, a cut-off value close to .06 or a stringent upper limit of 0.07 seems to be the general consensus amongst authorities in this area* (Hooper et al. 2008: p.54; Kenny et al. 2015).

- **Goodness of fit index and adjusted goodness of fit index**

The goodness of fit index (GFI) is a measure of fit between the hypothesized model and the observed covariance matrix. The adjusted goodness of fit index (AGFI) corrects the GFI, which is affected by the number of indicators of each latent variable (Baumgartner and Homburg 1996).

- **Comparative fit index**

The comparative fit index (CFI) analyses the model fit by examining the discrepancy between the data and the hypothesized model, while adjusting for the issues of sample size inherent in the chi-squared test of model fit (Gatignon 2010), and the normed fit index (Bentler 1990). CFI values range from 0 to 1, with larger values indicating better fit; a CFI value of .90 or larger is generally considered indicating acceptable model fit (Hu and Bentler 1999).

The aim of the current SEM is not to show if the consigned items measure one factor or a number of factors as the items are constrained to load on a single factor in CFA (Worthington and Whittaker 2006). However, CFA intends to test the hypothesis that shows the existence of a relationship between latent constructs and observed variables and confirm to what extent the theoretical model, derived from unified theory of acceptance and use of technology and other theories, of the research is valid in the new sample data (Suhr 2006). As a result, CFA is performed in this study to approve academically-driven factors without the necessity of using of EFA.

## **5A.6.2. Measurement Model Tests**

In order to evaluate the proposed theoretical model, two fundamental bundles of statistical approaches are utilized. The first one is goodness of fit (GOF) criteria indices; the next one is the validity and reliability of the theoretical model (AlKhatib 2013).

### **5A.6.2.1. Goodness-of-Fit Criteria Indices**

The goodness of fit index (GFI) is a measure of fit between the estimated population covariance matrix or the hypothesized model and the observed covariance matrix; corrected GFI results the AGFI (adjusted goodness of fit index), which is influenced by the number of items related to each latent variable (Baumgartner and Homburg 1996; Levine, 2016). GOF indices reveal the discrepancies between the expected values in the proposed theoretical model and the observed values. Consequently, the primary mission of model fit practice is to



indicate the GOF between the sample data collected and the theoretical model specified for the current research (Byrne 2013). CFA is applied on the proposed theoretical model before performing the path analysis. CFA is conducted on the 10 latent variables and their items that form the components of the theoretical model. The theoretical model proposed for the study utilized 54 items extracted from information system literature and other social sciences research, as represented in Table 5A.4.4. Table 5A.5.21 exhibits the latent variables and the items used in CFA.

## **5A.7. Chapter Conclusion**

In this chapter the researcher discussed the data analysis methods and demonstrated the results of the current study. The reliability and validity of the constructs in the pilot study were assessed through the use of Cronbach's alpha. The test shows that the eight constructs used in the study were reliable and valid. Missing data were aborted from the survey results through listwise deletion process after collecting data using paper and online survey (Qualtrics) for data collection. Additionally, Mahalanobis distance was utilized in SPSS 22 in order to check for outliers. 16 univariate outliers were dropped from the dataset based on the multiple regression tests. Also, in order to assess the univariate normality, the researcher used skewness and kurtosis results. The results obtained showed the data were normally distributed. The measurement and the structural model in the current research were assessed using SmartPLS 3 for structural equation modelling. Latent constructs were evaluated for validity and reliability. The results show that they all had no discriminant validity and were deemed reliable.

## **Chapter 5B**

# **Results Qualitative Data Analysis**

## **5B.1. Chapter Introduction**

This chapter discusses the results of the qualitative research looking at how a number of very important decision makers at APF obtain and use, or “harness” information from knowledge during their strategic decision-making activities to encourage the organisational learning. It then looks at how they use information to engage in organisational wide learning. The quality of data and information and ultimately knowledge are very important for APF.

## **5B.2. Qualitative Results**

The results summary is provided in the Table 5B.1 and then explained in the sub-sections to follow.

Table 5B.1: Summary of responses from key decision makers

	1	2	3	4	5	6
Position/Rank	Lt. General	General	General	Colonel	Colonel	Colonel
Position	Deputy Commander in Chief	Head of Police Operations	Head of Police Training	Head of Police Education	Head of Investigation	Deputy Head of Human Resource Planning
Decision	Major changes in promotions. He increased the minimum period to be promoted to the next rank by one year. For example, a Captain can be promoted to Major after 4 years from the date when he was promoted to Captain. The new decision makes it 5 years.	Introducing a new unit to support officers on duty. This unit acts as a statistics unit established in each major department to carefully analyse data generated from daily operations and reflect back to decision makers to monitor the effectiveness of each procedure made by staff.	Contracted a national training organisation to provide training. This organisation provides specific training to police staff that fits their job descriptions to enhance their policing skills, which includes but is not limited to: crime prevention, forensics, traffic monitoring, money laundering and anti – smuggling.	Amendments to some courses. With collaboration with NYPD and Singapore Police the education modules in Police college were updated to introduce best practice modules. After graduation police officers go on 2 years implementing what they learned in a different department every 4 months and transmitting that knowledge to other staff.	Using new advanced tools that provide more accurate results. Signed a deal with London metropolitan police to import cutting-edge technology along with contracted expertise.	Investing in hiring more staff for a period of 5 years. Keeping 5% annual job substitution and aiming to reach 95% nationalization. Substitution can take up to 2 years to complete and that is believed to be a long enough period to gain the experience and knowledge necessary to replace staff, especially in leading positions.
Data/Information /Knowledge used	Data from different sources from inside and outside the organisation, including personal judgement. For example: Abu Dhabi government Budget, total number of police officers in the organisation, work load on each officer and consulting best practices.	Most data came from citizen feedback obtained over a period of time, staff observation; data gained from traffic reports and crime scenes.	There was market research conducted to find the best training providers for a specific type of skill development.	Data are generated on a daily basis from learners. These data suggested the amendments.	Data from weekly reports submitted by the investigation teams.	Surveys conducted with current employees, annual reports, performance assessments, etc.
Learning	The data helped them reach	The analysis of the feedback	The research data helped	The data were analysed,	The knowledge gained	The knowledge obtained was

	<p>the decision taken</p> <p>Data of good quality can help making right decisions and limiting waste of resources.</p> <p>Right amount of experience required to promote staff is essential to prevent crime.</p>	<p>allowed gaining insight into an issue, which could be addressed later.</p> <p>The analysed data helps decision makers in ADPO to keep track of its services provided to society and to keep on improving them accordingly.</p>	<p>improve the understanding of the training needs. The decision to contract a national organisation was based on evidence that they were able to be competent</p>	<p>which showed potential improvements that could be made if amendments were conducted</p>	<p>from the analysis of the data helped understand the problem better.</p> <p>Understand criminal behaviour better, which made it easier to track when incidents happen.</p> <p>Criminal behaviour is understood and crime better prevented.</p>	<p>related to the need for staffing. This was done by considering a 5-year plan</p>
<p>Use the knowledge to help Abu Dhabi police</p>	<p>The knowledge gained was deployed in the decision-making process.</p> <p>The knowledge gain was announced among staff, which made them more self-oriented on how knowledge can influence the vision of Abu Dhabi Police and encourage learning.</p>	<p>The knowledge gained was translated into action and a new unit was introduced.</p> <p>Knowledge showed the necessity of analysing data thoroughly and to understand it in a way it can be translated in performed actions that can maximise customer satisfaction.</p>	<p>The knowledge was used to make the decision. The results provided skill improvement and cost reduction as part of organisational learning.</p>	<p>The amendments provided up-to-date information added to the courses and this will help APF to learn from.</p>	<p>The knowledge was used to introduce these tools, which in the long run, will prove to be cost effective.</p>	<p>The knowledge gained will help improve the hiring process, and reduce hiring costs. This will serve as a learning for APF.</p>

This research reveals that effective use of information/knowledge can contribute towards the intuitiveness and generation of knowledge that key decision makers then share with other civil protection/security organisation workers to increase effectiveness. The data was collected from six pertinent individuals using “information space”. Data was collected on each of the six stages: Information scanning, problem solving, abstraction, diffusion, absorption and impact, as discussed in the sections to follow:

### **5B.2.1. Sources of Diffused information/knowledge and its Scanning**

The major decision makers scanned the internal and external information in the following ways, as described by them in Table 5B.2 below:

Table 5B.2: Sources of information used by decision makers

Position	Decision	Approach to scanning Information/knowledge
Deputy Commander in Chief	promotions:	<p>It was found that there are many sources of information which influence decisions, in particular for promotions both from the Public and Private arena. This is constantly being monitored by the Deputy Commander in Chief and his team. Personal Intuitiveness was used in selecting many of these sources, based on their intuitive best practices developed over the years.</p> <p>A great deal of information came from the national stats office or government departments or mandates from the Abu Dhabi Executive Council. Typically, this is being more generalized information and is sometimes mandated and pushed onto the Deputy commander’s departments and in some cases actively scanned. For example, as part of Emiratization (in the Abu Dhabi Police Force) there will be a mandate in the form of generalized data and in turn this would be used as a basis when data is fed back to the Abu Dhabi executive council when updating on progress. Politically sources of information adopted a generic form where possible to avoiding backlash on decision making. Inevitably some of this information is sensitive and approaching the person who safeguards and provides this information is key (The gatekeepers of this information).</p> <p>The internal information is mostly from internal MIS and HR systems regarding key metrics on staff length of service, competency and</p>

		<p>performance, and is used by the Deputy Commander as part of his data collection and information for promotions</p> <p>There is also information from a third category, which is the public/proprietary domain such as information and data from partner police forces in Singapore or the NYPD, USA police forces. This information commonly falls into the best practices domain.</p> <p>The 'Old' system of promotion which relied on service length needed challenging so a drive to pool various sources of information by the Deputy commander was initiated in a coherent way to support the overall and amendment to the promotions systems and move to a more Merit based and competency model. This has driven the move and increase for promotion waiting across all levels to increase by 1 year.</p>
Head of Police Operations	Support for officers through statistical unit	<p>There are various internal and external sources of data and information which are used. There is a great deal of information provided by the public/citizens and the volume and magnitude of this information is an issue. A great deal of internal crime data is also scanned and utilised provided by officers in the field and on the front line, together with summarized reports used for senior level meetings. Formal and informal alliances with technical experts were also required due to the decision maker being new to IT and business intelligence.</p> <p>The Head of police operations often says, "We will always support you and understand your needs". This is directed at police staff to ensure that they will always have access to the most relevant information and data to carry out their role effectively. This could be in terms of the best technology, training, resources (vehicles, tools, weapons etc.), all of which can be enabled and enhanced through the decision to introduce the statistics unit</p>
Head of Police Training	National training	<p>External expertise in police training is researched and best practices identified, (e.g. Crime prevention, forensics, traffic monitoring etc.) through partner organisations, including NYPD and Singapore police force. Existing internal training practices are constantly analysed internally through discussions with peers and subordinates. The Head of Police Training has often iterated, "Best practices and excellence in training is a prerequisite for every officer". Internal HR systems outlining the level of training for individuals and their progress and past history/achievements are also</p>

		constantly scanned and looked at holistically to decide on areas for further training. "The Smartest investment is investing in human resource" (Head of police training).
Head of Police Education	collaboration with NYPD and Singapore/ amendment s to leading courses	The key information sources emanate from external sources and in particular from the NYPD and Singapore police best practices. These have included data and information in the form of teaching and effectiveness courses. Also information from police staff sent to educational courses which have been tailored for the ADPF hosted by NYPD and Singapore police trainers. The internal educational courses are also a source of data and for every course there is a series of steps: plan, execute, evaluate, improve and amend. The information from internal sources was concrete and information from the external sources abstract.
Head of Investigation	Using new advanced tools	It is a requirement (for the head of investigations) to stay up to date on all of the latest technology to serve and advance the investigations unit. This information is from external exhibitions, from external companies and experts and specialists in police crime investigation cutting edge technologies. Constantly keeping up to date with the advances involves being fed this data but also actively investigating and pursuing new sources.  Recently two technology sources have been of much interest and had a significant impact. This includes face recognition technology with much improved capabilities for many applications. The other is the Ultra Violet (UV) scanner technology for crime scene analysis. This was brought to the unit by attending a targeted exhibition. However, sometimes it can be generated by partner companies or simply by something that is available publicly.
Deputy Head of Human Resource Planning	in hiring more staff for a period of 5 years	The information sources which are greatly used and influence decisions have been derived from external government bodies, executive council and the Emiratisation drive. Also from internal sources which have been analysed holistically with these external sources. A great insight from this data is the importance and drive of Emiratisation which has influenced many present decisions and future ones. The drive from the government and or Government Emiratisation is to ensure Emiratis take up key roles in leading institutions. This means investing in staff through this 5year period, which includes appropriate academic training, continuous mentoring and assessment, shadowing of experts (usually non Emirate).

The data collected shows that there are many sources of data which have been made available in data collection scenarios from the public and private domains and utilised by the decision makers in question. In the public domain this came from the general public reporting crime or through community policing initiatives, together with public and national crime statistics. There are also specific private or sensitive sources of data, including that from the Abu Dhabi Executive Council and other government departments which also act as gatekeepers with mandates in the form of sensitive data (e.g. Emiratization goals for the police department). Conversely some data is more general and used for guidelines, potentially to improve service activities (e.g. Information from the National Statistics Office). Other external sources of data are also available to be scanned. This would typically include so called public/private proprietary partner organisations, such as the NYPD or Singapore police force, whereby best practices are embraced, including crime prevention techniques, forensics, traffic monitoring and the latest technology and tools. Internally the data can include internal MIS and HR systems which provide a constant source of performance and effectiveness of police staff, which can in turn be used for improving training, education, promotions and overall professionalism and effectiveness. This will help the organisation to enter the organisational learning spiral. There are other sources of internal data which are viewed holistically, such as crime data collected and presented by front line officers and summary reports and data provided to line managers. All of this data can be used to make decisions and improvements and provide insights for individual officers, groups and departments for crime prevention strategies and the more effective use of technology.

### **5B.2.2. Problem Solving: Codified in solving crime: Codified, abstract, diffused in generalised for application**

The problem solving undertaken by the major decision makers is explained in Table 5B.3 below:

Table 5B.3: Problem solving

Position	Decision	Approach to solving the problem
Deputy Commander in Chief	Promotions	Based on the internal and external sources of data this information is used to solve problems associated with undertaking fair and effective promotions of staff. A salient problem was with the old system of promotion whereby people were promoted automatically, not necessarily on merit, but more on



		length of service. These new sources of information are used by the Deputy commander to solve this issue in a holistic approach. By extending the period for promotion by 1 year across all ranks there is then the ability to enforce a new promotions approach. Certain criteria are used and certain goals (cost savings, better staff, and level playing field for officers). The Deputy Commander has often said that “this approach and decision will make Abu Dhabi a safer place to live.” “This decision will improve not only the police officer but the society as a whole”. The idea is that by improving and extending the promotion period, it provides greater opportunity to develop the individual’s policing skills and professionalism, which in turn is reflected in the policing done in society.
Head of Police Operations	Support for officers through statistical units	The Head of Police operations has always said, “Having the right data will lead to improved efficiency for the police and solving crime better in a more effective way”. Through the statistical units they believe they would be able to provide the right tools to improve their policing and identifying which areas of policing needed improvement from the various sources of data collected. There are many sources of data and having a mechanism to filter the useful data from the not so useful data is key. This could be achieved through a dedicated statistical unit. The statistical unit would allow the classification of difficult types of crimes, including new unusual crimes. The holistic and coordinated data and information provided by the statistics unit allowed more dynamic resolution to existing and, more importantly, new threats “making the best use of human resource”.
Head of Police Training	National training	The training needs and evolving needs of the organisation could be improved and evolved through a more comprehensive national training scheme. A more tailored program for police staff was required, based on the data and information which was collected internally and scanning the best practices in other police force agencies.
Head of Police Education	collaboration with NYPD and Singapore for amendments to learning	The scanning of information helped identify the key challenges and problems across increasing staff skills, or the need for a better police organisation to serve society, “Education is the strongest tool to fight crime”. Head of police has said, “our education and performance is reflected in society”. A common issue was that a number of police officers did not have the required level of education, whether that was academic, English language skills or other. This relevant data and information has led to a more comprehensive approach to the education of existing staff and the

	courses	recruitment and training of new staff. The problem of low impact and irrelevant education has been tackled replacing this with better approaches to education. For example, there are now many more prerequisites for recruiting in the police and levels of education before recruitment, during training and throughout the working life span.
Head of Investigation	Using new advanced tools that provide more accurate results	From attending exhibitions and speaking to specialist/experts the key technology enablers to tackle specific crime areas have become possible. The notion of effectiveness will be based upon the officer's past knowledge, experience and intuitiveness. For example, a better approach was required to tackle the problems faced with returning criminals at UAE borders and entry points who had been banned from returning to the UAE. The advances and proliferation of expert fake passports were not stopping these criminals returning. The knowledge gained on the potential and accuracy of facial identity technology has allowed a new solution to this problem. It was found that this technology was very difficult to trick or fool. Overall, this will help in organisational learning
Deputy Head of Human Resource Planning	Investing in hiring more staff for a period of 5 years	The key knowledge which has been obtained and the problems tackled based on this information is how to enforce elicitation for key positions, how to implement this and the appropriate training, assessment and continuous monitoring required. Candidates who have been selected to have this 5-year training are mentored and continuously assessed during this period and will also, when they return, shadow the expert (who most often is non Emirate) who they will eventually replace.

The data collection shows that the information/knowledge scanned from internal and external sources, including personal perspectives in the civil protection/security organisation, can be utilised and structured to tackle specific issues and problems. A better approach to tackle promotions based on data which is grouped into merit and performance codified knowledge is a good example of this. What also emerges from this are new criteria, goals and metrics, such as cost savings and a level playing field for officers. The importance of crime data and statistics also becomes apparent and its role in justifying a statistic unit to help to solve the issues around having the right data available to improve policing across many departments and functions. The relevant data can be grouped and filtered more readily providing the relevant information to specific departments, improving crime fighting and making better use of human resources. Training and education in the civil protection/security organisation also benefits from this, by providing a more structured and beneficial approach and encouraging learning. Insights into training requirements are abstracted from the relevant data and structured into specific requirements, such as the

need for a national training scheme. The Education needs for the civil protection/security organisation can be filtered and become more focused, such as minimum academic achievements, English language competency and specific policing expertise. The insights into technology and its role across specific areas of crime also allows the key areas to be abstracted and focussed on to tackle specific problem areas, such as the protection of borders through advanced facial recognition technology. The data and information on Emiratization requirements from the government and internal monitoring has provided insights which can now be structured to tackle the Emiratization quota and also the approach to replace non Emeriti experts in a more coherent and phased approach

### **5B.2.3. Abstraction and Decision Making: Knowledge shared/diffused in a codified and abstract way (Organisational learning) in civil protection/security organisation**

Once the decision is made then the knowledge is shared/diffused in a codified and abstract way and the organisational learning takes place at APF. The abstraction by decision makers is explained in Table 5B.4:

Table 5B.4: Abstraction and decision-making

Position	Decision	Abstraction and decision making
Deputy Commander in Chief	Promotions	Insights and intuition from the decision included the opportunity to utilize the extra year to improve the individual across many areas: greater professionalism, increased policing skills. Introduction of fitness test and metric for all police officers, Greater Overall Physical fitness.
Head of Police Operations	Support for officers through statistical units	This has allowed broader impact across Improved crime solving techniques and approaches and particularly for the following categories of crime: drug smuggling, border patrols, cybercrime, identity theft. The ability to utilize the data from citizens, police officer observations and traffic reports.
Head of Police Training	National training	Insights have included further decisions on education and skills enhancement and more personalised training. Greater measurement and training for improved officer effectiveness and continuous monitoring and development. The insights will enable the organisation to learn.
Head of Police	collaboration with NYPD	The insights gained have allowed new courses to be improved and tailored considerably across the board. This in turn has also allowed

Education	and Singapore amendments to new courses	better use of validation tools in other areas including statistics (crime rates), line manager feedback, problem solving abilities, performance in jobs and level of competency of staff. The overall education and standard of policing is also improved: “by educating you we expect you to solve problems in an effective and rapid manner”.
Head of Investigation	Using new advanced tools that provide more accurate results	The broad remit and knowledge to implement the technology across various areas and according to a particular process is possible now. This may involve initially experts accompanying police teams in utilising the technology. This in turn then involves competent staff passing on the knowledge and expertise to junior staff and so on.
Deputy Head of Human Resource Planning	in hiring more staff for a period of 5 years	Government directions/the driver for percentage of Emiratization in the country have influenced the decision on 5-year training for staff and additional hiring. A set of criteria has evolved from this, which is in turn used to implement the training. A better way of monitoring and collecting the effectiveness of this can be derived and also effectively fed back to the considered government agencies. The shadowing approach to replace ex-pats in key roles is also a key result and component of this.

Specific insights from various senior agents can lead to decisions, which are applied to a broad range of situations in the APF. The decision and approach to extend the length for promotions can be applied, it is believed, to a wider range of functions, from improved professionalism and policing skills to the introduction of metrics for improved physical fitness requirements for officers. Another example of this would be the broader range of crime solving approaches that can benefit from the introduction of statistical units from cyber-crime and border patrols to drug smuggling and identity theft. This can also be seen in the decisions taken on training and education, whereby more personalised training can be developed and broader metrics for continuous monitoring and improvements used. For police education the decisions made can have an impact on the type of courses to pursue and also on various other validation tools which reflect on these decisions. A more comprehensive approach to education will reflect on better crime statistics, problem solving abilities and performance. The use of specific technology can also now be applied to various functions and departments within the APF and in turn initiate a cycle of teaching and training on these technologies. The decisions on hiring more staff is in line with the Emiratization push in key organisations in the UAE. This decision will impact this and can be applied to a broader area of related functions. An example of this would be the replacement of non-Emeriti experts in the APF with new Emirati police staff. The process and approach to be used is another area which is also influenced by the decision to hire more staff over the next 5 years. Additionally, the progress and

feedback which can be given to the appropriate government departments is also improved and enhanced. The APF is then able to accurately provide information and present their strategy for meeting the government goals for Emiratization. It can be seen, therefore, that many wider situations and functions are affected by some of the key decisions.

### 5B.2.4. Diffusion: Organisational Level Impact

The diffusion of knowledge by the decision makers is explained in Table 5B.5 below:

Table 5B.5: Diffusion of knowledge

Position	Decision	Decision maker diffuses the learning to a select group
Deputy Commander in Chief	Promotions:	This is diffused to a small group in terms of 7 senior brigadiers reporting to the Deputy commander, outlining the new process for promotion and new criteria. This is then propagated further from this level throughout the organisation: "We must comply with Abu Dhabi 2030 vision and strategy". The feedback would generate a lot of learning of intuitiveness of the decision makers on promotional matters, such as whether the people who want promotion would actually try to fulfil the criteria in essence.
Head of Police Operations	Support for officers through statistical units	This was fed to various decision makers at the brigadier level initially. Then to various divisions within the relevant areas. Police officers in the field also directly benefit from this and the knowledge attained.
Head of Police Training	National training	Communicated to the heads of department, improvement and best practices for police officers in the field
Head of Police Education	collaboration with NYPD and Singapore, amendments to some courses	The knowledge and information was diffused to a select group within the Head of Education sections first
Head of Investigation	Using new advanced tools that provide more accurate results	The learning is provided to experts in the specific departments and specific experts who will utilize the technology first. A key learning is that there is very strict criteria and authorization required for use and access, within different divisions and the organisation as a whole.

Deputy Head of Human Resource Planning	Investing in hiring more staff for a period of 5 years	The learning and knowledge attained is first shared with a select group within the Human Resource planning department and also with the seven senior members of the executive team and the Deputy Commander. There are many key insights which allow them to monitor the effectiveness of this decision. In turn this information will also be used when dealing with government agencies, in particular the Emiratization department, who will need feedback on how far the police force has progressed in Emiratization goals.
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A great deal of the insights gained from various senior staff in the ADPF are now shared with a select group of peers. This knowledge has been filtered and the important key insights abstracted. Initially in most cases a great deal of this information may be shared between the senior seven Brigadiers reporting to the deputy commander, who will then further propagate this knowledge and learning to key people within their departments. This is certainly the case in terms of promotions, recruitment and education and training. In terms of the statistical units, it will follow the same process but an important diffusion is to police officers in the field and on the front line. The advanced tools and technologies follows a different path and will flow from the head of the relevant department to key experts who will utilize these tools in the most effective way. It is important to note that this diffusion is focussed and specific, as there are a great many sensitivities in the use of these tools and who is able to use the tools. This not only applies from an external perspective, but also internally within the APF, including various divisions and the organisation as a whole. The key insights from the decision to hire more staff over a 5-year period, are firstly shared with the senior brigadiers, as above, but then with the select members of the HR and planning group. This group in turn will also need to diffuse this information to some external bodies, such as the relevant Emiratization groups in the government to report on progress in Emiratization for key positions of expertise.

### **5B.2.5. Absorption: Organisation-wide impact on users of the decision output**

Here, the newly codified insights are applied to a variety of situations producing new learning experiences (knowledge is absorbed and produces learnt behaviour and so becomes 'uncodified' or 'tacit'). The absorption facilitated by the decision makers is explained in the table

below, where the decision maker communicates (new) knowledge to other organisational stakeholders, as in Table 5B.6:

Table 5B.6: Absorption and dissemination of knowledge

Position	Decision	Decision maker communicates (new) knowledge to other organisational stakeholders
Deputy Commander in Chief	Promotions:	<p>Organization dissemination occurs via certain channels: Intranet, meetings, workshops and to field staff via technology. In addition, Brigadiers pass to the deputy, who in turn pass it to subordinates, verbally or paper based.</p> <p>There is rapid absorption by staff.</p> <p>Decisions are tested first with the opportunity to critique before they become solidified and enforced. Opportunity is afforded for staff to debate, complain and provide suggestions.</p> <p>Systems of summarizing and collecting stats, which are then presented to brigadiers, who will meet with peers and commanders to then decide on the effectiveness of these decisions and the necessary actions.</p>
Head of Police Operations	Support for officers through statistical unit	<p>Insights were communicated via each specific unit.</p> <p>Tangible improvements and results, also constant and immediate feedback.</p> <p>New uses of statistical units and associated systems have spawned new approaches to power of attorney crime identification and prevention or identity fraud. This has led to greater and more effective tools for staff throughout the organisation and also a lot of cross functional integration and automation of crime detection and analysis. As this subject commented: "We are all police, everyone in society can be police, and everyone's opinion can be heard, regardless of rank, brigadier to officer".</p>
Head of Police Training	National training	<p>The knowledge gained was shared with senior peers. This helped to increase training needs and specific requirements for different units.</p> <p>Change is always rejected and challenged. The learning is usually passed down via the first group of staff who undertook the training and then fed back to other staff, formally and informally.</p> <p>The head of training not only has used this to improve training courses but also, in the long run, has allowed for greater cost reduction with more tailored and effective courses.</p>
Head of Police Education	collaboration with NYPD	<p>Organizational dissemination occurs via main channels.</p> <p>Training needs are better understood, and specialist courses are more readily sourced. It is a process of trial and error, have to try the courses first, and</p>

	and Singapore , amendments to some courses	<p>feedback from early participants influences other students, especially if they see a direct correlation to the new education leading to promotions and specialist skills which are in demand in the police force.</p> <p>The head of Police education has used this decision as a basis to further tailor education and also as a mechanism to provide UAE specific best practices, which in turn can be shared with other police forces with their own training course.</p>
Head of Investigation	Using new advanced tools that provide more accurate results	<p>The learning is first shared with peers and then via the relevant units. A lot of the specialist technologies are specific to certain units and also having access to certain tools and data is restricted and secured between departments and within the organisation until appropriate clearance and justification is made available.</p> <p>The decision to employ cutting edge technologies has had great impact on crime solving, being more effective and efficient. Criminal behaviour is better understood through tracking and monitoring information. The use of advanced face technology is one great example, especially for the borders entry and exit.</p> <p>The head of investigation has also acknowledged that some of the advanced tools can be applied to a broader spectrum of crimes and crime prevention. There has also been a view to a quicker adoption and proliferation of key advanced technologies and tools.</p>
Deputy Head of Human Resource Planning	Investing in hiring more staff for a period of 5 years	<p>This approach allowed greater improvements to the quality of staff hired and the motivation for new and existing staff to improve.</p> <p>This also allowed a more efficient approach to train Emirati officers to replace experts with certain specialism in an effective way.</p> <p>A new and better approach for recruiting and training staff has been identified by this decision by the Deputy Head of Human resources. This, he believes, will lead to a much better police force and more professional approach to policing on a par with some of the best police forces in the world.</p>

Many insights based on decisions made are diffused and absorbed throughout the ADPF via a number of channels; these could be through the company Intranet, meetings and workshops and to various front line officers through key technologies. There is also a mechanism to test these insights and critique them and make suggestions and debate before they become solidified. The feedback loop will reach the senior executive team in the APF, who will then evaluate them accordingly. This process allows this information to be absorbed and spawn further actions and behaviours. In other cases, such as the introduction of the



statistical units, it has derived new learnings specific to particular groups who have used this to develop new approaches to tackle crime prevention (e.g. new approaches to power of attorney crimes). In many cases change can be challenged. This can be the case when it comes to training and training needs; however, the new learnt behaviour in many cases improves the level of training and the relevance of training and has also been used to make significant cost reductions. When officers and staff in the APF are exposed to new insights and see the direct results and benefits of these insights, they formulate their own learnings and behaviours. A good example of this is the decision for more stringent education requirements for personnel in the ADPF, which has encouraged better academic pursuits and specialist skills training, which has had a direct correlation to promotions and financial gains. When officers see this correlation between attaining greater academic and specialist training and salary increases it spawns new behaviours. The introduction of more advanced tools for policing and in many cases through new and advanced technologies, has also initiated new learnings and behaviour. It has also initiated the adoption and proliferation of these technologies for groups and departments who are then able to use them in different ways. A number of insights have generated broader behaviours and actions, for example the approach to recruiting and training new staff and replacing existing experts in a more controlled and incentivized manner.

**5B.2.6: Impact: Release/Reuse: Info/knowledge becomes embedded in concrete practices, rules and behaviour of APF**

The decisions made and impact yielded becomes embedded in concrete practices, for example in artefacts, rules or behaviour patterns (knowledge becomes 'concrete'). The impact is explained in Table 5B.7.

Table 5B.7: Organisational level impact

Position	Decision	Decision maker had an organisational impact
Deputy Commander in Chief	Promotions	<p>These decisions have made the greatest impact to individuals who have embraced the change. The executive team, including the Deputy commander, have enforced the approach driven by this decision and also in conjunction with the relevant government organization.</p> <p>In turn this is reflected in their greater training, education and professionalism. This is once again reflected by the improved statistics on crime, car accidents, public feedback and also savings on costs.</p> <p>The individual officers see greatest impact and improvement on their policing skills, fitness and police knowledge and education. Now they accept that promotion is not just automatic and is now merit based. Also</p>

		there is a greater incentive to improve. Impact is also seen in greater responsibility to meet specific criteria and metrics, including fitness, language skills and education or academic achievements
Head of Police Operations	Support for officers through statistical unit	Greatest impact is seen in first responders and first line responders and this becomes inherent in their policing and approach to policing. The head of Police operations has ensured that the relevant data and knowledge has become available in all police cars and to all departments
Head of Police Training	National training	New policy and procedure for national training was endorsed and implemented which enabled improvement and continuous scrutiny and improvement of officers via assessment. This has led to new and more stringent criteria from new recruits (e.g. minimum education achievement, physical fitness, English language competence)
Head of Police Education	collaboration with NYPD and Singapore, amendments to some courses	The impact included the improvement of officers across a number of areas, by filtering the best practices from various training and courses and putting them into action. This has also led to significant cost savings for the organisation, better leaders, services, improved staff, and government awards won. In addition, they have led to “creating our own best practices”. This has now been used by other police organisations internationally.
Head of Investigation	Using new advanced tools that provide more accurate results	The decision to acquire new technologies has made significant impacts on the organisation and externally. The speed at which crime is detected and tackled has significantly improved and this in turn has led to a safer society. Take, for example, the face recognition technology; this has led to much safer boards, the capture of repeat criminals and of those criminals who have been deported and have tried to re-enter Dubai illegally.
Deputy Head of Human Resource Planning	in hiring more staff for a period of 5 years	This has led to an improvement in the quality of staff and the continuous development of staff from initial training, education, shadowing of experts (Non-Emeriti) to eventually becoming the expert in a specific field of expertise. This has also led to key motivation for non-Emirati staff in the police force to help train Emirati police officers. The Emiratisation approach needs to be more flexible and needs to have special circumstances and contracts for non-Emirate staff to help with the transition and training of Emirate police staff.

A great deal of the decisions made by the key senior agents have become embedded into specific practices and behaviours. This can be seen through the improvements in the professional manner of officers and staff and, moreover, is reflected in the improved statistics on crime, car accidents, positive public feedback and cost savings. For example, there is a considerable impact on individual officers, after embracing the approach to promotions because of greater training and education they see massive improvements to their policing skills, fitness, problem solving abilities and self-worth. Additionally, they do not take promotion for granted (“A change in behaviour”) driven by more concrete criteria and metrics, including fitness level, English language abilities, academic qualifications and specialist skills. The impact of the statistical units has initiated better access to important data which has now become seamless and inherent in approaches to solving crimes from officers in the field to specific specialist groups and units. In other areas, such as training and education, more stringent criteria and rules have been implemented across minimum levels of attainment for new recruits and better monitoring and evaluation of existing staff. In addition, the filtering of best practices from external sources and internal historic learnings have been derived and have a significant impact on the ADPF. Interestingly, this has also spawned best practices from the ADPF, which have been shared and embraced by other international police organisations. The impact of the introduction of new advanced tools and technologies has enforced new standards and approaches which have directly impacted crime rates and the solving of crimes. A significant impact can be seen through the introduction of face recognition technology, which has had a considerable impact on detection of criminals at border points. The abstract knowledge and insights on new recruits and the 5-year goal to increase this in line with Emiratization goals has impacted the ADPF positively in a number of ways. A better approach has been embraced and adopted, which not only allows better staff to be recruited, but also a better mechanism to ensure Emirati staff are able to replace existing experts and, at the same time, ensuring a correct and fair succession planning approach.

### **5B.3.Chapter Conclusion**

As explained earlier, Abu Dhabi is going through major developments economically and politically. Hence, there is a need to impose changes upon the APF, and bring together a range of processes, including the human side as well as software and hardware deployment, in order to improve the results and quality of decisions undertaken. As will have been seen in this chapter, higher level decision-making in APF is a complex process that has many aspects and involves many variables. Such complexity often used to lead to inefficient outcomes. The biggest issue was that such inefficient decisions in APF often led to economic loss and social deficiencies and politically disastrous outcomes since they led to waste of public resources.

Hence APF wants to look deeper into the use of information and knowledge to generate efficient results.

The results show that APF acquires a great amount of data generated by public services. However, using a vast amount of data stored in public organisations' databases may be one of the main reasons for inefficient decisions made by public organisations. Processing vast amounts of data and extracting accurate information are not easy tasks. Although technology helps in this respect, (for example, the use of decision support systems), it is not sufficient for improving decisions to a significant level of assurance. Thus complete data quality framework is needed in order to improve data quality and, consequently, the decision-making process in public organisations. The framework comprises elements found necessary to attain the quality of data reaching decision makers.

## **Chapter 6A:**

### **Discussion of the Findings**

#### **6A.1. Chapter Introduction**

In this chapter the findings of the current research are discussed in detail with regard to the proposed hypothesis and the research questions. The chapter begins with providing an introduction to the research, followed by a section explaining the theoretical model of the study. Also, this chapter presents an overall discussion of the main outcomes of the study, with a focus on the demographic characteristics of the participants and the causal relationships among the latent variables of the proposed model. In addition to that, the impact of age, education, gender, and experience is considered, on the information abstraction of decision makers in solving problems and decision-making that leads to intuition. The research questions are also answered in this chapter. Lastly, the researcher discusses the managerial and theoretical effects of the findings.

#### **6A.2. Introduction to the Research**

The current study aims to advance our knowledge in the field of decision-making by providing an empirical model, including the different variables that influence our decision-making and problem solving, including diffusion and absorption of information and its impact. The theoretical model advocates the use of public knowledge, proprietary knowledge, personal knowledge, and common sense knowledge in decision making. The current research tests empirically the conceptual model in this study and the hypotheses constructed based on the literature in chapter three. The values obtained after conducting the analysis show that the data fit the anticipated model.

The current study aims to advance our knowledge in the field of decision-making and problem solving by providing an empirical model including knowledge dimensions and explaining the research gap. The present study achieved the research objectives by:

- Undertaking a review of the literature in the area of knowledge scanning in the decision-making field. Particular focus will be on problem solving, abstraction, diffusion and absorption (Chapter 3).
- Reviewing key findings of former research and pinpoint the issues inducing knowledge and decision-making (Chapter 3).
- Defining a theoretical framework to elucidate and clarify the impact of diffusion and absorption of knowledge (Chapter 3).
- Recognizing the significance of each of the constructs presented in the model and their impact on decision-making and problem solving (Chapter 3 and 5).
- Empirically validating and evaluating the proposed framework, as well as testing the constructs of the knowledge towards the constructs of the problem solving and decision-making (Chapter 5).

Literature associated with decision-making and problem solving was reviewed in order to meet the objectives and achieve the aim of the study. The literature review provided the foundation of the current research in detecting the gap in the field, which needs exploration in order to extend the understanding of knowledge and its diffusion. Centred on the objectives of the current research, the research problem focussed on how information and knowledge can be used to help the decision makers in APF to gain a high degree of intuitiveness and intelligence to be effective. The aim is to increase the amount of information that can be processed and converted into deeper level abstract knowledge while at the same time, how to get them to codify in order to help them to externalise the knowledge that they hold. The review of the literature is based on the comprehensive research problem and, therefore, the research problem is divided into two research questions.

Ultimately, 17 hypotheses were framed, built on the theoretical discussion conducted previously. The proposed framework embraced additional dimensions: namely, age, education, gender, years of experience, role, and department and offered an initial assessment of the practicality of the research model in clarifying the decision-making and problem solving. In order to evaluate the proposed model, primary data was collected and refined during the empirical phase of the

research. From the data analysis of the present study, it was found that 45.2% of the variance among the constructs is explained. Consequently, 6 hypotheses out of the 10 hypothesized paths are proven to be statistically significant, as was shown from the T-value, P-value, and path coefficient between latent constructs.

### **6A.3. Hypotheses Testing Against the Data**

After evaluating the validity of the construct and the model fit, assessing the structural model is going to be our next step. In this step, the relationship between latent constructs and the hypothesis established are going to be tested. Latent constructs are unobserved variables that are measured indirectly, using directly observed indicators that represent the underlying construct (Brown 2015). The structural equation model in this study includes exogenous and endogenous latent constructs. Exogenous constructs are independent variables that influence a model without being influenced by other constructs in the model, while endogenous constructs are constructs in a causal model whose values are dependent on the conditions of other variables in the model (Hair et al. 2010) (Garson 2012). In structural model assessment, the researcher focuses on the magnitude and the nature of the relationships between the latent constructs presented in the theoretical model (Hair *et al.*, 2010). Therefore, the description of each correlation among the constructs. Table 6A.1 shows the 10 hypotheses signified by causal paths that are utilized to examine the relationships between the latent constructs.

Table 6A.1 Hypotheses Testing/Paths Causal Relationships (N= 592)

Code	Construct	Hypotheses	Statistically Significant Positive Hypothesized Relationships	Statistically Significant Negative Hypothesized Relationships
Q1-MAge	Age	H1(H-M1)	Age→ Abstraction	Information
Q2-MEdu	Education	H2(H-M2)	Education→ Abstraction	Information
Q3-MGen	Gender	H3(H-M3)	Gender→ Abstraction	Information
Q4-MExp	Experience	H4(H-M4)	Experience→ Abstraction	Information
Q5-MRole	Role	H5(H-M5)	Role→ Abstraction	Information
Q6-Mdep	Department	H6(H-M6)	Department→ Abstraction	Information
Q8-Publ		H7	Public information → Information Abstraction	
Q10-Prop		H8	Proprietary information → Information Abstraction	
Q12-Perl		H9	Personal information → Information Abstraction	
Q14-ComSI		H10	Common sense information → Information Abstraction	
Q15-ProbDif		H11	Problem solving → Diffusion	
Q16-ProbAbsorp		H12	Problem solving → Absorption	
Q17-AbsDif		H13	Abstraction → Diffusion	
Q18-AbstAbsorp		H14	Abstraction → Absorption	
Q19-DifImp		H15	Diffusion → Impact	
Q20-AbsorImp		H16	Absorption → Impact	
Q21-Implmp		H17	Impact → Impact	

After aborting items with low factor loading relative to their constructs, 35 indicators were left to identify the 5 latent constructs of the theoretical model and the 6 demographic variables. The researcher applied the covariance matrix among the latent constructs in order to test the structural model. The hypothesized relationship is statistically significant if the t-value is higher



than 1.96 (T-value > 1.96) and the P-value is significant at 0.05 level ( $P < 0.05$ ) (Hair et al., 2010). 11 causal paths were tested in the current research through the values of T-statistics, P-values, and path coefficients obtained using SmartPLS 3. As a result, (Table 6A.2), H4, H5, H6, H7, H8, and H10 are statistically significant and in the right expectation. H1, H3, and H9 are not statistically significant and do not show any correlation.

Table 6A.2: Path Coefficients for the Proposed Structural Model

		Path Coefficient	T Statistics >1.96	P Values <0.05
H1	Age → Information Abstraction	-0.124	1.477	0.140
H5	Role → Information Abstraction	0.514	16.012	0.000
H4	Experience → Information Abstraction	0.437	13.274	0.000
H10	Common sense information → Information Abstraction	0.097	2.448	0.015
H9	Personal information → Information Abstraction	-0.012	0.344	0.708
H2	Education → Information Abstraction	-0.089	2.309	0.021
H3	Gender → Information Abstraction	-0.066	1.56	0.119
H7	Public information → Information Abstraction	0.137	3.293	0.001
H8	Proprietary information → Information Abstraction	0.453	12.193	0.000
H6	Department → Information Abstraction	-0.406	11.12	0.000
H11	Problem solving → Diffusion	0.355	14.093	0.050
H12	Problem solving → Absorption	0.276	7.012	0.000
H13	Abstraction → Diffusion	0.221	6.003	0.011
H14	Abstraction → Absorption	0.353	8.512	0.022
H15	Diffusion → Impact	0.416	11.293	0.467
H16	Absorption → Impact	0.013	2.112	0.132
H17	Impact → Impact	0.117	4.135	0.350

**Yellow:** Hypotheses are statistically significant; **Green:** Hypothesis is statistically significant but not as expected; **Red:** Hypotheses are not statistically significant

As per Table 6A.3, the ( $R^2$ ) is a statistical measure of how well a regression line approximates real data points and a descriptive measure between zero and one, indicating how good one term is at predicting another (Hair et al. 2010; Brown 2015). The squared multiple correlations ( $R^2$ ) for the endogenous constructs are revealed in Table 6.31. As a result, the closer its ( $R^2$ ) value is to one, the greater the ability of that model to predict a trend (Brown 2015). There is a 45% variance among the constructs of information quality and decision making. Consequently, six hypotheses out of the ten hypothesized paths are proven to be statistically significant, as shown from the T-value, P-value, and path coefficient between latent constructs in Figures 6A.2.

Table 6A.3: Percentage of Variance Accounted for by the Predictors of the Endogenous Constructs

	R Square
Role	0.33
<b>Experience</b>	<b>0.452</b>
Common Sense information	0.206
Personal Information	0.278
Proprietary information	0.165
Public information	0.199

### A6.3.1. Results of Testing the Hypotheses

The evaluation of the structural model in the current research reveals that 12 hypotheses are positively significant (H4, H5, H7-8, H10-17). Two hypotheses have a significant negative impact on other constructs (H2, H6). Additionally, 3 hypotheses are non-statistically significant (H1, H9, H3). The results of the pre assumed hypotheses are presented in Table 6A.4. As a result, the hypotheses of the current study presented in the proposed model are not all supported by the results demonstrated in Table 6A.4. The supported hypotheses have a significant P-Value at  $P \leq 0.05$  and R-Value greater than 1.96. Therefore, six out of ten hypotheses are statistically significant and in the expected direction. The path coefficient between social influence and perceived ease of use is statistically significant, but not in the predicted direction ( $\beta = -0.089$ ;  $P = 0.021$ ; and  $T\text{-value} = 2.309$ ). The final structural model with the standardized path coefficients and the  $R^2$  is presented in Table 6A.3.

Table 6A.4: Findings of the Research Hypotheses

No	Hypotheses	Results	$\beta$	Sig
H1	Age is related significantly to information abstraction of the decision maker in solving problems and decision-making that leads to intuition.	Rejected	-0.124	0.140
H2	Education is related significantly to decision maker in solving problems and decision-making that leads to intuition.	Significant	-0.084	0.021
H3	Gender is related significantly to decision maker in solving problems and decision-making that leads to intuition.	Rejected	0.066	0.199
H4	Experience is related significantly to decision maker in solving problems and decision-making that leads to intuition.	Accepted	0.437	0.000
H5	Role-based authority is related significantly to decision maker in solving problems and decision-making that leads to intuition.	Accepted	0.514	0.000
H6	Department is related significantly to decision maker in solving problems and decision-making that leads to intuition.	Accepted/Negative Correlation	-0.406	0.000
H7	Public information is related significantly to decision maker in solving problems and decision-making that leads to intuition.	Accepted	0.137	0.001
H8	Proprietary information is related significantly to decision maker in solving problems and decision-making that leads to intuition.	Accepted	0.453	0.000
H9	Personal information is related significantly to decision maker in solving problems and decision-making that leads to intuition.	Rejected	-0.012	0.708
H10	Common sense information is related significantly to decision maker in solving problems and decision-making that leads to intuition.	Accepted	0.097	0.015
H11	Problem solving is related significantly to diffusion in diffusion and absorption	Accepted	0.355	0.050
H12	Problem solving is related significantly to Absorption in diffusion and absorption	Accepted	0.276	0.000
H13	Abstraction is related significantly to Diffusion in diffusion and absorption	Accepted	0.221	0.011
H14	Abstraction is related significantly to Absorption in diffusion and absorption	Accepted	0.353	0.022
H15	Diffusion is related significantly to Impact in Impacting Organisational Effectiveness and organisational learning	Accepted	0.416	0.467
H16	Absorption is related significantly to Impact Impacting Organisational Effectiveness and organisational learning	Accepted	0.013	0.132
H17	Impact is related significantly to Impact Impacting Organisational Effectiveness and organisational learning	Accepted	0.117	0.350

On the other hand, the quantitative research shows that 12 hypotheses are positively significant (H7, H8, H4, H10, H5, H11, H12, H13, H14, H15, H16, H17). Two hypotheses have a significant negative impact on other constructs (H2, H6). Additionally, three hypotheses are non-statistically significant (H1, H9, H3). The proposed model reveals that six hypotheses of the ten hypotheses are significant. One hypothesis is negatively significant but not in the estimated direction. Three hypotheses are non-significant.

- It was hypothesized that the relationship between age and information abstraction of the decision maker in solving problems and decision-making that leads to intuition. This hypothesis is not supported after running the structural model of the current research ( $\beta = -0.124$ ;  $P = 0.140$ ).
- It was hypothesized that the relationship between education and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is not supported after running the structural model of the current research ( $\beta = -0.084$ ;  $P = 0.021$ ).
- It was hypothesized that the relationship between gender and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is not supported after running the structural model of the current research ( $\beta = 0.066$ ;  $P = 0.199$ ).
- It was hypothesized that the relationship between experience and information abstraction of the decision maker in solving problems and decision-making that leads to intuition. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.437$ ;  $P = 0.000$ ).
- It was hypothesized that the relationship between role-based authority and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.437$ ;  $P = 0.000$ ).
- It was hypothesized that the relationship between department and information abstraction of the decision maker in solving problems and decision-making that leads to

intuition is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.514$ ;  $P=0.000$ ).

- It was hypothesized that the relationship between public information and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant negative relationship. This hypothesis is supported after running the structural model of the current research ( $\beta= -0.406$ ;  $P=0.000$ ).
- It was hypothesized that the relationship between proprietary information and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.453$ ;  $P=0.000$ ).
- It was hypothesized that the relationship between personal information and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant negative relationship. This hypothesis is not supported after running the structural model of the current research ( $\beta=-0.012$ ;  $P=0.708$ ).
- It was hypothesized that the relationship between common sense information and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.097$ ;  $P=0.015$ ).
- It was hypothesized that the relationship between problem solving is related significantly to diffusion in diffusion and absorption This hypothesis is supported after running the structural model of the current research ( $\beta= 0.355$ ;  $P=0.050$ ).
- It was hypothesized that the relationship between problem solving is related significantly to absorption in diffusion and absorption This hypothesis is supported after running the structural model of the current research ( $\beta= 0.276$ ;  $P=0.000$ ).
- It was hypothesized that the relationship between abstraction is related significantly to diffusion in diffusion and absorption This hypothesis is supported after running the structural model of the current research ( $\beta= 0.221$ ;  $P=0.011$ ).

- It was hypothesized that the relationship between abstraction is related significantly to absorption in diffusion and absorption This hypothesis is supported after running the structural model of the current research ( $\beta= 0.353$ ;  $P=0.022$ ).
- It was hypothesized that the relationship between diffusion is related significantly to Impact in impacting organisational effectiveness This hypothesis is supported after running the structural model of the current research ( $\beta= 0.416$ ;  $P=0.467$ ).
- It was hypothesized that the relationship between Absorption is related significantly to Impact impacting organisational effectiveness This hypothesis is supported after running the structural model of the current research ( $\beta= 0.013$ ;  $P=0.132$ ).
- It was hypothesized that the relationship between Impact is related significantly to impact in impacting organisational effectiveness This hypothesis is supported after running the structural model of the current research ( $\beta= 0.117$ ;  $P=0.350$ ).

## **6A.4. Discussion of the Main Findings**

The current study is positioned mainly in the direction of descriptive research and utilizes a deductive perceptive approach in which the hypotheses were abstracted and a framework was established. The research used a quantitative approach through a positivist paradigm that emphasizes on evidences by framing a hypotheses deduction technique accompanied by operationalizing perceptions to be restrained.

The present research used self-administered questionnaires wherein participants responded to the questions directly without the attendance of the investigator or researcher. The choice of answers was fixed (closed-ended) in advance. However, in order to minimize the chance of confusion and misunderstanding among respondents answering the questions, the content validity and reliability of the questionnaire was tested in the pilot study before launching the main survey. The researcher circulated the survey amongst a particular group of specialists in

the field throughout the pilot study to evaluate the survey and get feedback. The initial survey shaped was made of 66 items. After amendments based on CFA and reliability test, 35 items were used to measure the 10 constructs in the conceptual model.

The survey started by clarifying the goal of the research and explaining the need for information and its importance for gaining knowledge by decision makers. The survey was divided into two sections. The first section was created to collect demographic information about the respondents, such as level of education, gender, age, internet experience, and computer experience, etc. The second section was created to collect information about the behaviour of the respondents related to the variables tested and specified in the literature. The survey was conducted following ethical guidelines and, consequently, the survey received approval before collecting the data.

The current research used two software programs to analyse and code the data: 1-SPSS 22.0; and 2- Smart PLS 3. Also, SEM techniques were used in the present study. SPSS 22.0 was employed in providing descriptive analysis and deducting missing values. The variables of the proposed model were hypothesized to be tested as solo indicators. Therefore, performing EFA was not needed on any of the constructs because their items were derived from other studies in the field. Smart PLS 3 was exploited in this research to perform SEM analysis such as: CFA, hypotheses testing, and GOF. The results obtained from analysing the data in chapter 5 need to be interpreted and discussed. The subsequent sections in the current chapter interpret and discuss the findings in depth.

#### **6A.4.1. Response Rate from Respondents**

Primary data was collected from 137 respondents, which decreased to 129 after checking for outliers and deducting 8 cases. The targeted sample was Abu Dhabi Police Force, who were serving in the public service. Obtaining an accurate sample about the number working in Abu Dhabi Police Force from officials was not possible due to security and sensitivity reasons surrounding police services. Therefore, to achieve a suitable sample frame for this study, it was decided to consider the non-probability sampling techniques; specifically, the convenience sample. Convenience, sometimes called haphazard or accidental, sampling involves selecting the most available sample elements to participate in providing the information needed for the study and, accordingly, it defines ranges of alternatives of responses. The participants of this survey were UAE citizens who agreed to fill in a voluntary self-administered online

questionnaire. The researcher distributed the survey using electronic means (emails, social network, etc.) and hard-copies. The total number of police officers who participated in the survey was 137. The total number who completed the majority of the questions in the survey was 129, with a response rate of 94.1%. The response rate achieved is reasonably high due to the fact that the respondents were police officers and, thus, familiar with the current systems.

#### **6A.4.2. Demographic Characteristics of Respondents**

The results show that males constitute 81.6% of the whole respondents and females 18.4%. This finding shows that the percentage of males is much higher than the percentage of females in Abu Dhabi police force. Also, it means that there is a high masculine dominance in the police force in Abu Dhabi. This finding came as no surprise as in all the Arab societies there is a predominance of men in the public sector.

The respondents of this survey are divided into six age groups. The age group 21-34, which represents mostly fresh graduates and young police officers is the second most predominant group in the survey, constituting 42 respondents or 30.9%. 35-44 age group is 23.5%, followed by 33.8% for 45-54 age group, which is considered the predominant group of participants in the survey, 11.8% for 55-64 age group. The majority of the respondents were between the ages of 21-54, forming 88.2% of the participants.

63.2% of the citizens who responded to the survey hold a university degree, while only 4.4% have only attended secondary or primary school. Additionally, 27.2% of the respondents are of higher education while 5.1% have chosen others as education level, as demonstrated in Table 6A.5. The statistics are not surprising since the literacy rate in Abu Dhabi is high and most of the servants in the police force are required to be of a certain level of education.



Table 6A.5: Education Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secondary or Primary School	6	4.4	4.4	4.4
	University Degree	86	62.8	63.2	67.6
	Higher Education	37	27.0	27.2	94.9
	others	7	5.1	5.1	100.0
	Total	136	99.3	100.0	
Missing	System	1	.7		
Total		137	100.0		

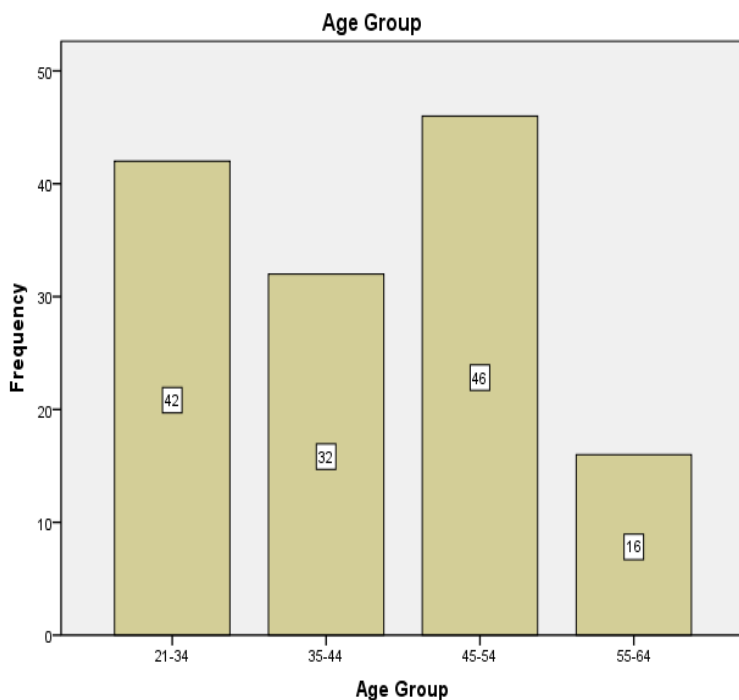
The findings show that the mainstream of participants has between 0 to 5 years of experience, forming about 57.4% of the whole population. The numbers of participants with experience starts to decline regularly as we can see from Table 6A.6. 17.6% (or only 24 respondents) have 6 to 10 years of experience. The percentage will also decrease, the more the years of experience increases to reach 7.4% for 16-20 and 20+ years of experience. This shows that the majority of the participants do not have enough years of experience in problem solving and decision making. In addition to that, the police force with experience belongs relatively to the older age groups, as we saw in the statistical tests chapter. This could create a partiality in the research results and analysis.

Table 6A.6: Length of Service at Abu Dhabi Police force

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-5 years	78	56.9	57.4	57.4
	6-10 years	24	17.5	17.6	75.0
	11-15 years	14	10.2	10.3	85.3
	16-20 years	10	7.3	7.4	92.6
	20+ years	10	7.3	7.4	100.0
	Total	136	99.3	100.0	
Missing	System	1	.7		
Total		137	100.0		

Decision support system overlooks the use of information systems among police force with a percentage of 48.5%, which means that 66 out of the 136 who answered this question use decision support system mainly for making decisions. Decision support system is followed by general information system (28.7%) and then data mining system (19.9%). When asking the respondents about evaluating their knowledge in using information systems, 33.8% considered themselves moderate in using information systems. 17.6% of the participants of police force who participated in this study considered their knowledge in using information systems as very poor. 19.9% of the participants of police force who participated in this study considered their knowledge in using information systems as poor. Additionally, the lowest percentages are for the participants who considered themselves good and very good in using information systems (16.2% and 12.5% respectively). The poor use of information systems among police force in Abu Dhabi is mainly due to the short years of experience and the low number of young police officers, as demonstrated in the age group Figure 6A.1.

Figure 6A.1: Age group frequencies



## 6A.5. Hypotheses Testing within this Research

### 6A.5.1. Age and Information Abstraction

H1 examined the impact of age on information abstraction of the decision maker in solving problems. Consequently, how age impacts on information abstraction of the decision maker in solving problems was investigated. After running the structural model of the current research, it was shown that this hypothesis is not supported and, therefore, there is no relationship between those two constructs ( $\beta = -0.124$ ;  $P = 0.140$ ). As a result of path coefficient and p-value for hypothesis 1, there was no indication that age is related significantly to information abstraction of the decision maker in solving problems.

### 6A.5.2. Education and Information Abstraction

H2 tested the impact of education on information abstraction of the decision maker in solving problems. Boisot's (1995) and Nonaka's (1994) literature was used by Hall (2003) to outline the process, recognition and education in processing information and knowledge within an

organisation. There are three dimensions, which are codification, diffusion, and mind-set as a new axis that is adaptive competency for disruption technology. Consequently, how education impacts information abstraction of the decision maker in solving problems was examined. This hypothesis is not supported after running the structural model of the current research ( $\beta = -0.084$ ;  $P=0.021$ ). The relationship between education and information abstraction of the decision maker in solving problems is statistically significant, although negative. The relationship between the two constructs is not very strong, as shown from the p-value. The non-technical factors, e.g. creativity and the ability to generate new ideas, are said to be the answer to gaining an understanding (Manyika et al., 2011). Thus, the non-technical factors will be more extensively explored. McAfee and Brynjolfsson (2012) report that when data and intuition are conflicting, then decision makers are forced to override their personal intuition in order to gain more data. However, on the other hand, there are more people who rely on the internalised experience and intuition alone is not enough (McAfee and Brynjolfsson 2012).

Based on the writing of Hall (2003) the results obtained from examining this hypothesis were based on five processes: (1) Externalization, (2) Education, (3) Internalization, (4) Socialization, (5) Radical transformation and the associated unlearning. It shows that not only culture and resource are needed, but rather technology and tools need to be considered as they may affect the overall outcome. In relation to the outcome, Tynjälä (2012) described the process of learning as an insight into academic space.

### **6A.5.3. Gender and Information Abstraction**

H3 studied the impact of gender on information abstraction of the decision maker in solving problems. Consequently, how gender impacts information abstraction of the decision maker in solving problems was examined. This hypothesis is not supported after running the structural model of the current research ( $\beta = 0.066$ ;  $P=0.199$ ). There is no evidence of relationship between gender and information abstraction of the decision maker in solving problems, unlike the writing of Johnson and Powell purported (1994).

Results suggest that there is no evident relation between gender and information abstraction of the decision maker in solving problems.

#### **6A.5.4. Experience and Information Abstraction**

H4 studied the experience on information abstraction of the decision maker in solving problems. Experience is a significant determinant of information abstraction of the decision maker in solving problems, accounting for 20% of its variance. Past experience factors, information databases, tendencies, and associated facets are needed to aid in decision-making and planning (Srivardhana and Pawlowski, 2007). The data mining specialist may consider certain subgroups relevant to the business problem based on prior knowledge or experience or according to the results of the summary and description operations on data. Automatic segmentation, known as clustering, can discover hidden and unsuspected structures in data that allow segmentation (Tan et al., 2005). Nonaka and Takeuchi (1995), highlight the fact that there are two types of knowledge: explicit knowledge, which is gained from manuals and procedures, and tacit knowledge, learnt only by personal experience.

Consequently, the relationship between experience and information abstraction of the decision maker in solving problems is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.437$ ;  $P = 0.000$ ).

#### **6A.5.5. Role-Based authority and Information Abstraction**

H5 examined the impact of role-based authority on information abstraction of the decision maker in solving problems. Consequently, how role-based authority impacts information abstraction of the decision maker in solving problems was investigated. The relationship between role-based authority and information abstraction of the decision maker in solving problems is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.514$ ;  $P = 0.000$ ). One has to check where knowledge is being deployed in the organisational hierarchy, which leads to certain challenges (LaValle et al. 2011). Barton and Court (2012) showed that it is difficult to get all employees to work in an aligned way. Therefore, it is proposed this area needs more attention in order to disseminate 'expert' level analytical skills to others in the organisation (Shah et al. 2012). Users are important to the success and they are arguably overlooked in many studies, which

concentrate on the technology rather than the user's perspective. Matthias et al. (2016) conveys the importance of user skill and not of the technology.

### **6A.5.6. Department and Information Abstraction**

H6 looked at the impact of department on information abstraction of the decision maker in solving problems. Consequently, how department impacts information abstraction of the decision maker in solving problems was investigated. The relationship between department and how it impacts information abstraction of the decision maker in solving problems is a significant negative relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = -0.406$ ;  $P = 0.000$ ). McKinsey Global Institute outlines the importance of the use of the expertise of users in deep data analytics (Manyika et al., 2011), whilst Chen et al., (2012) introduces specific skills in managing, descriptive, predictive, and prescriptive analytics. Due to a shortage of skilled workers, these cannot be used to its full potential, leaving an ever widening gap (Russom 2011).

### **6A.5.7. Public Information and Information Abstraction**

H7 examined the impact of public information on information abstraction of the decision maker in solving problems. Public information is defined in the current study as the Boxer (2006) defines public knowledge, as textbooks and newspapers, which is codified and diffused. Thus, how public information influences information abstraction of the decision maker in solving problems was examined. The relationship between public information and information abstraction of the decision maker in solving problems is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.137$ ;  $P = 0.001$ ). As mentioned previously, public information has a major influence on the relationships between the interacting parties. As Massingham and Massingham (2014) believe, KM can generate a lot of value for organisation and pay attention to many different benefits offered. They look at KM verses traditional approach to running organisations. They look at business performance metrics to derive a criterion to measure the value of KM. They present the results from a longitudinal

change project for a large Australian Research Council Linkage Project. The Project was a transformational change program that aimed to evaluate KM in terms of financial and non-financial measures and seven practical outcomes from which to identify the organisational problem which may be addressed by KM. They write that that investment decisions regarding KM can benefit from focusing on significant and on-going organisational problems, which will connect KM with firm performance and demonstrate financial and non-financial impact. The seven practical outcomes were evaluated against measurement criteria and against KM's claims. They found that time, cost, capability growth and performance improvements were the key themes.

### **6A.5.8. Proprietary Information and Information Abstraction**

H8 looked at the impact of proprietary information on information abstraction of the decision maker in solving problems. Proprietary information is defined by (Boxer, 2006) as patents and official secrets, which are codified but not diffused. Here barriers to diffusion must be set up. Thus, how proprietary information impacts information abstraction of the decision maker in solving problems was considered. The relationship between proprietary information and information abstraction of the decision maker in solving problems is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.453$ ;  $P=0.000$ ). Information and knowledge are an important strategic resource in organisations (Shakespeare, 2012; Yiu, 2012; Bujak et al., 2012; Galliers and Leidner, 2014); Robson, 2015). Use of relevant information and its quality are crucial for organisations where the information has to be consistent, comprehensible and relevant to particular situations (Singh and Singh, 2010; Ronquillo et al., 2016).

### **6A.5.9 Personal Information and Information Abstraction**

H9 looked at the impact of personal information on information abstraction of the decision maker in solving problems. The relationship between personal information and information abstraction of the decision maker in solving problems is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.097$ ;  $P=0.015$ ). Boxer, (2006) defined personal knowledge as biographical knowledge, which is neither codified nor diffused. Conceptual filters extract *information bearing* data from what has then been registered. Filters get “tuned” by the agents’ cognitive and affective expectations (Clark, 1997; Damasio,

1999), shaped as these are by prior knowledge, to act selectively on both stimuli and data. Machlup (1980), information is basically a flow of messages and the amount of information, even it is too much can be a problem too (Rowley and Hartley, 2017). However, one of the main discussions in firms is how to improve productivity and the flow of these messages (Epple et al., 1996). Structured data supports decision-making (Laihonen, 2006) and forms knowledge pyramids.

#### **6A.5.10. Common Sense and Information Abstraction**

H10 looked at the impact of common sense on information abstraction of the decision maker in solving problems. The relationship between common sense and information abstraction of the decision maker in common sense is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.097$ ;  $P = 0.015$ ). Boisot, (1998, 2013), and Boisot and Canals (2004) who stated there was a positive correlation between the two. This is in line with the literature that states that Conceptual filters extract *information bearing* data from what has been then registered. Filters get “tuned” by the agents’ cognitive and affective expectations (Clark, 1997; Damasio, 1999), shaped as these are by prior knowledge, to act selectively on both stimuli and data. Machlup (1980) contends information is basically a flow of messages and the amount of information, even it is too much, can be a problem too (Rowley and Hartley, 2017).

#### **6A.5.11. Problem Solving and Diffusion**

H11 looked at the impact of problem solving on diffusion of the decision maker in solving problems. The relationship between problem solving and diffusion of the decision maker in problem solving is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.355$ ;  $P = 0.050$ ). Boisot, (1998, 2013), and, Boisot and Canals (2004) who stated there was a positive correlation between the two. This is in line with the literature that states that effective use of information and knowledge helps to solve problem in organisations (Schön, 2017; Van Aken, and Berends, 2018). Boisot (1998) states that within Social Learning Cycle (SLC) that utilises the I-Space model it is important to show



the flow of information-knowledge through a series of phases, which include problem-solving. Here problems are solved giving structure and coherence to these insights (knowledge becomes 'codified').

### **6A.5.12. Problem Solving and Absorption**

H12 looked at the impact of problem solving on absorption of the decision maker in solving problems. The relationship between problem solving and absorption of the decision maker in problem solving is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.276$ ;  $P = 0.000$ ). This is in line with the writings of Boisot, (1998, 2013), and, Boisot and Canals (2004), who stated there was a positive correlation between the two.

### **6A.5.13. Abstraction and Diffusion**

H13 looked at the impact of abstraction on diffusion of the decision maker in solving problems. The relationship between abstraction and diffusion of the decision maker in problem solving is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.221$ ;  $P = 0.011$ ). This is in line with the writings of Boisot, (1998, 2013), and Boisot and Canals (2004), who stated there was a positive correlation between the two. This is because, as Chilcote (2017) noted, intuition is important as it enhances knowledge and decision making. It is a rapid, unconscious process based on global knowledge. Chilcote (2017) states that the use of intuition is reported by nurses, but is not legitimized within the nursing profession. Attributes of intuition are defined as an unconscious, holistic knowledge gathered without using an analytical process and knowledge derived through synthesis, not analysis. Fowler (2016) found that there was widespread implementation of managerial intuition in choosing retail sites. Miller and Ireland (2005) write that many executives and managers embrace intuition as an effective approach to important decisions. Indeed, recent surveys and business press articles indicate broad support for the use of intuition when making strategic decisions.

#### **6.5.14. Abstraction and Absorption**

H14 looked at the impact of abstraction on absorption of the decision maker in solving problems. The relationship between abstraction and absorption of the decision maker in problem solving is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.353$ ;  $P = 0.022$ ). This is inline with the writings of Boisot, (1998, 2013), and Boisot and Canals (2004), who stated there was a positive correlation between the two. Also the knowledge developed by individuals within the context of an organisation is linked to the 'learning' process (March and Olsen 1976; Sim and Gioia 1986; Simon 1991; Nonaka 1994; Nonaka and Takeuchi 1995; Spender 1996. McPhee and Poole (2001) explain the knowledge distribution that occurs in organisations, through their formal structures. This form of knowledge sharing is achieved through the exchange of manuals and instruction books alongside other types of formal means (Nonaka 1994).

#### **6.5.15. Diffusion and Impact**

H15 looked at the impact of diffusion on impact of the decision maker in solving problems. The relationship between problem solving and information abstraction of the decision maker in problem solving is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.416$ ;  $P = 0.467$ ). Boisot, (1998, 2013), and, Boisot and Canals (2004) who stated there was a positive correlation between the two. This is in line with the writing of Haldin-Herrgard (2000) note that it is difficult to diffuse knowledge within organisations. Knowledge management requires varying methods and can be based on Internal individual processes, such as experience, that acquires the tacit knowledge; which is so difficult to code and therefore cannot be managed and shared as explicit knowledge.

Perspective and purpose is an ideology whereby an individual has knowledge and use this to organise their knowledge (Dalkir, 2011:77). Wiig's model defines the level of internalisation in relation to knowledge, which could actually be related to the fourth quadrant of internalisation by Nonaka and Takeuchi. The different levels of internalization include varying stages ranging from novice to master and include beginner, competent and expert.

### **6.5.16. Absorption and Impact**

H11 looked at the impact of absorption on the decision maker in solving problems. The relationship between absorption and impact abstraction of the decision maker in problem solving is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.013$ ;  $P=0.132$ ). This is in line with the writings of Boisot, (1998, 2013), and Boisot and Canals (2004), who stated that there was a positive correlation between the two. In the literature knowledge as a strategic resource (Nonaka 1994; Nonaka and Takeuchi 1995; Kolb, 1984, Tsoukas, 2009; Fowler, 2016; Chilcote, 2017). According to Bhatt (2001), knowledge creation is the first process to share knowledge; however, David (2000) mentioned that culture forms a major barrier in the form of value, practices, norms and interactions behaviour when harnessing knowledge. Boisot's (1995) and Nonaka's (1994) literature was used by Hall (2003) (Figure 2.5) to outline the process, recognition and education in processing information and knowledge within an organisation.

### **6.5.17. Overall Impact**

H11 looked at the impact of impact on impact of the decision maker in solving problems. The relationship between impact and impact of the decision maker in problem solving is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.117$ ;  $P=0.350$ ). This is in line with literature, where Rothberg (2017) also found that knowledge and intelligence can increase organisational effectiveness and learning. The ideology of individual intuition and knowledge that can then be passed on to others can be associated with the idea of appropriation by Orlikowski's (1992), who implements a structured model of technology. Boisot, (1998, 2013), and, Boisot and Canals (2004) who stated that there was a positive correlation between the two.

## **6A.6. Chapter Conclusion**

The evaluation of the structural model in the current research reveals that 12 hypotheses are positively significant (H7, H8, H4, H10, H5, H11, H12, H13, H14, H15, H16, H17). Two hypotheses have a significant negative impact on other constructs (H2, H6). Additionally, 3 hypotheses are non-statistically significant (H1, H9, H3). One hypothesis is negatively significant but not in the estimated direction. Three hypotheses are non-significant.

- It was hypothesized that the relationship between age and information abstraction of the decision maker in solving problems and decision-making that leads to intuition. This hypothesis is not supported after running the structural model of the current research ( $\beta = -0.124$ ;  $P = 0.140$ ).
- It was hypothesized that the relationship between education and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is not supported after running the structural model of the current research ( $\beta = -0.084$ ;  $P = 0.021$ ).
- It was hypothesized that the relationship between gender and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is not supported after running the structural model of the current research ( $\beta = 0.066$ ;  $P = 0.199$ ).
- It was hypothesized that the relationship between experience and information abstraction of the decision maker in solving problems and decision-making that leads to intuition. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.437$ ;  $P = 0.000$ ).
- It was hypothesized that the relationship between role-based authority and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.437$ ;  $P = 0.000$ ).
- It was hypothesized that the relationship between department and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.514$ ;  $P = 0.000$ ).
- It was hypothesized that the relationship between public information department and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant negative relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = -0.406$ ;  $P = 0.000$ ).

- It was hypothesized that the relationship between proprietary information and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.453$ ;  $P=0.000$ ).
- It was hypothesized that the relationship between personal information and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant negative relationship. This hypothesis is not supported after running the structural model of the current research ( $\beta=-0.012$ ;  $P=0.708$ ).
- It was hypothesized that the relationship between common sense information and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.097$ ;  $P=0.015$ ).

Therefore, it becomes apparent that demographic factors, such as age, level of education, gender, work experience and level of authority have a significant impact on problem solving and decision making. In terms of type of information, the proprietary and common sense information types have more significance for solving problem and decision making. But, much to the researcher's surprise, the public information and personal information played very little role.

## Chapter 6B

### Discussion of Qualitative findings

#### 6B.1. Chapter Introduction

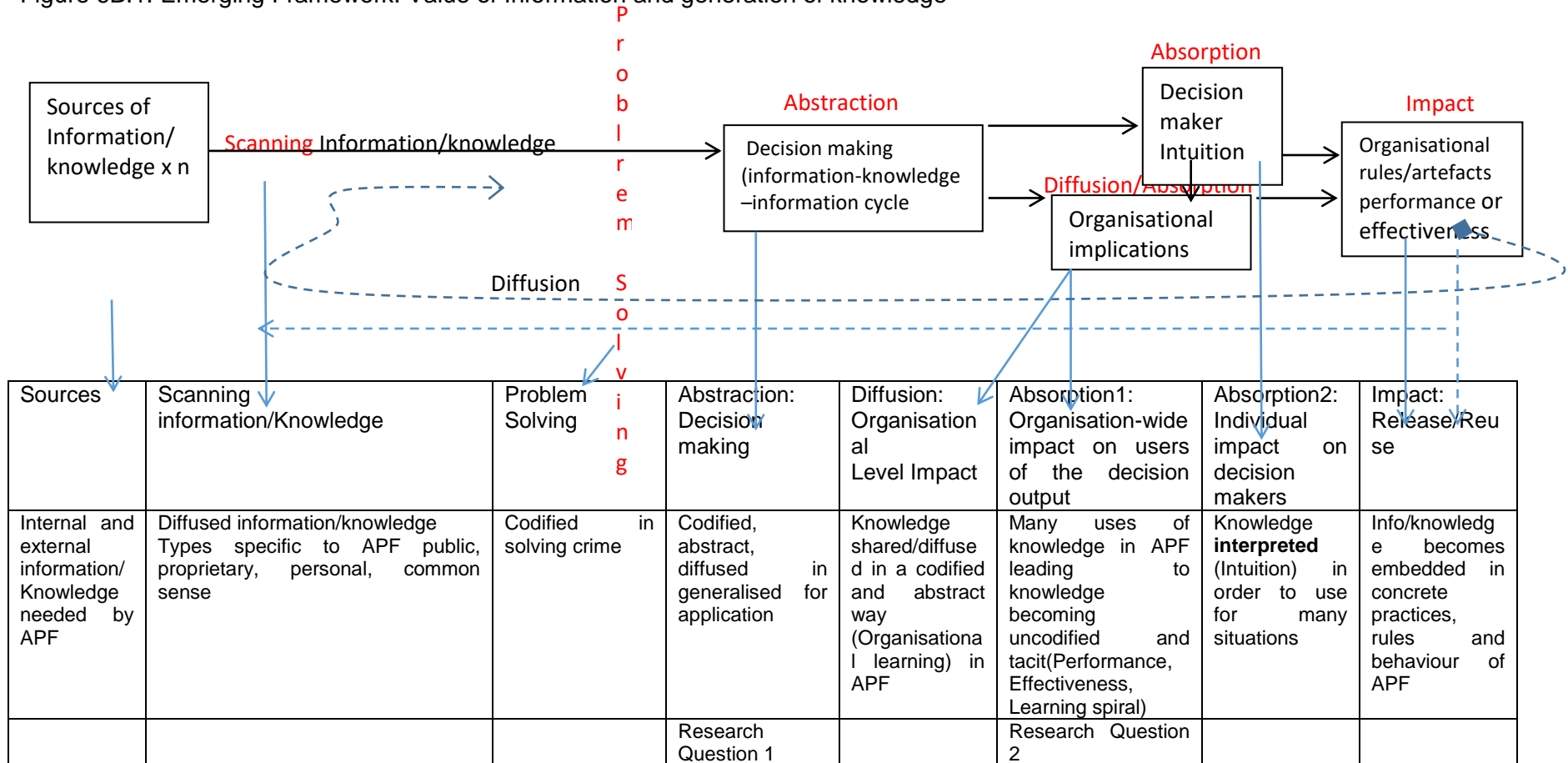
The purpose of this research is to check the value of information in harnessing knowledge needed in making effective decisions and increasing the effectiveness of the overall organisation. Therefore, this research aimed to create solutions that would facilitate:

- Capturing relevant information for knowledge conversion.
- Increasing individual intuitiveness of decision makers.
- Mapping and defining information-knowledge-information cycle using information space.
- Using information to develop decision makers and to increase organisational performance and effectiveness.

The results of this research shows how six key strategic decision makers made their decisions. They are high level decision makers and their responses indicate how other decision makers would perhaps behave. The results show that these are intuitive and intelligent individuals who became even more intelligent through using information in their decisions to make the organisation more effective. At the same time their intuitiveness would flourish at the decision-making stage that involves interpreting and converting information into knowledge.

However, it was interesting to see that in essence, being intelligent social agents, they already had a degree of intuitiveness which they would use at the start of the decision process, which is selecting the information and solving problems and then proceeding forward and taking actions, learning themselves and facilitating organisational effectiveness. Therefore, they would make a tremendous contribution to the organisation by helping it to enter a spiral of learning, which would lead to creating a learning organisation thereby supporting and sustaining organisational effectiveness over a long period of time. This process of using personal intuitiveness and building more intuitiveness is shown in Figure 6B.1

Figure 6B.1: Emerging Framework: Value of Information and generation of knowledge



As well as using their personal intuitiveness when selecting information, something else became apparent in the data collection which actually was 'not mentioned' in the theory (Boisot 1998). This was the role of politics and self-interest of the decision makers in question. Decision makers used their learning and self-objective of maintaining their positions in selecting information and solving problems and decision-making to protect themselves in addition to for helping the organisation. They did this unintentionally.

The results of the qualitative data collection show how six key decision makers made decisions and gained a certain degree of intuition from it. It shows how they processed, filtrated, interpreted, and retained the information and knowledge in question. The data was collected based on the "information space" framework provided by Boisot (1998), who suggests the dynamic flow of knowledge goes through a series of six phases known as the 'Social Learning Cycle' (SLC), which is used to convert data into understandable information through filtration. In the APF it is used to generate useful knowledge; useful for the decision maker to help APF to enter the learning cycle.

The information space (Boisot, 1995, 1998), is a conceptual framework that relates the degree of structure of knowledge (for example, its level of codification and abstraction) to its diffusibility as that knowledge develops. Tacit knowledge (low codification and abstraction) flows very slowly between agents and often only in face-to-face situations. Codified and abstract knowledge, by contrast, can diffuse rapidly throughout a population, whether such diffusion is desired or not. Extracting value from knowledge is difficult. The structuring of knowledge increases its utility while – on account of its increased diffusibility – simultaneously compromising its scarcity. Thus the value of knowledge goods, in contrast to that of physical goods, is inherently unstable and requires a more dynamic treatment than the latter.

The SLC serves to link content, information, and knowledge management in a very effective way - the codification dimension is linked to categorization and classification; the abstraction dimension is linked to knowledge creation, and the diffusion dimension is linked to information access and transfer. Data is filtered to produce meaningful information and this information is then abstracted and codified to produce useful knowledge. Such knowledge is used in different APF departments to produce new experiences and uncoded forms that can lead to new knowledge. As discussed in chapters 1 and 3 the guidance for data collection was derived from the works of Boisot (1995, 1998; 2013), Boisot and Canals (2004), Crossan et al. (1999).



The results of the data collected have been highlighted in the previous chapters, 5A and 5B. In this chapter a discussion is provided to check the findings of the researcher against the literature. The discussion is based on the results and is provided in the subsection to follow.

### **6B.2.1. Sources of Diffused information/knowledge and its Scanning**

The first dimension in SLC, Boisot (1998) is concerned with selecting the sources of information/knowledge carefully. In selecting the sources, the decision makers made sure that the decisions were reliable. They used intuitiveness in selecting sources, and this was based on their intuitive best practices over the years. They used the sources that other people used as they were tried and tested, and also to back themselves up politically. This is to protect them preliminarily in case the decisions go wrong, so that these are endorsed and sanctioned sources of information, which is in line with the writings of Shollo and Galliers (2016). Politically, sources of information were kept as generic as possible to avoiding backlash on decision making. When the information was interpreted from these sources, some of the personal knowledge and intuitiveness was used for comparison and association of experience for when these decision makers were interpreting this information and when thinking about how their management and subordinates would react to it.

In terms of the availability of information from technical information sources of information, a lot of decision makers were new to IT and data business intelligence so would seek help from experts, which required formal and informal alliances with technical experts. Hence, when decision makers identify potentially useful insights, data, or information, they often need to clean them up from the background “noise” they carry (Shannon and Weaver, 1949). Any extra information can disrupt the process of codification.

In APF the decision makers, as agents, monitored the external environment looking for bundles of useful knowledge, which is in line with the writings of Boisot (1998; 2013), Boisot and Canals (2004), and Crossan et al. (1999). The data collected from the six decision makers shows that there are many sources of data which have been made available in data collection scenarios from the public and private domains and utilised by the decision makers in question. In terms of

decision-making the information came from internal sources of documented information kept in the human resource records and also the decision maker's knowledge base after having been promoted through the same process.

The external information/explicit knowledge used was from external police forces, including the NYPD and the Singapore police forces. They then applied their experience and knowledge and codified the information available from the internal and external sources. This was in line with the extant literature that puts emphasis on use of relevant information and its quality is crucial for organisations where the information has to be consistent, comprehensible and relevant to particular situations (Singh and Singh, 2010; Ronquillo et al., 2016). The information from internal sources was concrete and information from the external sources abstract. In both cases, internal and external sources were diffused in a legitimate way. A use of the legitimate sources of information helps the decision makers politically. This information was used by the decision maker and documented so that a credible explanation could be given to the rest of the organisation and make it a new procedure and as a learning source for the organisational stakeholders.

The second decision maker looked at codified internal data, which has been codified based upon the type of crimes in question. Here new categories of crimes were used, based upon more confidential and sophisticated crimes, such as organized crime and money laundering, which in the past were uncoded or placed into more general categories. Other crimes included various and different types of terrorism. The statistical unit's intent is to convert abstract information into more concrete forms so that it could be disseminated. A lot of this information, which in the past had not been diffused and was largely undiffused, will become diffused and create a learning organisation. The third decision maker looked into best practices for officer training and codified information for officer training. Codified information from within the police force was used. This would include a certain level of uncoded information in the form of positive feedback from training. However, in training most of the information used and diffused was concrete in order to justify having particular types of training. Once again the decision maker's personal intuition was utilized and their need to politically justify was also apparent.

The fourth decision maker also looked at best practices and approaches for Education from internal and external codified information sources. In addition, there was a certain level of uncoded information in the form of positive feedback. However, in training most of the

information used and diffused was concrete in order to justify having particular types of training. Once again the decision maker's personal intuition was utilized and the need to politically justify this was also apparent. The fifth decision maker had to make a decision regarding new technology. The practicality information of these devices is largely uncodified, largely abstract and largely undiffused. For this decision maker some previous intuition from the use of technology was applicable but it is a largely unexplored territory. Therefore, this decision maker is going to take a lot of political risk by introducing the devices from the user's point of view and sponsor's (APF) point of view due to the risks associated with a lack of technology use.

The final decision maker looked at the uncodified abstract information, including the purpose and meaning of Emiratization and the statistics and predictions diffused by appropriate outlets to determine what sources of information would be useful for deciding on the exact number of officers needed in the APF in the future. Here their personal intuition related to policing in the community and dealing with organised crime would be useful. This decision would have a formidable policy impact, both with the APF and also impacting at national level. Hence the decision to be made based on the information and knowledge collected could come under huge scrutiny.

Likewise, Boisot (1998) explained how scanning may be rapid when data is codified and abstract, while slow and random whether uncodified and context-specific. In the real world, firms compete in industries and cooperate with partners and suppliers. Other external sources of data are also being scanned. This is in line with Cohen and Levinthal (1994), who stress how *"the capacity to exploit outside knowledge is comprised of the set of closely related abilities to evaluate the technological and commercial potential of knowledge in a particular domain"* (Cohen and Levinthal, 1994: 227). This would typically include so called public/private proprietary partner organisations, such as the NYPD or Singapore police force, whereby best practices are embraced, including crime prevention techniques, forensics, traffic monitoring and the latest technology and tools.

However, internally the data can include internal MIS and HR systems which provide a constant source of performance and effectiveness of police staff, which can in turn be used for improving training, education, promotions and overall professionalism and effectiveness. There are other sources of internal data which are viewed holistically, such as crime data collected and

presented by front line officers and summary reports and data provided to line managers. All of this data can be used to make decisions and improvements and provide insights for individual officers, groups and departments for crime prevention strategies and the more effective use of technology.

In literature it is noted that both the external and internal data is interpreted and codified, similar to the writing of Boisot (1995, 1998), who stated that the utility and scarcity of any information and its value can be expressed by just three dimensions: codification, abstraction, and diffusion, which can then be plotted on an information space cube. Likewise, in the APF any data that could not be codified and used was then shed, which reduced the amount of data needed to be processed (Boisot, 1995).

### **6B.2.2. Problem Solving: Codified in solving crime: Codified, abstract, diffused in generalised for application**

The second dimension in SLC, according to Boisot (1998), is solving the actual problem in question. This happens after the data/information collection. The data collection shows the information/knowledge scanned from internal and external sources, including personal perspectives in APF that can be utilised and structured to tackle specific issues and problems. This involved reducing the data/information using codification (Boisot, 1998), which prepares the incoming information for the coding process; a more effective codification process facilitates the coding. A careful selection of information by decision makers has enabled them to solve problems more meticulously and contribute to organisational effectiveness. Once again, their previous knowledge and experience of solving problems and their high degree of intuitiveness was used in problem solving. The solving of problems can come under scrutiny and criticism, hence they behaved politically to avoid any risk of being questioned or scrutinised. The first decision maker solved the problems of unfair promotions and the problem of unmotivated officers who lacked merit. The decision maker associated with the decision around introducing a statistical unit found that the statistical unit would allow the classification of difficult types of crimes, including new, unusual crimes. Secondly it was necessary to communicate this to stakeholders at all levels.

The third decision maker tackled how to overcome the problem of low impacting training and to replace outdated training practices which were decades old (for example, being able to utilise the latest smart phone technologies). The fourth decision maker identified how to overcome the problem of low impact and irrelevant education and to replace this with better approaches to education (more updated and national practices, for example, best practices from the NYPD and Singapore police department). The fifth decision maker focussed on the problem of how to replace or enhance the outdated tools used in fighting crimes. These tools are to be used over a long period so they need to be effective. The notion of effectiveness will be based upon the officer's past knowledge, experience and intuitiveness.

Thus, as Boisot (1998) states, the APF decision makers performed a process of simplification and problem solving to give structure and consistency to such insights: *"In this phase they are given a definite shape and much of the uncertainty initially associated is eliminated"* (Boisot, 1999: 59). What also emerges from this is new criteria, goals and metrics, such as cost savings and a level playing field for officers. The timing of the codification is also important, because *"once codified, standards often create a lock-in effect that over time become irreversible"* [1998: 45]. The relevant data can be grouped and filtered more readily providing the relevant information to specific departments improving crime fighting and making better use of human resource. Boisot also remarks about codification that it: *"... creates ... perceptual and conceptual categories that facilitate the classification of phenomena. The act of assigning phenomena to categories once these have been created is known as coding"* [1998: 42]. Codification of an experience can, to a certain extent, be described as committing *"oneself to a particular view of the world"* (Boisot 1983: 163).

The insights into technology and its role across specific areas of crime also allows the key areas to be abstracted and focussed on to tackle specific problem areas, such as the protection of borders through advanced facial recognition technology. The data and information on Emiratization requirements from the government and internal monitoring has provided insights which can now be structured to tackle the Emiratization quota but also the approach to replace non Emeriti experts in a more coherent and phased approach. Boisot hypothesizes that codification and abstraction together facilitate the diffusion of information and that they reinforce each other.

### **6B.2.3. Abstraction and Decision making: Knowledge shared/diffused in a codified and abstract way (Organisational learning) in APF**

Information collection, storage and dissemination through diffusion is costly and difficult but essential because it can be codified by virtue of being expressed in words, numbers, and symbols and is more easily shared. According to Boisot (1998; 2013), Crossan et al. (1999), Boisot and Canals (2004) the content of information and knowledge are linked very effectively in order to help decision making and generation of intuition. This happens through codification that is linked to categorisation and classification, the abstraction of data is linked to the production of knowledge, and the diffusion of data is linked to transfer and accessibility of information and knowledge. However, abstraction can work “*independently or in tandem*” with codification (Boisot, 1995). Where codification gives form to phenomena through categorising data of experiences into categories, abstraction gives the phenomena structure by identifying the underlying relationships among the data. Specific insights from various senior agents can lead to decisions which are applied to a broad range of situations in the APF.

Therefore, abstraction involves conceptualisation of new “*codified*” insights and it reduces them to a general structure which enables generalisations, where a decision maker classifies factors into a smaller number of categories. Therefore, abstraction can correspond to a high level of codification as it enables a creation of rules or theories. This enables a decision maker to work out a cause and effect relationship in a situation. For example, for the first decision maker new rules were created in APF. A new process of promoting officers was then applied to a wider range of functions from improved professionalism and policing skills to the introduction of metrics for improved physical fitness requirements for officers.

The abstraction in the case of the second decision maker is related to a broader range of crime solving approaches that can benefit from the introduction of statistical units, from cyber-crime and border patrols to drug smuggling and identity theft. The third decision maker’s decision regarding training allowed more personalised training to be developed and broader metrics for continuous monitoring and improvements. Similarly, for the fourth decision maker, police education will now have a wider impact on the type of courses to pursue and also on various other validation tools which reflect on these decisions. A more comprehensive approach to education will reflect on better crime statistics, problem solving abilities and performance.

For the fifth decision maker the use of specific technology can also now be applied to various functions and departments within the APF and, in turn, initiate a cycle of teaching and training on these technologies. The final decision maker's decision on hiring more staff is in line with the Emiratization push in key organisations in the UAE. It will impact this and can be applied to a broader area of related functions. An example of this would be the replacement of non-Emirati experts in the APF with new Emirati police staff. The process and approach to be used is another area which is also influenced by the decision to hire more staff over the next 5 years. Additionally, the progress and feedback which can be given to the appropriate government departments is also improved and enhanced. The APF is then able to accurately provide information and present their strategy for meeting the government goals for Emiratization. It can be seen, therefore, that many wider situations and functions are affected by some of the key decisions.

Therefore, abstraction involves conceptualisation of new "codified" insights and it reduces them to a general structure which enables generalisations, where a decision maker classifies factors into a smaller number of categories. Therefore, abstraction corresponds to a high level of codification as it enables a creation of rules or theories. This enables a decision maker to work out a cause and effect relationship in a situation. For example, new rules were created in APF, such as a new process of promoting officers which was applied to a wider range of functions. Another example of this would be the broader range of crime solving approaches that can benefit from the introduction of statistical units, from cyber-crime and border patrols to drug smuggling and identity theft. In fact, abstraction is closely related to codification as it is an extended form of data reduction.

In structuring the phenomena that have been codified, the number of categories is again reduced. However, abstraction essentially differs from codification; the process of codification gives form to phenomena, and the process of abstraction structures these phenomena. On the abstraction scale abstract opposes concrete, in which abstract stands for conceptual and non-local knowledge – abstract thought – and concrete stands for perceptual and local knowledge – highly concrete experiences.

#### **6B.2.4. Diffusion: Organisational Level Impact**

The decisions made by the first decision maker was immediately diffused to immediate peers for their feedback and political sanctioning. Here the feedback would generate a lot of learning of intuitiveness of their decision makers on promotional matters, such as whether the people who want promotion would actually try to fulfil the criteria in essence. The decision to have a statistical unit was diffused to the people collecting the statistics and communicating this information to the others. There are various brigadiers who would strategically be shown how the data is collected and how it is used for organisational effectiveness. Then the information is diffused to the general organisation level. There past intuition on how communication takes place was useful at this stage in planning how this decision will be diffused to a select number of stakeholders. In terms of the third decision maker, the diffusion occurred to the Human Resources group and unit heads and their views were sent before the training program was fully codified and communicated to all in question. The third dimension in SLC, according to Boisot (1998), is covered by diffusion, as it establishes ‘the availability of data and information for those who want to use it’ (1998: 52). Diffusion “*can be scaled to refer to the proportion of a given population of data-processing agents that can be reached with information operating at different degrees of codification and abstraction*” [1998: 52]. In other words, the diffusion expresses the *ratio* of a certain population compared to that part of this population that is susceptible to the way that the information is codified and abstracted. This diffusion scale “establishes the availability of data and information for those who want to use it”. Hence in APF the insights gained from various senior staff in the APF are now shared with a select group of peers. Here, according to Boisot, information is depersonalised and then can be codified and structured by way of abstraction and then it is disseminated to the remaining decision makers in a select group. An example of diffusion by the 6 key decision makers is presented below.

For the fourth decision maker the approach was to communicate the educational outcomes to the relevant brigadiers and the need for continuous development and what that would entail and how that would affect the current officers and their expected level of education. For the fifth decision maker this required co-ordination between the technology unit and IT units and the human resource units to strategically plan a re-training program aimed at exploiting new types of technology that would then become training and development study that the workers would have to follow. The final decision maker would initially communicate between the HR director and senior directors and managers and the deputy commander in chief to increase their



awareness and obtain financial backing for this project. This would then impact the whole organisation whereby the new members of staff would have to be accommodated and trained with the need for further plans to be put in place to provide them the necessary support.

This is in line with the writing of Haldin-Herrgard (2000) who noted that it is difficult to diffuse knowledge within organisations. Knowledge management requires varying methods and can be based on Internal individual processes, such as experience, that acquires the tacit knowledge; which is so difficult to code, therefore, cannot be managed and shared as explicit knowledge. Perspective and purpose is an ideology whereby an individual has knowledge and uses this to organise their knowledge (Dalkir, 2011:77). Wiig's model defines the level of internalisation in relation to knowledge, which could actually be related to the fourth quadrant of internalisation by Nonaka and Takeuchi. The different levels of internalization include varying stages, ranging from novice to master and include beginner, competent and expert.

### **6B.2.5. Absorption: Organisation-wide impact on users of the decision output**

Many more stakeholders were educated based on the decisions made. Absorption requires disseminating information and knowledge to a wider group of people, some of whom would not have any knowledge of the decision in question. In the case of the APF, the following six decisions were absorbed in the following way. The fourth dimension in SLC according to Boisot (1998), is covered by absorption. Absorption involves taking action and *"learning-by-doing"*, hence in APF decisions were made and then implemented throughout the APF via a number of channels. These could be through the company Intranet, meetings, workshops and to various front line officers through key technologies. The deliberate application of newly codified knowledge fosters absorption at the organisational level (Boisot, 1999:61).

In terms of the first decision maker, the promotion criteria and rules and regulations were described and categorized by the HR department and communicated throughout the organisation. This new criterion is to be acted upon and officers would conform to the new requirements if they wish to be promoted. Hence, the notion of automatic progression and promotion has been replaced. The second decision maker's decision on the use of the new statistical units would involve communicating this to the data collection specialists in each unit and would use new mechanisms for collecting data so that it could be fed into the statistical unit.

In terms of the third decision maker concerned with educational unit absorption of information and knowledge, this will be communicated to the HR department and to the rest of the organisation to define the kite mark for educational achievement and for CPD (continuous professional development). This would make personal effect changes in life to attain educational qualifications. The fourth decision regarding tools and technology would involve the entire workforce for fighting crimes based upon their respective jobs. Hence new skills and technology need to be developed and any personal weaknesses need to be eliminated and this may affect the officer's social life. The decision to increase the number of staff was communicated throughout the police force and relevant agencies in assisting in recruitment of staff. There is a lot of action required in this process with external agencies. This means the absorption requires external participation and collaboration.

Due to the wider organisational impact, this aspect of SLC is referred to as "*learning-by-doing*" stage in the literature as it stresses processes of knowledge absorption through the engagement in explorative experiences, and the testing of former cognitive schemes and structures (Boisot, 1999). Boisot claims, for example, how mastery in activities such as playing an instrument, practicing a sport or engaging in a specific field of studies is reached when "*one has consciously no longer to attend to the codes to offer a skilful performance*" (Boisot, 1999: 61). He states such a blend of individual skills and codified insights leads to individuals converting knowledge back into its tacit, concrete and undiffused form.

Polanyi (1958, 1966), Kolb (1984) and Tsoukas (2009) all agree that the source of knowledge comes from individuals within the organisation who have the knowledge or experience distinctions (Kolb and Kolb 2005). These experiences are the base for monitoring and reflection, which then leads on to further attributable knowledge. These inferences can be measured and tested, therefore can be used as a learning manual by the organisations (Kolb and Kolb 2005). Tsoukas (2009) suggest that new distinctions are the basis, therefore, once they are recognised, accepted and implemented the new knowledge begins to surface. Once they are actioned actively the organisation can reap the benefits. The new knowledge, however, needs to come from the individual with whom it resides. Only by engagement with the individual's knowledge can it be accepted by the organisation community.

The Wiig KM model (1997a) argues that knowledge can only be effective and valuable if it is organised for a purpose and attention needs to be paid to its completeness, connectedness, congruency, perspective and purpose (Dalkir, 2017). Organisational action is a result of the concentration and absorption of that feed into each cycle and within each of these phases is the

involvement of an external stimulus (Dalkir, 2017). Hence, an aggregation of individual learning through their knowledge can then help them to engage in group learning (O'Keeffe, 2002). The advantage of group or shared learning is that staff develop all the more rapidly (O'Keeffe, 2002) and the critical thinking limit of the association is enhanced through better access to and mastery of information (McHugh et al., 1998). Learning associations have structures that encourage group learning with highlights, for example, limit crossing and openness. Team learning expects people to take part in exchange and talk (O'Keeffe, 2002).

### **6B.2.6. Impact: Info/knowledge becomes embedded in concrete practices, rules and behaviour of APF**

In fact, as a result of taking decisions the APF decision makers have become embedded into specific practices and behaviours. The impact by the six decision makers has had both positive and negative impacts on the organisation, as is described below in Table 6B.1. The impact in SLC is the sixth stage that is concerned with the “*embedding of abstract knowledge in concrete practices*” (Boisot, 1999:61). There are many ways in which the impact can take place; it could be in the form of new rules, procedures and even actions and behaviours.

Table 6B.1: Impact of Six Decision on APF

Decision Maker	Decision	Positive Impact	Negative Impact
Deputy Commander In chief	Promotions	A significant and impactful reduction in costs Meritocratic behaviour Greater transparency In line with international standards and encouragement of higher standards generally Greater motivation and learning	Disrupts the status quo Demotivation due to unexpected change. Push back and resistance to change, leading to negative dynamics. Impact and affects on organisational morale, especially with those with long service.
Head of Police Operations	Support for officers through statistical unit	In line with international standards Better information about types of crime Better preparation for the future and learning from it	Information units need to make sure good quality information is inputted into the systems to avoid garbage in and garbage out issues. Information overload and communicating too much information to low level staff.
Head of Police Training	National training	International training Bench mark training Best practices More capable work force CPD (Continuous Professional Development) and to learn and	Increased costs and expenditure. Not necessarily productive Implementation is expensive.

		share that learning	
Head of Police Education	Collaboration with NYPD and Singapore/ amendments to leading courses	More educated workforce More intuitive work force which is able to learn and share that learning Better equipped to deal with complex situations	Greater costs, not just financial but time off for officers May not always be productive because of difference in crime dynamics between countries.
Head of Investigation	Using new advanced tools	Best practices and leading edge technology use Faster crime detection and resolution. Facial recognition at borders. Greater portfolio of tools to fight crime Ability to continuously update and improve. Ability to cope and learn with more sophisticated and complex crimes and or new digital/cybercrimes.	Huge cost implications in acquiring and deploying and operating the technology and tools Training, expertise and support, including costs associated with the security and privacy implications Managing expectations, both internally and externally on the use and ability of this technology
Deputy Head of Human Resource Planning	in hiring more staff for a period of 5 years	Fulfilling policing demands and growing crime activity Better trained and qualified officers with continuous training and development to become more learned. Fulfilling Emiratization goals and requirements in the police force	Costs involved in accommodating this increase in staff Allocation of appropriate roles and responsibilities Impact on existing staff and motivation for non-emirate staff and police experts

For example, there is a considerable impact on individual officers, after embracing the approach to promotions; because of greater training and education they see massive improvements to their policing skills, fitness, problem solving abilities and self-worth. Additionally, they also do not take promotion for granted (“A change in behaviour”) driven by more concrete criteria and metrics, including fitness level, English language abilities, academic qualifications and specialist skills.

Furthermore, the impact of the statistical units has initiated better access to important data, which has now become seamless and inherent in approaches to solving crimes from officers in the field to specific specialist groups and units. In other areas, such as training and education more stringent criteria and rules have been implemented across minimum levels of attainment for new recruits and better monitoring and evaluation of existing staff. In addition, the filtering of best practices from external sources and internal historic learnings have been derived and have a significant impact on the APF. Finally, the impact of the introduction of new advanced tools

and technologies has enforced new standards and approaches which have directly impacted crime rates and the solving of crimes.

Likewise, as Rothberg (2017) noted, knowledge and intelligence that can increase organisational effectiveness and learning. So as appropriate learning in the organisation starts to take place, as Senge et al. (1999) states, there are numerous reasons why an association may experience difficulty in changing itself into a learning association. The first is that an association does not have enough time (Senge et al., 1999:66). Watson (2015) also found that the names, concepts and ideologies are always being changed by decision makers and professionals in order to attract consumers and other company propositions. The study of Steiger (2010) is based on Nonaka's (1991, 1994) knowledge spiral. Choo (1998) outlines the process by which an insight to these factors can be achieved and how they can then be used to assist in decision-making and links them to the organisational knowing processes. Shollo and Galliers (2016) address the role that intelligence plays in the creation of organisational knowledge and organisational learning through articulation. In order to improve and learn, organisations need to be able to associate information and knowledge management with their business strategies (Viaene, 2008; Robson, 1997; Ward and Peppard 2015; Cassidy, 2016).

### **6B.3.0. Chapter Conclusion**

The results of the qualitative data collection show how six key decision makers made decisions and gained a certain degree of intuition from it. It shows how they processed, filtrated, interpreted, and retained the information and knowledge in question. The data was collected based on the "information space" framework provided by Boisot (1998), who suggests the dynamic flow of knowledge through a series of six phases known as the 'Social Learning Cycle' (SLC), which is used to convert data into understandable information through filtration. In the APF it is used to generate knowledge which is useful for the decision maker. APF acquires a great amount of data generated by public services. Processing vast amounts of data and extracting accurate information are not easy tasks. This research aimed to explore how information and knowledge can be used to help the decision makers in APF to gain a high degree of intuitiveness and intelligence to be effective.

Therefore, this research shows that the generation of intuitiveness is more intense at the decision-making stage, it is also generated and practiced at the earlier stages involved in

decision making. Furthermore, politics plays a pro-active role in the process of selecting, using, and harnessing value from use of information in organizations and decision making. This research has made the following theoretical contributions based upon Boisot's (1998) theory:

1. Theoretical contribution by utilising Boisot's (1998) theory in a large complex and ever changing organisation
2. By showing that the boundary between information and knowledge is irrelevant in decision making.
3. Intuition generation and accumulation is mostly concentrated at the decision-making stage but it is also used by the decision makers when selecting information and knowledge from different sources.
4. The results of the research show that once intuitiveness has taken place by decision makers, they can convert it into the knowledge for themselves following the process of diffusion. They then disseminate this knowledge to other organisations and stakeholders, at a wider scale, using the process of absorption. While this is done they continue to use their intuitiveness and preliminary learning, which helps them to create organisational learning and thereby generating better organisational impact (please refer to the results chapter).
5. As can be seen by the statistical analysis, the age, gender, experience and educational background have an impact on the development of intuitiveness and its use.

Furthermore, there are practical contributions of this research, which are listed below:

1. Showing how careful selection of information and decision-making contribute to organisational effectiveness and enable an organisation to learn from its decision-making process.
2. How individual roles of decision makers contributes to organisation effectiveness and learning.
3. It was discovered that politics and self-interest have a role and those in charge of decision-making need to learn from it.
4. The play out of politics is rather done in an unindenting way, where, despite the absence of explicit use of politics, decision makers inherently guard themselves against any possible adversities.

5. Politically the decision makers not only protect themselves, but intentionally and unintentionally try to enhance their personal and professional image, which ensures them a better and secure future and internal and external status. This is highlighted in the discussion sessions to follow.

The outcome of this research has implications for creating a learning organisation and helping it to enter a learning spiral and continual improvement. Hence the researcher aims to make recommendations to a number of different stakeholders, in particular the APF to (i) to develop its management and specialist personnel, and, (ii) to have necessary information management strategy in place that would harness information and help towards (iii) creating an effective and robust knowledge management strategy to minimise the impact of political factors.

# Chapter 7

## Conclusion and Recommendations

### 7.1. Chapter Introduction

Data quality, information and, ultimately, knowledge, are important aspects of an organisation's strategies for supporting decision makers in reaching the best decisions possible and consequently attaining the organisation's objective, which is to enter a learning cycle or spiral. The context of this is Abu Dhabi Police Force (APF). APF operates with other UAE police departments through the Ministry of Interior to achieve a safer society. APF serves four major UAE districts: Abu Dhabi, Al-Ain City, the External Region, and the Western Region. APF has several units, which include police patrol, emergency response, crime investigation, and traffic control (Alqahtani, 2017).

As APF has evolved at a phenomenal speed, its systems, approaches, mechanism of management and decision-making have also developed at an unprecedented speed. While this has been a very positive thing, APF has faced various constraints, such as ability and capacity of many decision-making individuals to process information and, even more seriously, to convert it into knowledge and intuition. Therefore, the problems that have recently surfaced are:

- Ineffective or even wrong decisions are being made due to inaccurate information.
- There is a lack of information absorption and, given the current era of high level of crime and terrorist threats, that level of ineffectiveness imposes a real risk.
- There is an over and heavy reliance on computer tools, such as decision-making and general information systems.
- There is a lack of information/knowledge conversion (codification).
- There is a lack of intuitiveness and internalisation of information and its conversion into knowledge.



- There is a lack of knowledge documentation and most of it resides in the head of workers. Hence any employee attrition imposes high risks for the organisation.

Therefore, there are many consequences of wrongful information and it not being converted to knowledge. Therefore, the objectives of this research are to expose these and then propose ways to eliminate such issues.

The purpose of this research is to check the value of information in harnessing knowledge needed in making effective decisions and increasing the effectiveness of the overall organisation. Therefore, this research aimed to create solutions that would facilitate:

- Capturing relevant information for knowledge conversion.
- Increasing individual intuitiveness of decision makers.
- Mapping and defining information-knowledge-information cycle using information space.
- Using information to develop decision makers and to increase organisational performance and effectiveness.

The primary objective of the research is to focus on how to obtain and use, or “harness” knowledge from information for improving the organisational decision-making performance of APF. Thus it is crucial to utilise concepts relating to information and knowledge.

The primary objective of the organisation is to become an intelligence-led, proactive police force that reacts to the needs of society with the highest level of integrity and training. For this aim, APF has constantly undergone approaches to improve its use of information. APF has established the “Decision-Making Support Centre” to help the organisation explore future challenges rather than just conduct research on current phenomena. The centre also helps in quality assessment and control.

### **7.1.1. Key Insights Emerging From this Research**

Therefore, this research explored how information and knowledge can be used to help the decision makers in APF to gain a high degree of intuitiveness and intelligence to be effective. It is important to increase the amount of information that can be processed and converted into

deeper level abstract knowledge, while at the same time how to get them to codify in order to help them to externalise the knowledge that they hold.

The results of the qualitative data collection show how six key decision makers made decisions and gained a certain degree of intuition from it. It shows how they processed, filtrated, interpreted, and retained the information and knowledge in question. The data was collected based on the “information space” framework provided by Boisot (1998), who suggests the dynamic flow of knowledge through a series of six phases known as the ‘Social Learning Cycle’ (SLC), which is used to convert data into understandable information through filtration. In the APF it is used to generate knowledge which is useful for the decision maker. APF acquires a great amount of data generated by public services. Processing vast amounts of data and extracting accurate information are not easy tasks. This research aimed to explore how information and knowledge can be used to help the decision makers in APF to gain a high degree of intuitiveness and intelligence to be effective.

On the other hand, the evaluation of the structural model in the current research reveals that 12 hypotheses are positively significant (H7, H8, H4, H10, H5, H11, H12, H13, H14, H15, H16, H17). Two hypotheses have a significant negative impact on other constructs (H2, H6). Additionally, 3 hypotheses are non-statistically significant (H1, H9, H3). One hypothesis is negatively significant but not in the estimated direction. One hypothesis is negatively significant but not in the estimated direction. 3 hypotheses are non-significant.

- H1 - It was hypothesized that the relationship between age and information abstraction of the decision maker in solving problems and decision-making that leads to intuition. This hypothesis is not supported after running the structural model of the current research ( $\beta = -0.124$ ;  $P = 0.140$ ).
- H2 - It was hypothesized that the relationship between education and information abstraction of the decision maker in solving problems and decision-making that leads to

intuition is a significant positive relationship. This hypothesis is not supported after running the structural model of the current research ( $\beta = -0.084$ ;  $P = 0.021$ ).

- H3 - It was hypothesized that the relationship between gender and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is not supported after running the structural model of the current research ( $\beta = 0.066$ ;  $P = 0.199$ ).
- H4 - It was hypothesized that the relationship between experience and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.437$ ;  $P = 0.000$ ).
- H5 - It was hypothesized that the relationship between role-based authority and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.437$ ;  $P = 0.000$ ).
- H6 - It was hypothesized that the relationship between department and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.514$ ;  $P = 0.000$ ).
- H7 - It was hypothesized that the relationship between public information and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant negative relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = -0.406$ ;  $P = 0.000$ ).
- H8 - It was hypothesized that the relationship between proprietary information and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta = 0.453$ ;  $P = 0.000$ ).
- H9 - It was hypothesized that the relationship between personal information and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant negative relationship. This hypothesis is not

supported after running the structural model of the current research ( $\beta=-0.012$ ;  $P=0.708$ ).

- H10 - It was hypothesized that the relationship between common sense information and information abstraction of the decision maker in solving problems and decision-making that leads to intuition is a significant positive relationship. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.097$ ;  $P=0.015$ ).
- H11 - It was hypothesized that the relationship between problem solving, and is related significantly to diffusion in diffusion and absorption. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.355$ ;  $P=0.050$ ).
- H12 - It was hypothesized that the relationship between problem solving is related significantly to absorption in diffusion and absorption. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.276$ ;  $P=0.000$ ).
- H13 - It was hypothesized that the relationship between abstraction is related significantly to diffusion in diffusion and absorption. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.221$ ;  $P=0.011$ ).
- H14 - It was hypothesized that the relationship between abstraction is related significantly to absorption in diffusion and absorption. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.353$ ;  $P=0.022$ ).
- H15 - It was hypothesized that the relationship between diffusion is related significantly to impact in impacting organisational effectiveness. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.416$ ;  $P=0.467$ ).
- H16 - It was hypothesized that the relationship between absorption is related significantly to impact in impacting organisational effectiveness. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.013$ ;  $P=0.132$ ).

- H17 - It was hypothesized that the relationship between Impact is related significantly to impact in impacting organisational effectiveness. This hypothesis is supported after running the structural model of the current research ( $\beta= 0.117$ ;  $P=0.350$ ).

On the other hand, the qualitative results show a number of theoretical contributions, such as the boundary between information and knowledge, are irrelevant in decision making; intuition generation and accumulation is mostly concentrated at the decision-making stage but it is also used by the decision makers when selecting information and knowledge from different sources. It also shows that once intuitiveness has taken place by decision makers, they can convert it into the knowledge for themselves following the process of diffusion. They then disseminate this knowledge to other organisations and stakeholders, at a wider scale using the process of absorption. While this is done they continue to use their intuitiveness and preliminary learning, which helps them to create organisational learning, thereby generating better organisational impact.

Furthermore, there are practical contributions of this research that show a careful selection of information and decision-making contribute to organisational effectiveness. It shows how individual roles of decision makers contributes to an organisation's effectiveness and learning, and it was discovered that politics and self-interest have a role. Finally, the politics are played out in an unindenting way, where despite the absence of explicit use of politics, decision makers inherently guard themselves against any possible adversities. Politically the decision makers not only protect themselves, but also intentionally and unintentionally try to enhance their personal and professional image in a bid to ensure them a better and more secure future and internal and external status. This is highlighted in the discussion sessions to follow.

Therefore, this research has implications for creating a learning organisation as a key outcome of this is to help it to enter a learning spiral of continual improvement. The researcher aims to make recommendations to a number of different stakeholders, in particular the APF, to (i) to develop its management and specialist personnel, and, (ii) to have necessary information management strategy in place that would harness information and help towards (iii) creating an effective and robust knowledge management strategy to minimise the impact of political factors.

Therefore, this research shows that while the generation of intuitiveness is more intense at the decision-making stage, it is also generated and practiced at the earlier stages involved in decision making. Furthermore, politics plays a pro-active role in the process of selecting, using, and harnessing value from the use of information in organizations and decision making.

## **7.2. Contribution to Theory and Practice**

This research has made the following theoretical contributions:

1. It has made a theoretical contribution by operationalising Boisot's (1998) theory in a large complex organisation. It shows that it is possible to make sense of complex, real life problems and make organisational decision makers aware of the intuition that can be generated. This helps their organisation to enter learning and to become effective. The results of the research show that once intuitiveness has taken place by decision makers, they can convert it into the knowledge for themselves following the process of diffusion. They then disseminate this knowledge to other organisations and stakeholders, at a wider scale, using the process of absorption. While this is done, they continue to use their intuitiveness and preliminary learning, which helps them to create organisational learning, thereby generating better organisational impact.
2. It has been shown through this research that the boundary between information and knowledge is irrelevant in decision-making and it is important to focus on the organisational purpose.
3. Intuition generation and accumulation is mostly concentrated at the decision-making stage but it is also used by the decision makers when selecting information and knowledge from different sources. As can be seen by the statistical analysis, the age, gender, experience and educational background has an impact on the development of intuitiveness and its use. Hence organisations can be helped more by particular types of decision makers.

Furthermore, there are practical contributions of this research, which are listed below, showing:

1. How careful selection of information and decision-making contribute to organisational effectiveness and learning.
2. How individual roles of decision makers contribute to an organisation's effectiveness and learning. By being aware of the process of becoming intuitive and effective they can self-improve.
3. That politics and self-interest have a role to play in knowledge diffusion and acceptance by the recipient. The play out of politics is done in rather a crude way, where despite the absence of explicit use of politics, decision makers inherently guard themselves against any possible adversities. Politically the decision makers not only protect themselves, but also intentionally and unintentionally try to enhance their personal and professional image, which ensures them a better and secure future and internal and external status. This is highlighted in the discussion sessions to follow.

The outcome of this research has implications for creating a learning organisation and helping it to enter a learning spiral and continual improvement. Hence, the researcher aims to make recommendations to a number of different stakeholders, in particular the APF to (i) to develop its management and specialist personnel, and, (ii) to have necessary information management strategy in place that would harness information and help towards (iii) creating an effective and robust knowledge management strategy to minimise the impact of political factors.

### **7.3. Implications of this Research**

The outcomes of this research has implications for policy and practice; thus, the researcher aims to make recommendations to a number of different stakeholders: policymakers, practitioners and researchers.

### **7.3.1. Implications for APF Management**

The implications for APF Management are, firstly, that they need to create information management and knowledge management strategies, policies and procedures to facilitate an atmosphere of quality information flow and how to use it for organisational effectiveness and its learning. They need to pay attention to clear information sources, information handling procedures and guidance available to workforce on the use of information. They can achieve this by providing strategy apparatus, a human resource management department and online advice and training, which could give the workers information, guidance and possibly access to APF sites. This advice can be provided via the information technology department via helpdesk support or even an online portal. The online approach could be a popular option given the increased use of technology and the Internet.

Secondly, there is a need for coordination between APF departments to formulate and implement new innovative policies. Currently the connection and coordination between institutions is undefined, informal and politically motivated throughout APF. This has led to many unintended consequences, such as demotivation amongst the workforce.

Thirdly, the management need to focus on encouraging decision makers of all ages and education backgrounds to develop their knowledge and intuition. The intuition should be kept at the heart of any use of information in decision making, starting from regular decision-making to ad-hoc decision-making to facilitate creativity, imagination, risk-taking and communication skills that they can use to disseminate their intuition and knowledge throughout the organization as absorption. Policy on becoming intuitive should be realistic and backed by the HRM department and strategic management.

### **7.3.2. Implications for APF Decision Makers**

There are implications of this research for decision makers engaged in APF decisions. Hence, a number of implications have emerged based on the results of this research.

Firstly, a decision maker can become more conscious of the decision-making process and then learn to become more intuitive. They can consciously aim to harness greater amount of knowledge to make themselves more valuable to the company. They will be able to capture and internalise more useful and valuable knowledge in order to increase their degree of intelligence and effectiveness.



Secondly, a decision maker can learn about the invisible process of converting information into knowledge and vice versa, as per Boisot's information space model. They can then consciously convert more of the information into knowledge to achieve a greater degree of usefulness. They will gain greater expertise in the art of codifying and de-codifying useful knowledge.

Finally, decision makers will learn to perform the absorption role much better where they learn how to inform the organisational stakeholders in order to increase their awareness, understanding and knowledge. Hence, they can lead others to increase the organisational effectiveness and allow them to enter the learning spiral. Hence they will gain the leadership role to facilitate the improvement for the overall organisational.

## **7.4. Research Limitations Involved in this Research**

There are several limitations of this research. These are discussed below:

Firstly, this research is mainly focused around civil protection/security organisations and involved collecting the data from Abu Dhabi Police Force. This has been a limitation in this instance as a wider coverage of similar contexts may have generated more insights into how organisational decision making leads to learning organisations. A mirror approach to collecting data from other organisations would have helped to see any similarities and differences. This would also have helped to create insights and patterns of information use and its dissemination.

Secondly, a focus on a defined number and types of decisions to see the use of information-knowledge would have been easier in order to better focus on the decision making process and to work out particular types of information and knowledge used. Hence it would have been easier to work out information-knowledge-information conversion. This would have also helped to work out the creation of intuition and organisational learning more transparently, then articulate it.

Finally, it would have helped to focus on decision makers, their innate abilities and intelligence, given that the impact of their abilities and personality on the organisation

would differ. The research strategies used did not particularly lend themselves to facilitate a closer focus on the personal aspects. Furthermore, the research did not take into account that the judgement of the respondent may be impaired or obstructed, given the work related and political pressures imposed on managers, as decision makers.

## **7.5. Future Direction**

This research has highlighted a number of implications for APF, decision makers and researchers, thus this research has made some very useful contributions to organisations. There are implications of this research for future research:

Firstly, a researcher could undertake a comparison of the APF with other public and non-public organisations in order to create learning for practitioners and academics. There are many organisations that face a similar information use. There are some organisations that appear different; however, they have similar problems so it is worth looking at their ways of decision making.

Secondly, a researcher can undertake research into the different types of decisions in different organisations. This would help management to develop more intuitive decision makers who can help them to achieve their business objectives. This would enable decision makers to use appropriate mechanisms to develop themselves and to contribute towards the rest of the organization.

Thirdly, a researcher can focus on the changing role of the decision maker to lead the organisation to enter a learning spiral. They can then look at the degree of effectiveness of an organisation that has entered the spiral. They look at the speed to climb on the spiral, focus on the enabling and hindering forces and look at the role played by different organisational strategies facilitating this.

## **7.6. Chapter Conclusion**

This chapter concludes the thesis and shows the key findings of this research. It has outlined the importance of this study. It shows how this research has discovered the gaining and accumulation of intuitiveness of APF decision makers. It discusses the key insights, contribution to theory and practice and the implications of this research. It becomes apparent that the sources of information, such as proprietary knowledge and common sense, along with demographic factors, have a lot of impact on the problem solving, and decision-making that is used at all stages. Also it showed politics play a big role in the process of decision-making due to decision makers being aware of potential consequence of wrong choice.

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# Appendices

## Appendix A: Survey Questionnaire Letter

### SURVEY QUESTIONNAIRE

#### Covering Letter

Dear Officer,

I am a PhD student and would like to invite you to be a part of my research study. Its aim is to assess information value for harnessing knowledge needed for improving decision-making and effectiveness of the Abu Dhabi Police Force using a knowledge management approach. The research will be very helpful for APF in improving its effectiveness.

My survey is academic in nature and it is part of a study being conducted. It is intended to obtain your opinions on your decision-making practices using information and knowledge. The information that you provide will be invaluable for developing a better understanding of the perceptions and trends in developing knowledge based for the organisation.

Your voluntary input will only take about 20 minutes of your time and please do try to focus on the question being asked. Please feel comfortable to state your opinion to answer the survey questionnaire.

All information including the responses will be kept anonymous and will only be used for research purpose. Your response to the survey will be kept confidential and will not be exposed to any one inside or outside your school. Please note that your completion of this online survey constitutes consent. Please click on the URL below and complete the survey online, if you are happy.

Yours sincerely,  
Omar AlKetabi  
Email <<>>  
Telephone <<>>

## Appendix B: Qualitative Research

### Qualitative Research

Research **Propositions** and Questions in the conceptual framework:

- P1. Information and knowledge leads to better everyday problem solving.
- P2. Information and knowledge leads to better everyday decision making.
- P3. Well thought out decisions lead to your good intuition.
- P4. Accurate decisions lead to positive organisational implication.
- P5. Appropriate and good level of intuition increases organisational effectiveness.
- P6. Appropriate and good decision-making and organisation wide implications of it increase organisational effectiveness.

#### Interview questions:

Question 1. What types of information do you use for your everyday problem solving at work?  
Also discuss information systems

Question 2. What types of information do you use for your everyday decision-making at work?  
Also discuss information systems

Question 3. How does your problem solving and decision-making leads to your intuition?

Question 4. How does your problem solving and decision-making lead to organisational implications?

Question 5. How does your intuition increase organisational effectiveness?

Question 6. How does your decision-making and its organisation wide implication increase organisational effectiveness?

Open Question	Proposition 1	Proposition 2	Proposition 3	Proposition 4	Proposition 5	Proposition 6
1	X					
2		X				
3			X			
4				X		
5					X	
6						X

Confidentiality: The interview will be tape recorded; however, your name will not be recorded on the tape. Your name and identifying information will not be associated with any part of the written report of the research. All of your information and interview responses will be kept confidential. The researcher will not share your individual responses with anyone other than the research supervisors.

## Appendix C: Hypothesis

### Quantitative Research

**Hypothesis** and Questionnaire **questions** for quantitative data collection

No	Hypotheses
H1	Age is related significantly to information abstraction of the decision maker in solving problems and decision-making that leads to intuition.
H2	Education is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H3	Gender is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H4	Experience is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H5	Role-based authority is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H6	Department is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H6a	Information systems are related significantly to decision maker in solving problems and decision-making that leads to intuition.
H6b	Decision support Information systems are related significantly to decision maker in solving problems and decision-making that leads to intuition.
H6c	Data mining Information systems are related significantly to decision maker in solving problems and decision-making that leads to intuition.
H7	Public information is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H8	Proprietary information is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H9	Personal information is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H10	Common sense information is related significantly to decision maker in solving problems and decision-making that leads to intuition.
H11	Knowledge use by decision maker for solving problems increases knowledge diffusion (sharing insights with a target select population).
H12	Knowledge use by decision maker for solving problems increases knowledge absorption, leading to knowledge application to a variety of organisation-wide situations.
H13	Knowledge abstraction by decision maker for intuitiveness leading to some organisational positive implication(s) (sharing insights with a target select population).
H14	Knowledge abstraction by decision maker for intuition increases knowledge absorption, leading to organisation-wide positive implication(s).
H11	Knowledge use by decision maker for solving problems increases knowledge diffusion (sharing insights with a target select population).
H12	Knowledge use by decision maker for solving problems increases knowledge

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	absorption leading to knowledge application to a variety of organisation-wide situations.
H13	Knowledge abstraction by decision maker for intuitiveness leading to some organisational positive implication(s).
H14	Knowledge abstraction by decision maker for intuition increases knowledge absorption leading to organisation-wide positive implication(s)
H15	Knowledge diffusion to a small select team by the decision maker leads to positive impact on organisational effectiveness.
H16	Organisation-wide knowledge absorption leads to positive impact on organisational effectiveness.
H17	Organisation-wide knowledge used leads to positive impact and increased organisational effectiveness.

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## Appendix D: Survey Questionnaire

### Questionnaire questions

Question 1 – What is your age range?

Question 2 – What is your education background?

Question 3 – Which gender group do you belong to?

Question 4 – How many years of job experience do you hold in your area of employment?

Question 5 – What is your current role in the organisation?

Question 6 – Which department do you work in?

Question 6a – Do you use general information systems for your daily decision making?

Question 6b – Do you use Decision support information systems for your daily decision making?

Question 6c – Do you use data mining information systems for your daily decision making?

Question 7 - Does publically available knowledge (such as books, newspapers and professional reports) help you in problem solving?

Question 8 - Does publically available knowledge (such as books, newspapers and professional reports) lead to decision-making and greater intuition?

Question 9 –Does proprietary knowledge (such as APF secrets and actions) help you in problem solving?

Question 10 - Does proprietary knowledge (such as APF secrets and actions) lead to decision-making and greater intuition?

Question 11 – Does personal knowledge (such as biographical knowledge) help you in problem solving?

Question 12 - Does personal knowledge (such as biographical knowledge) lead to decision-making and greater intuition?

Question 13 - Does common sense knowledge (such as everybody's awareness) help you in problem solving?

Question 14 - Does common sense knowledge (such as everybody's awareness) lead to decision-making and greater intuition and?

Question 15 – Does your use of knowledge for solving problems increase your knowledge diffusion involving sharing knowledge with a target select group)?

Question 16 - Does your use of knowledge for solving problems lead to an increase in knowledge application to a variety of situations in APF.

Question 17 – Has your use of knowledge for intuitiveness in decision-making led to sharing knowledge with a target select group)?

Question 18 - Has your use of knowledge for intuitiveness in decision-making led an increased in knowledge application to a variety of situations in APF?

Question 19 – Has your release of knowledge to small target APF groups led to positive impact and organisational learning?

Question 20 - Has your sharing of new knowledge insights with many groups across the organisation led to positive impact and organisational learning?

Question 21 – Have new knowledge insights related to your decision-making led to positive impact and made the organisation more effectiveness and organisational learning?

Question	H1	H2	H3	H4	H5	H6	H6 a-c	H7	H8	H9	H 10	H 11	H 12	H 13	H 14	H 15	H 16	H 17
1	/																	
2		/																
3			/															
4				/														
5					/													
6						/												
6a-c							/											
7								/										
8								/										
9									/									
10									/									
11										/								
12										/								
13											/							
14											/							
15												/						
16													/					
17														/				
18															/			
19																/		
20																	/	
21																		/

## Appendix E: Research Ethics form

UNIVERSITY OF BEDFORDSHIRE

Research Ethics Scrutiny (Annex to RS1 form)

SECTION A To be completed by the candidate

Registration No: 0814766

Candidate: OMAR ALKETBI

Research Institute: IRAC

Research Topic: Detecting Patterns in Decision Support Systems Operation through Data Mining Techniques

External Funding: Sponsorship from UAE government

The candidate is required to summarise in the box below the ethical issues involved in the research proposal and how they will be addressed. In any proposal involving human participants the following should be provided:

- clear explanation of how informed consent will be obtained,
- how will confidentiality and anonymity be observed,
- how will the nature of the research, its purpose and the means of dissemination of the outcomes be communicated to participants,
- how personal data will be stored and secured
- if participants are being placed under any form of stress (physical or mental) identify what steps are being taken to minimise risk

If protocols are being used that have already received University Research Ethics Committee (UREC) ethical approval then please specify. Roles of any collaborating institutions should be clearly identified. Reference should be made to the appropriate professional body code of practice.

This research will not involve any ethical issues.

Signature of Applicant:



Date: 19 May 2010

Signature of Director of Studies:



Date: 19 May 2010

*This form together with a copy of the research proposal should be submitted to the Research Institute Director for consideration by the Research Institute Ethics Committee/Panel*

**Note you cannot commence collection of research data until this form has been approved**

**SECTION B To be completed by the Research Institute Ethics Committee:**

Comments:

*see attached approved copy.*

Approved

Signature Chair of Research Institute Ethics Committee:

Date:

*This form should then be filed with the RS1 form*

If in the judgement of the committee there are significant ethical issues for which there is not agreed practice then further ethical consideration is required before approval can be given and the proposal with the committees comments should be forwarded to the secretary of the UREC for consideration.

**There are significant ethical issues which require further guidance**

Signature of Applicant:

Date: 19 May 2010

Signature of Director of Studies:



Date: 19 May 2010

*This form together with a copy of the research proposal should be submitted to the Research Institute Director for consideration by the Research Institute Ethics Committee/Panel*

**Note you cannot commence collection of research data until this form has been approved**

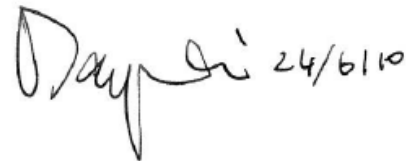
**SECTION B To be completed by the Research Institute Ethics Committee:**

Comments:

Approved

Signature Chair of Research Institute Ethics Committee:

Date:



*This form should then be filed with the RS1 form*

If in the judgement of the committee there are significant ethical issues for which there is not agreed practice then further ethical consideration is required before approval can be given and the proposal with the committees comments should be forwarded to the secretary of the UREC for consideration.

**There are significant ethical issues which require further guidance**

*This form together with the recommendation and a copy of the research proposal should then be submitted to the University Research Ethics Committee*