# The Interrelationship between Knowledge Management and Business Process Management and its Impact on the Decision-Making Process in the Construction Sector: A Case study of Jordan


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# ABSTRACT

In recent years, Knowledge has always been accepted as being a valuable asset. In particular, it has become an important factor for the construction industry. To adapt to changes in the local and global business environment including the information technology revolution and to cope with the new competition, construction organisations have attempted to manage and apply their knowledge effectively and efficiently.

The literature has shown that several problems in relation to the decision-making process in the construction sector in general and in particular, in Jordan, have been identified, e.g. selecting suppliers, equipment, and contractors. Because of the numerous number of business processes associated with making key decisions which require eliciting the correct knowledge to facilitate performing those business processes, there is a gap in the integration between knowledge management and business processes with regard to the decision making process. In order to bridge this gap, this research was carried out in order to investigate and explain how organisations in the construction sector can enhance the decision-making process (DMP) by practicing knowledge management (KM) and business process management (BPM) activities. To fulfil this aim, a mixed-methods approach has been adopted, combining a literature review approach, a questionnaire and semi-structured interviews to collect data from the Jordanian construction organisations.

A framework has been proposed. This framework contains three elements with twelve sub-variables with all of these determined from an extensive review of previous studies and validated through an empirical survey.  The quantitative data was obtained from the respondents through the use of a five-point Likert scale. To refine and validate the proposed framework, semi-structured interviews were then carried out with selected, experienced practitioners in the construction sector in order to elicit their views on any element that should be added to the framework in addition to those that had been discovered within the literature review and synthesis, and to discover if the domain experts supported the outcomes from the questionnaire survey and to verify the findings achieved from the questionnaire analysis.

The current study provides a method of acquiring a more comprehensive knowledge of the importance of KM alongside BPM for the improvement of DM styles to attain organisational goals. It generates a strong operational as well as theoretical approach to the organisational utilization of knowledge and business processes through the development of an associated theoretical framework. While previous studies have indicated that knowledge enablers along with business processes guarantee organisational achievement across organisational DMP, this research shows that precise decision-making determination by decision makers could strengthen the relationship chain.

*To My Parents*

*To My Wife*

*To My Beloved Daughters*

*To My Brothers*

*To My Sisters*

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# List of Abbreviations

| Abbreviation | Description |
|---|---|
| KM | Knowledge Management |
| BPM | Business Process Management |
| KMBPM | The integration of KM and BPM |
| DMP | Decision Making Process |
| DM | Decision Making |
| BP | Business Process |
| DSS | Decision Support System |
| KMS | Knowledge Management System |
| IT | Information Technology |
| SECI | Socialization, Externalization, Combination, And Internalization |
| PC | Personal Computer |
| KWS | Knowledge Work System |
| CAD | Computer Aided Design |
| KBDSS | Knowledge-Based Decision Support Systems |
| AI | Artificial Intelligence |
| OAS | Office Automation Systems |
| IQ | Intelligence Quotient |
| CEO | Chief Executive Officer |
| GM | General Manager |
| CKO | Chief Knowledge Officer |
| KPIs | Key Performance Indicators |
| CPO | Chief Process Officers |
| PIS | Problem Identification Speed |
| DMS | Decision Making Speed |

| | |
|---|---|
| DMA | The Extent of Analysis in Decision Making |
| GDP | Gross Domestic Product |
| JCCA | Jordanian Construction Contractors Association |
| JEA | Jordanian Engineers Association |
| SMEs | Small Medium Enterprises |
| HR | Human Resource |
| BPG | Business Process Governance |

# 1. Chapter 1: Introduction

## 1.1. Introduction

This chapter introduces the PhD thesis titled “The Interrelationship between Knowledge Management and Business Process Management and its Impact on the Decision-Making Process in the Construction Sector: A Case study of Jordan”. Chapter 1 presents and discusses the rationale behind the research. It clarifies the problem and defines the motivation for applying knowledge management (KM) and the business process management (BPM) in the development of the decision-making process (DMP). Accordingly, the research aim and objectives are presented followed by the research questions, along with the research methodology in which a mixed-method approach is adopted. Finally, the chapter is concluded with the contribution of this research and thesis structure.

## 1.2. Background

Business organisations have been witnessing rapid changes to their structure, culture, behaviour, and processes. This accelerating change can be explained simply by the high stream of the information volume dribbling down which Baeyer and Christian (2004) described as an “invisible, and impalpable electric rain”. Every business today must build its own information system and learn what turns a possible transformation of information into an instruction to produce knowledge (Rowley and Hartley, 2008). Moreover, new business forces business enterprises to adopt knowledge management systems (KMS) in order to effectively learn and nurture innovation (Hershberg et al., 2007). It is therefore critical that businesses improve their knowledge-based resources which are increasingly seen as the main asset for growth and sustainable competitive advantage (Barney, 1991; Hill and Levenhagen, 1995; Desouza and Awazu, 2006).

In recent years, there is a wide acceptance in the construction industry that knowledge is a valuable asset (Omotayo, 2015; Takhtravanchi and Pathirage, 2016; Serpell et al., 2018; Yusof et al., 2015; Rezgui et al., 2010). There is no doubt that the industry must fully implement KM. Therefore, if the construction industry wants to reduce costs, increase profits, work efficiency, and improve customer service, it must adopt KM (Walker, 2005). In regard to this, many working in the construction business recognise KM as a comprehensive strategy for the construction industry in achieving its aim (Yu and Yang, 2018; Elfar et al., 2017; Carrillo et al., 2004; Robinson et al., 2001). Furthermore, Construction organisations have clearly adopted KM because of the obvious benefits in improving its performance as well as in achieving a competitive advantage (Hsu, 2008; Khalfan et al., 2003).

Arif et.al., (2017) found that there are three key factors of knowledge sharing in the Jordanian construction sector, which are trust, management and communication. And his research concluded that trust is the most crucial factor for sharing knowledge. One limitation of his study is that he only focused on the Jordanian construction sector and internal knowledge sharing, this makes his finding unrepresentative of other construction sectors in the world and other types of knowledge sharing, therefore it is hard to make generalisation with his findings. Also, Almomani et al., (2019) concluded that KM has a positive relationship with marketing innovation and the cost of quality. In order to affectively include marketing innovation and high-quality products and services, the organisation's processes should gather, store and apply KM to remove poor quality costs.

Construction has many major concerns concerning the requirement for enhancing processes (Wolstenholme et al., 2009). Several studies have paid attention to processes in the construction industry at both high and low-level stages (Kagioglou et al., 2000). Others have sought to improve a small part of the process across the organisation (Mohamed and Tucker, 1996). Construction projects are characterized by a long-life cycle which produces large amounts of data and operation processes. Therefore, the construction sector has improved its focus on the possible advantage of using KM (Carrillo et al., 2004). However, the exceptional demands of construction organisations cannot be met if important knowledge essential for enhancing processes is not included. Bani Ismail (2012) pointed out that the application of total quality management in Jordanian construction organisations helps to develop the market share which improves the organisations' competitiveness, but the profit and the quality of the service would not be improved. In contrast, in the UK the application of TQM would improve the competitiveness, profit, market share and the quality of the service within the UK organisations. Also, Al-Werikat, (2017) discussed the effect of supply chain management on Jordanian construction projects performance and he pointed out that there are problems relating to deliver the correct knowledge to the appropriate people at the right time. He also found that there is a delay in the flow of the information within the main contractor's company.

To ensure the effective utilization and improvement of the role of knowledge throughout the business life cycle, the process of KM is an essential driver for any BP development and evolution as it engages with planning, implementing, controlling, monitoring and improving processes and systems in an organisation. The combination of KM and BP is indispensable. Once knowledge is implemented over a process of elaboration, infusion, and thoroughness, it will be beneficial in enabling creativity, shared knowledge, individual learning, collaborative problem solving, and organisational learning as a goal of KM (King et al., 2008). Furthermore, this combination will enable BP to be more extensive and well-aligned with the evolving organisational information systems' needs and requirements.

In addition, the interrelation between KM and BPM, has the ability to help the business processes through merging KM techniques with the day-to-day operations. Along with the area of knowledge which can be applied, all core KM activities are interconnected with precise BPs (Schmid and Kern, 2014).

KM is business and process oriented (Zhang, 2013). KM can recognize the creation of value and join with different kinds of management through BPs. Knowledge can be administered and distributed actively with a dynamic BP in the organisation through the process-oriented KM which can prevent the overload of information and focuses on useful information that is important for firm value chains (Kwan and Balasubramanian, 2003). The aim is to transfer suitable knowledge at the appropriate time to the right people which can also enhance the effectiveness of decision making (DM) within the company.

Recently, studies have shown a desire to develop the concept of DMP in the construction sector. In this respect, prior studies reveal the methods and approaches for analysing the data which support the DMP (Espino et al., 2014; Dziadosz and Konczak, 2016). Additionally, Mahbub, (2015) developed a sustainable DM framework for the implementation of advanced technology within construction considering the knowledge collaboration principles and sustainability issues.

## 1.3. The Dearth of Research on KM and BPM in Jordan

The main motivation for conducting this research is the absence of empirical research on the implementation of knowledge management and business process management in the Jordanian construction industry.

Whilst there has been considerable awareness dedicated to the interrelationship between KM and BPM, the mainstream of literature had been concentrated on its involvement with the planning, analysis and implementation of process-oriented KM (Schmid and Kern, 2014). The expansion of attention of the significance of KM and BPM on developing the industries has attracted many researchers. This empirical research study aspires to investigate the relationship between KM and BPM for enhancing (decision making process) DMP in an organisation. It has been pointed out in the literature that the number of enterprises that executed KM and BPM successfully is comparatively small (Schmid and Kern, 2014). Specifically, the research of DMP in the construction industry is comparatively rare. Consequently, managing knowledge could be assumed a vital tool to the construction industry's long-term success. As with any organisation, institutions in the construction sector are challenged by the competition due to the existence of several organisations in Jordan in addition to other countries in the region.

Schmid and Kern (2014) stated that only a few studies have been completed dealing with the issues associated with the handling of knowledge. Additionally, the frameworks, within them are not entirely developed. Furthermore, Zhong (2008) stated that the contribution of KM to the DMP has been mostly disregarded by researchers from aspects of decision theory in addition to knowledge management as well.

Another issue associated with DM is the difficulty of making a solid decision. This occurs as there are exist several choices (Shapiro et al., 2000). This is because of the increasing complexity and uncertainty in the business environment as well as the growth of the necessity to make rapid and free error decisions. Therefore, the nature of managerial DM at all levels of an organisation has been changed (Turban and Aronson, 2001).

The literature shows that although the part played by knowledge management (KM) for decision support is properly recognised, there is a gap in current KM theory along with the actual KM practice in the current decision-making reality. One reason for this could be the lack of case studies showing how KM affects DM.

Many entrepreneurs and practitioners recognize the value of knowledge when presented in a theoretical context. However, there are still shortcomings when it has to do with utilizing KM in BPs as they find it too slippery to handle (Quintas, 2004).

This research will provide an opportunity to investigate the factors affecting DMP in Jordanian construction organisations in terms of KM and BPM.

## 1.4. The Research Problem

Several institutions seek to keep abreast of modern administrative improvements and apply them in their numerous activities not only in order to flourish and survive but also to sustain top quality leadership. Furthermore, knowledge management enabled many construction organisations to attain a highly competitive advantage and enhance their performance. Hence, research stands out as an essential tool for discovering what is necessary to enhance the efficiency of the process of decision making in terms of KM and BPM.

However, the construction industry has long been criticized for its low productivity and problems related to process management (Pheng et al., 2016; Hasan et al., 2018; Fulford and Standing, 2014; Bankvall et al., 2010; Tran and Tookey; 2011).

There is a gap in the literature pertaining to the reporting and analysis of the integration between KM and BPM throughout construction organisations and its usefulness in DMP.

However, the main question is what distinguishes the current study from previous studies? By reviewing past studies, it appears that some have examined the knowledge processes role (Fong and Choi, 2009; Bahtiar, 2012) and previous works have assessed the performance of knowledge management (Yusof along with Bakar, 2012; Charlesraj and Kalidindi, 2006; Abu Bakar et al., 2016), and the effect on construction innovation (Maqsood and Finegan, 2009; Wynn et al., 2008; Zhen and Zhenmin, 2008). In addition, some researchers have pointed out the role of KM in achieving a competitive advantage in the construction industry (Bakar et al., 2012; Magenuka, 2004; Schulte and O'Sullivan, 2009; Virgiyanti, 2014).

The complexity of construction projects created by large amounts of complex data, tasks and operation processes trigger several problems related to the decision-making process. At every phase of the decision-making process problems can occur, for example, choosing the most appropriate location for a new project, the design stage, problems regarding the management of the new project, the quality of the project, and the selection of the most appropriate technologies, contractors, suppliers, equipment and materials (Erdogan, 2017; Szafranko, 2017; and Omar, 2013).

Another issue associated with DM is the difficulty of making a solid decision in order to increase complexity and uncertainty in the construction environment. A solid decision means having to make a decision that has a very little number of risks, since the Jordanian construction organisations include complex tasks and roles which need to be completed carefully. The inability to make such a decision could affect the performance and delay the growth of the organisation. It is challenging to make a solid decision because the construction sector lacks the effective knowledge management where employees do not have the access to the relevant and basic knowledge needed in a daily basis to find solutions to problems in projects (Okere, 2017). One of the other issues that Jordanian Construction organisations face is not being able to exchange the suitable information at the most appropriate time and to the right people, this issue could result in information disruption which leads to the delay of the construction project (Al-Werikat, 2017).

This research is differentiated from earlier studies by concentrating on a crucial feature, which is the integration of KM and BPM in addition to its influence on DMP in Jordanian construction organisations and its impact in attaining right decisions in these organisations, where majority attempts and research have stayed focused concerning the management of knowledge. Moreover, the researcher has benefited from past research and the advantage is displayed in two areas. First, is the formulation of the theoretical framework for the study and the formulation of hypotheses.

To sum up, the complexity of construction projects created by large quantities of complex data, tasks and operation processes trigger several problems related to the decision-making process. For example, there is the task of selecting the correct choice between project delivery, contractor, supplier, equipment and consultant (Omar, 2013).  Another issue associated with DM is the difficulty of making a solid decision in order to increase complexity and uncertainty in the construction environment. Some research has been completed on investigating the relationship between knowledge and process efficiency (Cheng et al., 2011; Tabares et al., 2016; Massingham and Al Holaibi, 2017; Febriantoro and Surendro, 2015; Höpken, et al., 2015). However, there is a lack of investigation into the effectiveness of such integration on DMP.

In numerous ways, the current study provides for deeper knowledge of the importance of KM apart from BPM in improving the DM styles to attain the organisational goals. To be clearer, it generates a strong operational as well as theoretical approach to the organisational utilization of knowledge and business processes (BPs) associated with a theoretical framework. Following, previous studies which indicate that knowledge enablers along with BPs guarantee organisational achievement across the organisational DMP, this research shows that precise DM determination by decision makers could strengthen the relationship chain. With further precision, the study recommends the moderating role of intuitive and rational DM styles on the relationship between managing knowledge and BPM combined with organisational success.

## 1.5. Research Aim and Objectives

The aim of this research is to investigate and explain how organisations in the construction sector can enhance the decision-making process (DMP) by practicing knowledge management (KM) and business process management (BPM) activities.

Therefore, this study has the following objectives:

1. To present an appropriate literature review on the concepts of KM and BPM alongside their significance for construction organisations in addition to assisting with the theoretical framing of them.
2. To develop a framework for the integration of KM and BPM to support DMP.
3. To investigate the integration between KM and BPM in construction organisations.
4. To investigate the effect of the integration of KM and BPM in the DMP of construction organisations.
5. To validate the proposed framework.

## 1.6. Research Questions (RQ)

In general, organisations need to develop and accumulate knowledge assets with a more robust structure. For example, it is important to acquire knowledge to generate new knowledge, or organisational capability to innovate and self-renew in order to adapt to changing market conditions (Nonaka et al., 2006). Business process management (BPM) is a major element in an organisation's capability to improve performance (Gartner, 2010). Furthermore, it is fundamentally the distinctive capabilities engendered through BPM that shape the basis for competitive advantage (Gartner, 2010; Hung, 2006). Thus, it is anticipated that combining KM and BPM will help organisations to recombine/reinforce their current capabilities and learn new skills in order to develop a more dynamic view of how organisations create new knowledge. This new knowledge is anticipated to have an impact on the DMP. The key research questions to inform the extent of the validity of this hypothesis include:

1. Can KM integrate with BPM and, if so, why should they integrate?
2. How can the interrelationship of KM and BPM be employed in the DMP?
3. What could be the method of improving BPs based on KM techniques to enhance DMP?
4. How can the integration of KM and BPs be modelled and analysed from the decision makers' point of view in the construction sector?

5. To what extent will the interrelation assist in enhancing the DMP?

## 1.7. Research Methodology

This research has employed a combination of qualitative and quantitative research strategies to achieve the aim and objectives of the research for the following reasons. *Firstly*, mixed methods research, by combining both qualitative and quantitative methods, has the ability to address both exploratory and confirmatory questions within the same research inquiry. Secondly, an explicit understanding of mixed-methods study drives researchers to create a knowledgeable choice considering the design as well as analysise features of a mixed-methods review (Venkatesh et al., 2013). Thirdly, Johnson and Turner (2003) stated that mixed-methods research has the ability to influence the benefits of both quantitative and qualitative methods as well as give more noteworthy experiences to a phenomenon than methods can provide independently. Fourthly, mixed-methods research presents an opportunity to accommodate more prominent groupings of conflicting as well as reciprocal discoveries (Tashakkori and Teddlie, 2008)

This will be achieved by gathering data from various bases as well as through utilising different methods, including previous studies, survey questionnaires as well as semi-structured interviews. The researcher first created the survey questionnaires to comprehend and understand the effect of the integration of KM and BPM to improve DMP in the construction sector. At that point the result of the questionnaire will triangulate with the semi-structured interviews which will completed by domain experts.

The semi-structured interviews will be used to support and validate the questionnaire outcomes. Gray (2013) indicates that the usage of different methods aided data triangulation and in addition was an efficient method to conquer the majority of the shortcomings of every method used.

## 1.8. Contribution to Knowledge

This research makes a contribution to both theory and practice, by providing a thorough and methodical analysis of the implementation of knowledge management and business process management to improve the process of decision making in the Jordanian construction industry. The outcomes are considered as making a considerable contribution to knowledge in terms of the following:

- It reviews and analyses the literature from distinct disciplines to explore how KM and BPM could support DMP in the construction industry. There is clearly a gap in the literature involving the integration of KM and BPM in assisting the DMP, particularly in the construction industry, and no research has been performed to reflect all variables applied in this research to date.
- According to the literature review, this study is the first to research the factors that affect the integration of KM and BPM in the Jordanian (Middle East) construction industry so far. Accordingly, it will offer valuable knowledge to Jordanian organisations when applying KM and BPM techniques and methods, by enhancing the decision-making process.
- It introduces a framework that can be applied in Middle Eastern countries. It can be acquired by Middle Eastern companies, since most Middle East construction companies operate in similar environments.
- This research offers a new conceptual framework that recognises the elements that impact DMP in terms of KM and BPM. The conceptual framework will make a significant contribution to the literature of KM and BPM which will help construction organisations to improve their DMP.
- The framework developed in this research expresses the language of an enterprise by analysing the relationships between KM variables (Processes, Technology and Team), BPM variables (Strategic alignment, Governance, Methods, Culture, Information

Technology and People) and decision-making process in the context of the construction industry in Jordan. Thus, this research is differentiated from current practical work on KM in addition to BPM as it investigates a wider variety of variables that impact DMP.

- There will be help for organisations to analyse the impact of factors in KM and BPM to providing the employees with the required knowledge needed for performing the organisation's operational business processes, enhance process performance, develop core competencies (Zhang et al., 2008), and optimize business performance (Han et al., 2008). The key aim of knowledge management is to deliver the right knowledge to the right people when needed. Also, the effectiveness of decision making within the organisations can be enhanced by the integration between KM and business processes (Chu et al., 2011).

## 1.9. Thesis Structure

The thesis is structured as follows:

**Chapter 1** presents and discusses the rationale behind the research. It clarifies the problem and defines the motivation for applying KM and BPM in the development of DMP. Accordingly, the main research aim and objectives are presented followed by the research questions. Finally, the chapter is concluded with the contribution of this research and the thesis structure.

**Chapter 2** discusses the background and literature review of this research. This literature is arranged based upon the ideas applied in this research as well as various theoretical courses that are related to this research. This study produces the literature from the fields of KM and BPM to identify the main gap in the literature. In particular, the literature in the topics of knowledge, knowledge management (KM), business process management (BPM), the interrelationship between KM and BPM, decision- making processes (DMP) and their implications for Jordanian construction organisations.

**Chapter 3** presents the mixed methods approach used in this research. The chapter explains the selection of both the qualitative and the quantitative methods used. This chapter also discusses the questionnaire and the semi-structured interview designs. Furthermore, it explains the data collection methods and data analysis methods that were chosen to fulfil the objectives of the present study. Finally, it discusses the reliability and validity of this research as well as ethical considerations.

**Chapter 4** discusses the data collection and quantitative analysis used to examine the proposed research model. It presents the sample population, response rate, the respondent's demographic characteristics along with their profiles, discusses the data analysis that reflects the views of respondents in Jordanian construction organisations towards different issues related to KM, BPM and DMP and presents the reliability of constructs along with hypothesis testing.

**Chapter 5** presents the outcomes of chapter four in relation to the research objectives presented in chapter one, and the research hypotheses presented in chapter four. It discusses the hypotheses with regard to the relationships between the constructs in the research model.

**Chapter 6** reveals the outcomes of the interviews. Initially, it proposes the background of the participants in addition to their selection criteria. The following section correspond to the qualitative analysis of the interviews. The final section is the main findings from the qualitative investigation. The interview results are summed up in this chapter's ending**.**

**Chapter 7** summarises the findings and conclusions of the thesis, discusses the theoretical and managerial effects of the research outcomes, lists the limitations of the study, and recommends further areas of research.

## 1.10. Conclusion

This chapter presents the background of the current research topic, the rationale of the research. The research aim and objectives are presented followed by the research questions., Finally, the chapter is concluded with the contribution made by this research and an overview of the whole thesis.

# 2. Chapter 2: Literature Review

## 2.1. Introduction

This chapter establishes the theoretical base used for this research through reviewing the literature as well as previous studies which relate to the study aim as well as the objectives. The literature is arranged based upon the ideas applied in this research as well as various theoretical concepts that are related to this research. This study produces the literature from the fields of KM and BPM to identify the gap in the literature. The study needs to investigate and explain how organisations in the construction sector can enhance the decision-making process (DMP) by practicing KM and BPM activities. The next sections provide the review of the literature regarding the following topics that are part of this research: knowledge, knowledge management (KM), business process management (BPM), the integration between KM and BPM, decision-making processes (DMP) and their implications for Jordanian construction organisations. This chapter ends with a discussion of the research gap analysis, and the theoretical framework in which the framework's variables and their rationale are explored.

## 2.2. Knowledge

### 2.2.1. The Historical Background of Knowledge

The concept of knowledge is extremely interesting for many and particularly scientists and logicians. The concept of knowledge has not adequately been defined and, in addition knowledge for many centuries has been fervently discussed by theorists such as Aristotle, Heidegger, Descartes, Locke, Kant, Hegel and Wittgenstein. A significant part of the discussion on knowledge has concentrated on assessing the concept of knowledge and how it identifies with comparative ideas, for example, belief, truth and justification. It additionally manages the methods for the generation of knowledge and, in addition, suspicion about various learning claims. Scholars like, for example, Plato (428 - 347 BC) strongly pushed the significance of learning through his aim to create an Utopia, stating that, “Without knowledge the human being will not be able to understand his identity, only he who carries the knowledge will be able to understand his surroundings represented by the existence itself” (Hassan, 2003). Other thinkers such as, Socrates (469-399 BC) and Aristotle (388-322 BC) point out that “there is only one good, knowledge, and one evil, ignorance”. Whereas Sir Francis Bacon (1561– 1626) recognized that knowledge relates to authority.

### 2.2.2. Definition of Knowledge

The concept of knowledge has been described by various modern intellects working in, for example, software engineering, computer science and management. Run of the mill catchphrases in their definitions include: experience, information and data, value, and processes.

Knowledge is organized and data gathered definitively (Zack, 1999). It can involve skills, information, competence, experience, know-how, learning, capability documents and repositories. In addition, it is an integral part of organisational procedures, processes, practices and standards (Wallace, 2007). Drucker (1993) states that knowledge is transformed is perhaps the core source of focused benefit. Its rapid development and communication systems have expanded the importance of knowledge in monetary growth (Beijerse, 2000; Carrion, et al., 2004; Tseng, 2010). Consequently, to increase the efficiency and effectiveness of organisations and to achieve competitive strength compared to competitors, the concept of KM must be achieved (Holt et al., 2007; Singh et al., 2006).

Numerous definitions have been developed in the KM literature in order to understand knowledge and differentiate it from other concepts such as data and information. Examples are given in Table 2-1.

**Table 2-1: Definitions of knowledge in the literature**

| References | Definitions |
|---|---|
| Davenport and Prusak, (1998) | "A fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms." |
| Davenport et al., (1998) | "Knowledge is information combined with experience, context, interpretation, and reflection. It is a high-value form of information that is ready to apply to decisions and actions." |
| Nonaka and Takeuchi, (1995) | "Information anchored in the beliefs and commitment of its holder." |
| Bath, (2000) | "a changeable reality created through interaction and information exchange" |
| KLICON, (1999) | "Knowledge is a body of information, coupled with the understanding and reasoning about why it is correct. ……Knowledge is the cognitive ability to generate insight based on information and data…… Knowledge is typically gained through experience or study." |
| Tiwana, (1999) | "Actionable (relevant) information available in the right format, at the right time, and at the right place for decision…… An understanding of information based on its perceived importance or relevance to a problem area." |
| Bennet and Bennet, (2008) | "Knowledge is the capacity (potential or actual) to take effective action in varied and uncertain situations." |
| McInerney, (2002) | "Knowledge is the awareness of what one knows through study, reasoning, experience or association, or through various other types of learning." |

Knowledge combines experience, values, contextual information, and expert insight that assist in evaluating and incorporating new experiences and information (Davenport and Prusak 1998). It can also be described as the information gained through experience or study to reason and understand why it is correct, generating insight (KLICON 1999). Another way of explaining knowledge is that it is the understanding of relevant information, at the right situation, based on its perceived importance or relevance to a problem area (Tiwana 1999).

Knowledge is a high-value form of information ready to be applied to decisions and actions. It is a combination of information, experience, context, interpretation, and reflection (Davenport et al., 1998).

Knowledge is currently viewed as the genuine centre of today's organisations and an effective contemporary regulatory tool though the aim is to adjust to the prerequisites of the times. Knowledge is the most critical asset in making a fortune and accomplishing brilliance and inventiveness considering the academic evidence which acts as a barrier, such as some intellectual ideas like globalization and privatization. The growth of information has accomplished a significant jump in the rate of performance in various organisations (Hamoud, 2010, p. 54). Different organisations, including construction, realise that knowledge is progressively being perceived as a very important key factor and is also provides a competitive advantage in order to enhance the organisation's performance (Robinson et al., 2001b). Numerous studies, for example, the research by Almalak and Alathary (2002, p. 19) and Shehabat and Berrish (2018), affirm that embracing KM in organisations creates advantages, such as upgrading proficiency and viability, enhancing DMP, improving performance, expanding profitability and innovativeness, accomplishing a competitive advantage, as well providing a rapid response to environmental changes.

On the one hand, knowledge is a state of continuous interaction between experience, personal skills and the psychological capacity within the workers, while on the other hand, the information and evidence of the phenomenon achieves something of value.

### 2.2.3. The Importance of Knowledge

The 1990s witnessed actual desire for knowledge within the business; this resulted in a wide increase in certainty, and an unavoidable focus on various areas at the same time.

In the current information economy, knowledge is a standout amongst the greatest essential resources of an organisation. Goods, manufacturing and services of a high quality and at a low cost are dependent very much on solid knowledge in the outline procedure. In order to succeed in a competitive market, the organisation has to focus on the quality of the knowledge used. This can be noticed in the originality of the organisation's products when the products are a reflection of understanding the nature of the market, or the latest technology, or by taking the customer's feedback into consideration as their knowledge can be beneficial for their organisation, or by knowing how to provide the most useful service (Barroso and Gomes, 1998, p. 1). This causes the organisation's directors to emphasise knowledge for monitoring and execution. Therefore, in addition to the completion of tasks, (particularly daily ones) the supervisor should coordinate the cooperation of the specialists. Individual communication emerges in order to share knowledge (as it is the premise of tackling the business's issues). Additionally, knowledge is an imperative and promotes innovativeness and achievement in an organisation and helps to coordinate the business. This core communication among individuals is able to provide profit to the organisation through acquiring new thoughts and merging them; this is known as brainstorming (Hansen and Oetinger, 2001, p. 108).

Many management concepts show that the key feature of knowledge that benefits the business financially and reputation-wise are when it becomes central and strategically allocated. This will mean that the success of an institution will be dependent on its ability to accumulate, create and maintain the continuance of the information that represents the anchor of knowledge.

Therefore, the most important benefit of knowledge is its ability to support the organisation to overcome all obstacles as well as to overcome restrictions. Another benefit is its significant part in appropriately functioning within the organisation.

Knowledge management is applied in all of the industry sectors, one example of the sectors would be banks. KM needs to be applied effectively into banks especially in the areas of operations, management, accounting and marketing. This is important because KM captures the experiences of customers, enabling the teams within the banks understand the customer's needs from the customers' feedback.

Another sector that KM is applied to is healthcare, KM improves the quality of patient care and safety. KM could help staff at a hospital understand how to utilize new technologies, also the knowledge and experiences transferred to new staff from professionals and experts helps them be able to diagnose patients efficiently (Dorow et al., 2019). KM in the healthcare industry is very complex, this is because KM includes a number of different technologies and processes that require a huge amount of attention and detail. In the healthcare sector knowledge is intense, this is because in the field of healthcare there are many highly specialized and experienced professionals (Miles, 2005). Other researchers such as Coombs and Ersser (2004) believe that having different professionals share different knowledge, helps to encourage teamwork in the healthcare sector.

Despite the terms of information, with data and knowledge being similar, they are not utilized conversely (Logan and Stokes, 2004). In several research studies the idea of information being seen as parallel with knowledge means it is utilized mistakenly (Alondeiene et al., 2006). As indicated by Awad and Ghaziri (2004), information, facts and knowledge have distinctive traits that are able to be outlined and delineated in Figure 2-1.

***Data*** refers to raw facts without any handling, organising or analysis, therefore it has low importance as well as few benefits for directors and decision makers within the business. As indicated by KLICON (1999) data is un-deciphered material as choice is to be constructed and it also relies on considering certainties as it may result in incorporating anything that is valid or which exists.

***Information*** refers to processed or organised data in order to be useful to its users. KLICON (1999) claims that information is an outcome through the elucidation of data in a given situation. Along these lines, a solitary piece of data might deliver distinctive information if the situation is extraordinary. Information includes facts which are sorted out structurally, but knowledge incorporates morals, beliefs, opinions, views, decisions and experience (Blumentritt and Johnston, 1999).

Laudon and Laudon (2007, p. 33) described the fundamental distinction between information and data as the level of dependence on decision making. In addition, not all department within an organisation use the same kind of information in decision making, as some information could be helpful for a particular department and not the other.

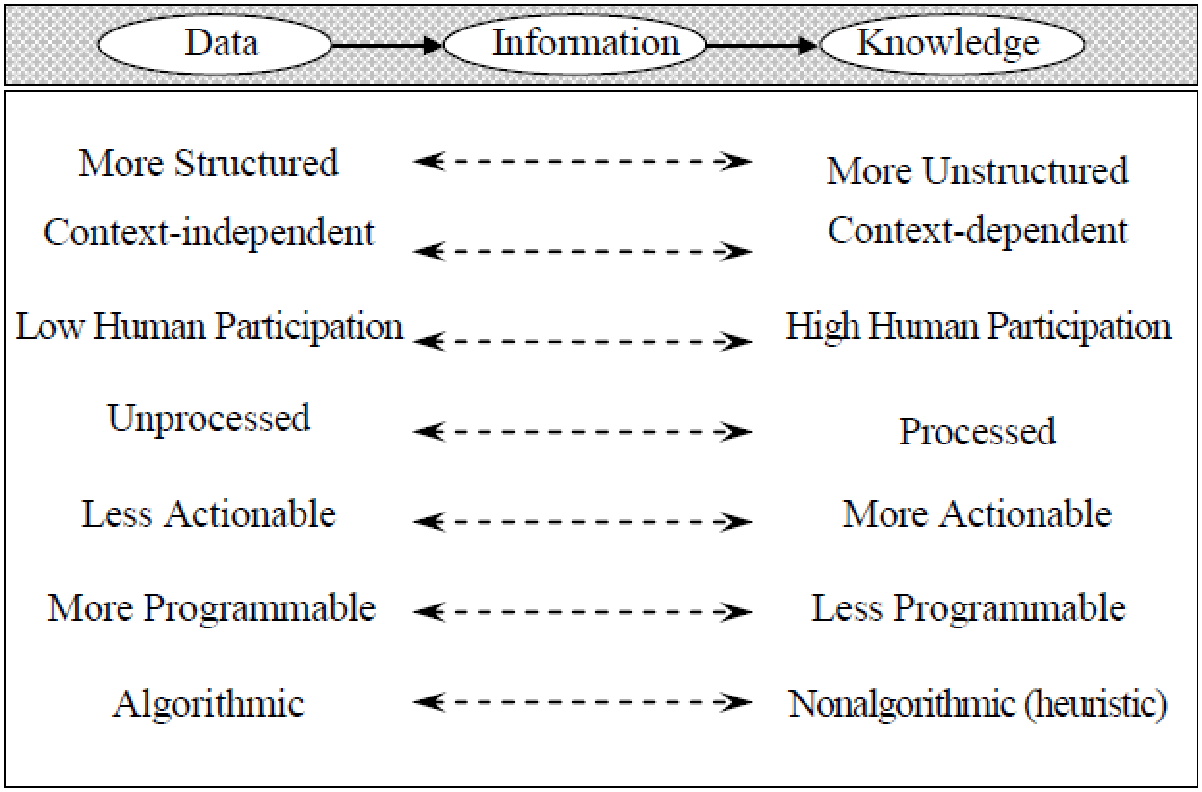


**Figure 2-1: Data, Information and Knowledge Attributes (Awad & Ghaziri, 2004)**

Knowledge is a valuable concept for decision makers as it carries a higher meaning compared to information and data. In this way, knowledge merges information with experience to explain techniques and methodology utilized through other people; This means that it is reusable later on in order to resolve similar problems (Tiwana, 1999; Davenport and Prusak, 1998).

A number of studies have found that hierarchy is the most suitable method to distinguish between knowledge, data and information. In hierarchy, knowledge that has the greatest value and purpose to its users is represented at the top, whereas data with the lowest value and purpose along with the maximum accessibility and programmability to its users is represented at the bottom. (Awad & Ghaziri, 2004). This is represented in Figure 2-2.

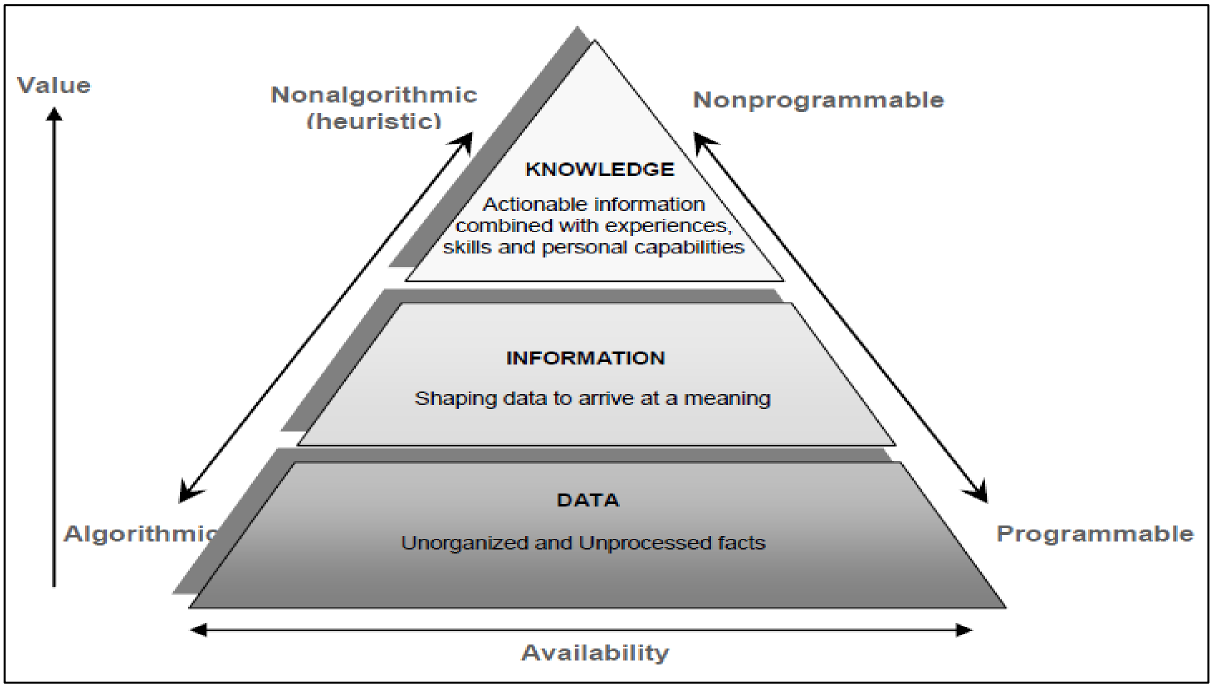


**Figure 2-2: Data, Information and Knowledge (Awad & Ghaziri, 2004)**

Daft (2001, p. 258) highlighted that the key distinction between them is the human role in creating knowledge. Consequently, as proposed by Zamel (2003, p. 1) there is a difference between KM and information management, which is that managing information suggests dealing with objects related to managing information and that dealing with people is knowledge management. Furthermore, managing information relates to documentation and design drawings made by any electronic device such as tablets or computers, as they help provide an accurate representation of data. This is in contrast to knowledge management which considers creativity, agility, adaptability, intelligence, and learning, as it helps to stimulate the capability of the organisation in these features.

To sum up, it can be said that subsequent information is derived from a sequence of data, whereas knowledge comes in at a later progressed phase. It is also explicit knowledge that is able to be saved, coded and retrieved. The major difference between knowledge and information in the way they interpret the needs of people is that tacit knowledge needs high-level skills in management.

### 2.2.4. Knowledge Types

According to the humanitarian perspective, the two kinds of knowledge are tacit knowledge and explicit knowledge. Nonaka and Takeuchi (1995) considered tacit knowledge to be personal and context-specific knowledge. Since tacit knowledge is highly individualized, it is hard to form, document or express it as it is stored in the minds of people and increases over the experiences of success and failure. On the other hand, Dalkir, (2017) define explicit knowledge as that which can be captured, gathered, kept and spread. This knowledge consists of assets such as documents, notes, plans, sketches and reports. It is knowledge which can be accessible to others and distributed in the form of systems. Dalkir, (2017) believe explicit knowledge cannot be separated from tacit knowledge and is able to be represented verbally.

Because of these attributes, explicit knowledge can regularly be reused inside organisations for decision-making purposes; it also remains within the institution even though the knowledge makers may leave the institution (Choo, 2000). In the construction institutions, explicit knowledge alludes to recorded information, for example, project details, outline illustrations and details, cost reports, risk study outcomes. Further information can be gathered, saved, then recorded on sheets or programs on computers.

Organisational knowledge can be constructed over nonstop discourse within tacit as well as explicit knowledge (Carrillo et al., 2003). This resonates with Nonaka and Takeuchi's (1995) proposal that knowledge is the result of the interaction between them. Nevertheless, tacit knowledge along with explicit knowledge can be easily lost unless organisations deal with their "inside assets" adequately to maintain their competitive advantage (Aziz et al., 2013).

## 2.3. Knowledge Management (KM)

KM, generally, is acknowledged as a factor of success for organisations managing complicated responsibilities. One of the actual challenges for institutions is to organize knowledge resources to gain a competitive advantage, particularly in the construction sector (Fong and Lee, 2009). Kamara et al., (2002) state that knowledge management techniques are able to maintain a strategic distance from the reiteration of comparable oversights from past work and thus enhance work proficiency. As such, KM strategies can avoid extra work, reduce the time spent and save money. Hence, many industries such as construction, banking or healthcare need to adopt KM strategies.

During the 1990s the growth of knowledge as well as rapid adjustments and improvements have contributed extraordinarily to the making of KM. At that point, many studies on developing KM decided on the models, concept, and the growth of applied standard. Several institutions have tried to use KM in their workplace. Some of which have prospered and accomplished great outcomes in their execution, whereas others collapsed because of the ambiguity and evolution of KM.

### 2.3.1. Definition of Knowledge Management (KM)

Continuous research for the exact definition of KM has been made because of a lack of agreement over KM (Girard, 2015; Dalkir, 2017; Mohajan, 2017; Omotayo, 2015). Omotayo (2015) argues that KM is a developing practice, and that there is a wide range of variations with respect to KM as well as the way to utilise its possible strengths adequately. There is a theoretical point of view on how KM can be understood from alternate points of view, for example, economic, IT, and organisational points of view (Omotayo, 2015; Dalkir, 2017). The meaning of KM is connected to the specialization perspective. From an economic perspective, KM is an intellectual asset. From an IT point of view, Zack (1999) characterizes KM as "an administrative movement to produce new utilizations of data innovation to help the computerized catch, stockpiling, recovery and appropriation of an association's unequivocally recorded learning".

Many scholars argue that it is hard to define KM due to the part credited to the challenges in recognizing knowledge. Therefore, defining KM could be really tasking, as various perspectives on KM are able to find diverse areas (Omotayo, 2015). Table 2-2 offers possible definitions of the numerous perspectives on KM drawn from previous studies.

**Table 2-2: Definitions of the term 'Knowledge Management'**

| Authors | Knowledge Management definitions |
|---|---|
| Harris & Berg, (2003) | Formalising the management of an enterprise's intellectual assets. |
| Sunasee & Sewry, (2002) | Knowledge management is an integrates systematic approach to identify, manage and share all information assets, including databases, documents, policies, procedure and previously unarticulated expertise and experience held by individual workers. |
| Newman & Conrad, (2000) | Knowledge management is a discipline that seeks to improve the performance of individuals and organisations by maintaining and leveraging the present and future value of knowledge assets. Knowledge management systems encompass both human and automated activities and their associated artefacts. |
| Scarborough et al., (1999) | Any process or practice of creating, acquiring, capturing, sharing and using knowledge wherever it resides, to enhance learning and performance in organisations. |
| Ruggles, (1998) | Knowledge management is an approach to adding or creating value by more actively leveraging the know-how, experience, and judgement resident within and, in many cases, outside of an organisation. |
| Hislop, (2018) | "an umbrella term which refers to any deliberate efforts to manage the knowledge of an organisation's workforce, which can be achieved via a wide range of methods including directly, through the use of particular types of ICT, or more indirectly through the management of social processes, the structuring of organisation in particular ways or via the use of particular culture and people management practices" |
| Mackintosh, (1996) | Knowledge management involves the identification and analysis of available and required knowledge, and subsequent planning and control of actions to develop knowledge assets so as to fulfil organisation objectives. |
| Dalkir, (2017) | "The deliberate and systematic coordination of an organization's people, technology, processes, and organizational structure in order to add value through reuse and innovation. This value is achieved through the promotion of creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practices into corporate memory in order to foster continued organizational learning." |
| Teece, (2000) | "It can be used to describe the panoply of procedures and techniques used to get the most from a firm's knowledge assets. The knowledge management requires the development of dynamic capabilities and the ability to sense and to seize opportunities quickly and proficiently." |
| O'Dell et al., (1998) | ''[a] conscious strategy of getting the right knowledge to the right people at the right time and helping people share and put information into action in ways that strive to improve organisational performance' |
| Davenport and Prusak, (1998) | "It consists of processes to capture, distribute, and effectively use knowledge." |
| Jashapara, (2004) | "The effective learning processes associated with exploration, exploitation and sharing of human knowledge (tacit and explicit) that use appropriate technology and cultural environments to enhance an organization's intellectual capital and performance. |
| Carlucci et al., (2004) | "The KM is a managerial paradigm which considers knowledge as a resource at the basis of a company's competitiveness. It identifies the capabilities to generate value for a company's stakeholders with the explicit and systematic implementation of approaches, techniques and tools for the assessment and management of intellectual capital." |

The different definitions of KM mentioned above provide a range of distinct concepts of KM, for example Jashapara (2004) defines KM as the process exploring and sharing both tacit and explicit knowledge that help employees understand how to utilize technology, this helps the organisation grow its performance and capital. Whereas Carlucci et al., (2004) argued that KM is paradigm for management, he believes that knowledge is considered as a resource that helps an organisation compete effectively against other organisations, this is because KM teaches employees within the organisation techniques and tools on how to assess and manage the organisation's capital, and learn explicit and systematic approaches that allows them to enhance the organisation's value. Overall, most of the definitions focus on the need for organisations to use knowledge effectively so that they are able to provide solutions to problems, and that KM is a process that uses old and new knowledge to help guide workers to understand their tasks within their organisation. Although there are good definitions of KM, this research found that O'Dell et al., definition of KM is the most appropriate one to adopt because he defines KM as a strategy used for delivering the most appropriate knowledge to the right workers at the right time, also he argued that KM is a way to help workers share and apply knowledge at the right context, so that the DMP improves which leads to the enhancement of the organisation's performance.

### 2.3.2. Development of KM

Knowledge management consists of several phases: experiences, theory origination, theory formation, and theory development [Wang (2008)]. There are two essential factors that drive KM origination: the logical idea and the applied application for KM in the workplace. The main aspects of KM growth are: the investigation of KM within the scholarly world and industry, reflecting on the important aspects of KM in the knowledge period, as well as endeavours to enhance productivity within the organisation [Wang (2008)].

Investigating knowledge and KM took some time. Western thinkers (such as Socrates, Plato and Russell) debated knowledge as well as KM for many years. In the East, the "apprentice-journeyman-master" technique as well as the craftsmen in the 1300's are models of the KM idea. The concept of KM was constructed through many organisation scientists around the 60's [Drucker (1969), Polanyi (1962)], whereas further official exchange of the ideas started to develop around the 80s, particularly during the advancement of asset-based view within the organisation. In the 90s the predominant subject within KM inquires stayed an attention for business process reengineering as well as a process-based perspective of the organisation [Hammer and Champy (2003)].

Knowledge management studies are growing quick in the help of information technology trigger. This achieved the pinnacle of swelled desires during 1995, then went through a long period of dissatisfaction around the 2000's, leading it to reach an insight around 2005, accomplished a level of profitability around 2010, and now is heading to development [Bullinger et al. (2009)]. Table 2-3 clarifies the conspicuous subjects since the 60s up to this point. It proposes that the pattern inside KM development is coordinated effort, cooperation among tacit and explicit knowledge, BP location and between the organisation relations.

**Table 2-3: Development of KM research**

| Time period | Driving forces | Research themes |
|---|---|---|
| 1950s–1980s | • Increased large organizations<br>• Scientific management<br>• Transaction processing systems and manufacturing automation | • RBV of the firm [Penrose (1995)]<br>• Knowledge classification [Polanyi (1962)]<br>• Organizational strategy [Drucker (1969)]<br>• Organizational learning models [Ar-gyris (1976)] |
| 1980–1990 | • Globalization<br>• Knowledge based organizations<br>• Total Quality Management | • Competitive strategy framework [Porter (1980)]<br>• Organizational design and strategic fit [Mintzberg (1980)]<br>• Strategic capability of the firm [Pra-halad (1983)] |
| 1990 onwards | • Business process re-engineering<br>• Increased attention to knowledge and intellectual capital management<br>• Information economy<br>• Tighter inter-organizational relations in operations and strategy | • Collaboration and communities of practice [Goodman & Darr (1998), Orlikowski (1993)]<br>• Spiral model of knowledge creation [Katsoulakos & Zevgolis (2004)]<br>• Interaction between tacit and ex-plicit dimensions [Nonaka (1994)]<br>• Industry practice and prescriptions for effective KM [Davenport et al. (1998)]<br>• The Fifth Discipline [Senge (1993)] |

**adapted from [Raghu & Vinze (2007), Wang (2008)]**

As shown in the table above, KM research has developed over the years, in the 1950s-1980s time period the research focused on many areas some are the scientific management, knowledge classification and organisational strategies. Later in the 1980s-1990s time period the focus of KM research shifted into globalization and the quality of management, and went into greater depth on the strategies within organisation (such as the strategic fit) in comparison to the previous time period. And from the 1990 onwards there was a focus on a different range of areas compared to the previous time periods e.g., the economy and business processes in terms of KM.

The introduction of new IT systems such video meetings, e-mails and social media technologies enabled employees to communicate and interact with each and be able to share knowledge easily. Also, new technologies such as data analytics and big data allowed employees within organisations to manage knowledge using processes of data mining and analysis. Due to these changes in technology, the recent research developed focused on incorporating IT and technology with KM (Syed et al., 2018). There has been research into the relationship between IT and KM, for example in 2016 a research that examines the use of modern ICT tools for KM within organisations, this research is found in journal of KM (volume 20, issue 3) (Syed et al., 2018). Moreover, in the same journal (volume 21, issue) a research was conducted in 2017 into the relationship between big data and KM.

Hislop et al., (2018) identified four different directions that the world of the work is changing in:

1. The development of digital technology, e.g. social media, computers and smartphones, they are changing the way people work and communicate.
2. Globalisation, many employees travel on a regular basis and organisations work with other organisations in different countries around the world, they collaborate and communicate with each other.
3. The changes of the workplace, there is a range of different locations that an employee can work from, for example, there are people who work at home so they use digital technology often, as they could communicate with their employer via e-mail or mobile.
4. The growth in automation and artificial intelligence has altered the nature of many jobs, for example, routine tasks are done on computers.

### 2.3.3. Research schools of KM

The theoretical basis of KM has developed from a widespread range of disciplines, for example, organisational theory, artificial intelligence theory and different scientific areas (Shang et al., 2009). Figure 2-3 delineates the interdisciplinary viewpoints in managing knowledge. The psychological concept demonstrates the fundamentals of learning behaviour, the gaining of knowledge and also the inspiration of individuals. Industries worry about problems concerning the sharing of knowledge. Moreover, sociology adds to KM in business in how society is structured. Software engineering utilizes information technology projects as well as ways to manage the stream of data and theories of knowledge. Alongside the growth of KM theory as well as practice, many KM schools have emerged, for example, with regard to technology, eclectics, strategy, knowledge capital and process.

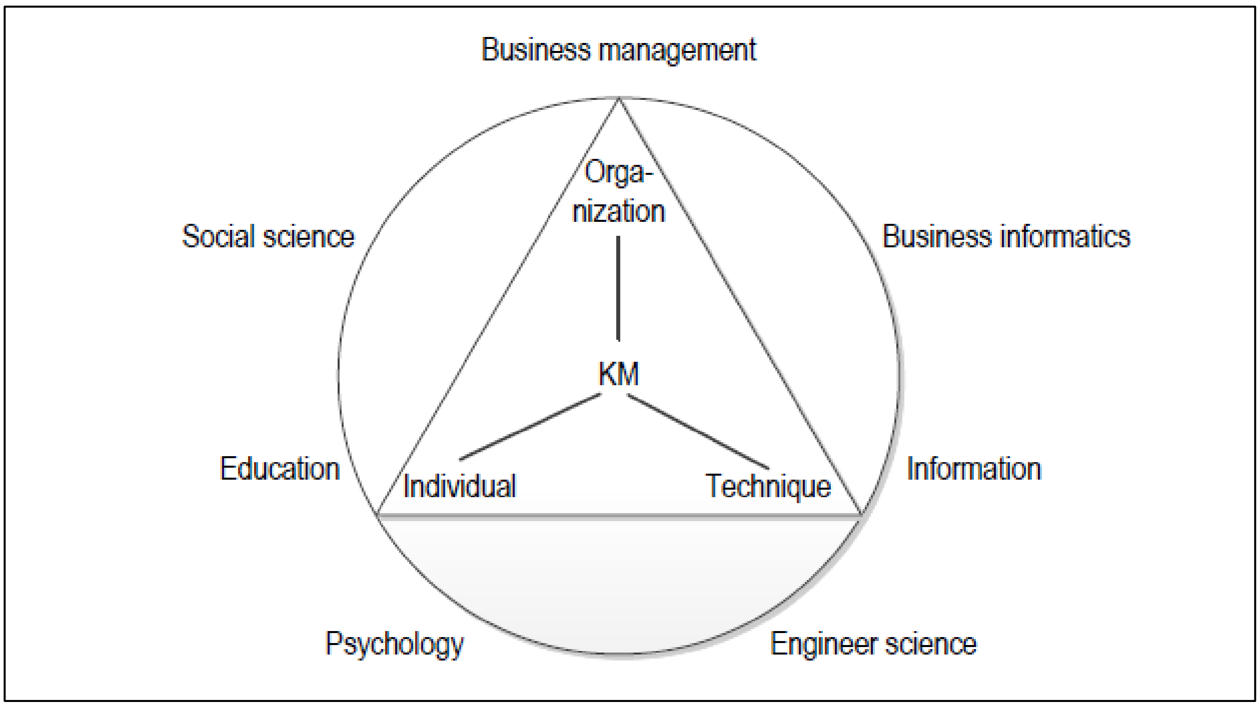


**Figure 2-3: Interdisciplinarity of KM (Source: [Haasis & Kriwald (2001)])**

The technology school considers the utilization of IT in KM, which incorporates the development of information systems (IS), artificial intelligence (AI), and groupware. Behaviourism (a learning school) examined KM through the participation of people, and sets as well as organisations from a psychological and sociological point of view. The third school (social-specialized), consolidating the technology school as well as the behaviour school, analyse KM depends on information technology and individuals' points of view. It is currently the KM theory stream. The economics of knowledge is considered by the knowledge capital school. The strategic school is established through the material-based view, and incorporates KM within the organisation's strategy in order to improve the competitive advantage in an organisation.

Utilising points of view expressed by management and within an organisation, KM studies are able to be separated into two streams [Grover and Davenport (2001)]. Firstly, the study would focus on the type of knowledge itself; the description of knowledge is significant while there is information that helps someone make a decision. Knowledge is divided into three types based upon their content: (procedural, declarative, and informal knowledge), type (tacit or explicit knowledge), and level (organisational, individual, group, and network knowledge) (Quagini, and Tonchia, 2010). Moreover, the other concept that studies adopt is the flow of knowledge, which focuses on the origin of knowledge and its phases. The phases begin with knowledge creation, followed by the storing and retrieval of knowledge and the share of knowledge, and finally the application of knowledge (Quagini, and Tonchia, 2010).

The process school argues that knowledge is able to acknowledge added value within the process stream. This school argues that the knowledge stream as well as the business process (BP) are both joined and divisible. BP is the foundation and submission ground of knowledge, whereas the process of knowledge is the unique aspect of BP. Taylor's scientific management, for instance, is a representative KM process: the perception of activities, tools and standards are a knowledge achievement and a creation process; persuading staff to incorporate knowledge as well as the organisation is a knowledge application process, thus it is hoped it will finally improve efficiency and effectiveness.

### 2.3.4. Models of KM

Different models of knowledge management have been developed with different points of view that differ in their complexity in the transfer of knowledge whether tacit or explicit, but knowledge is also known as intellectual capital (Shehabat and Berrish, 2018 and Feng, 2011). Haslinda and Sarinah (2009) critically reviewed KM models in which KM is presented as the categorical view and where knowledge is categorized into separate components as in Boisot (1987), Nonaka (1994) and Nonaka and Hedlund (1993). These models point to a more complicated view of knowledge that is mechanistic and socially constructed. These KM models made reference to: (1) the process of managing the flow of knowledge (2) categorisation models that are mechanistic, (3) the intellectual capital model, where intellectual capital is regarded as a vital asset in an organisation that should be managed efficiently for its success, (4) Demerest's model which is intrinsically linked with the social and learning processes within organisations, (5) Frid's model that suggests that knowledge should be managed systematically with equal emphasis on KM process levels, (6) Stankosky and Baldanza's knowledge management framework which emphasised that leadership, organisation structure, technology infrastructure and learning are important foundations for knowledge management in an organisation, and (7) Kogut and Zander's model that focused on the strategic importance of knowledge as a source of competitive advantage. Haslinda and Sarinah (2009) believe that the models have a specific aim to place main KM activities and enablers to produce a dynamic system to support the organisation's core competencies, where the KM process described in these models is a key to collecting, adapting and transferring information across an organisation. Jafari and Maleki (2013) briefly reviewed KM process models that were developed between 1991 and 2012 and concluded that these models were found to be generally applied to advance an operations' efficiency and the competitive advantage of an organisation utilising the three basic processes.

Furthermore, many studies presented certain models with regard to knowledge management trying to comprehend as well as direct the attempts of KM activities within the organisation. The objective is to guide organisations in order to create knowledge strategies to accomplish objectives as well as tackling issues, and also be in accordance with how everything changes. In this regard, various models are presented at this point for KM.

Firstly, the Duffy display model, Duffy (2000) proposed a KM model, that is viewed in Figure 2-4. The Duffy display model includes several issues:

- The opening stage in the organisation acquiring the data as well as activities from the exterior environment.
- During the course of the participation strategy, staff and operations, technical as well as information are converted to knowledge, processes and structures which deliver products and also add to the expansion of capital within the organisation.
- Knowledge management is viewed as a process which incorporates securing tacit and explicit knowledge, supporting and allocating roles, producing incomes, and emphasizing the importance of the participation of as well as the significance of accessing lessons inferred by the re-utilisation of knowledge.

This model for KM shows that the organisation finds information through its outside environment as well as changes made by the contribution of people, strategies, processes and technology. The processes are as follows:

- The acquisition of knowledge: contains the purchase, capturing as well as the creating of knowledge.
- The organisation process: it consists of classification and drawing.
- The retrieval process: includes research and access to stored knowledge.
- The distribution process: includes contribution and sharing of knowledge.
- The process of sustainability: includes revision and growth.

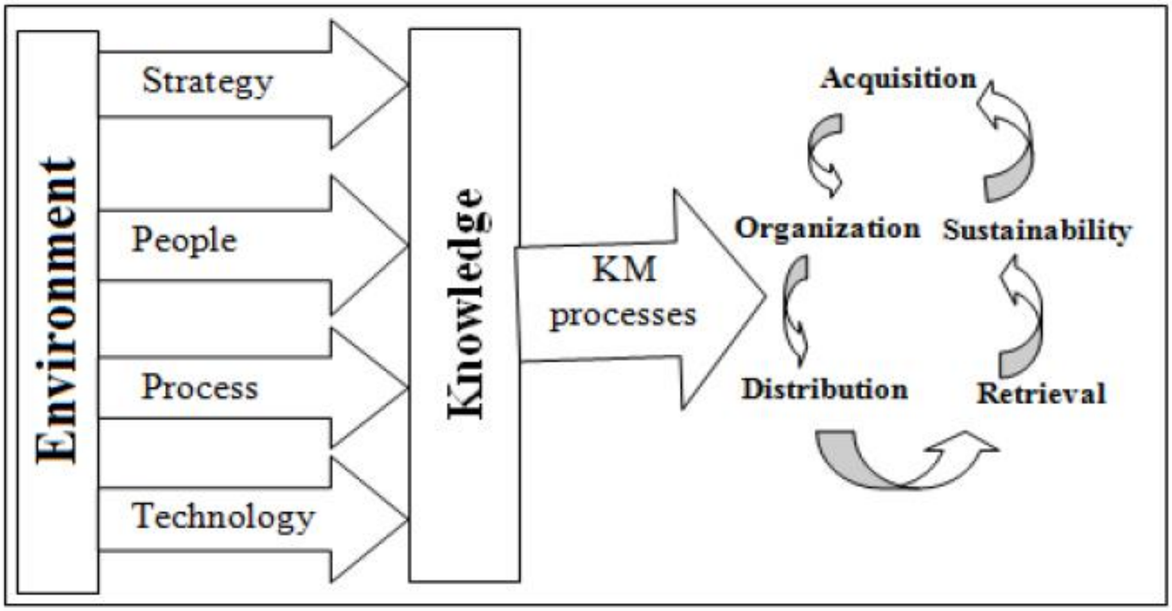


**Figure 2-4: Duffy model for KM (Duffy, 2000)**

Secondly, Jennex and Olfman's model, (Jennex & Olfman, 2004, p. 146) consider the use of impacts in effective KM frameworks. This model consists of:

- Quality systems: the way that KMS prepares the role of innovation, storage, retrieval, transfer as well as the application of knowledge.
- Knowledge quality: how can KMS guarantee that the increase of knowledge can be accessible to all clients?
- User satisfaction: Describes the level at which a KM system achieves high levels of user satisfaction.
- Possible returns: Measuring the advantages as well as the effects of KMS for the client and administration of the organisation overall.
- The collective impact: The utilization of a person's KMS to enhance the quality performance within the work environment, this is considered through the organisational performance.

The SECI is a model created by Nonaka and Takeuchi (1995). The acronym SECI stands for Socialization, Externalization, Combination, and Internalization. It was shortened to SECI to abbreviate a few of the KM processes. These are represented in Figure 2-5.

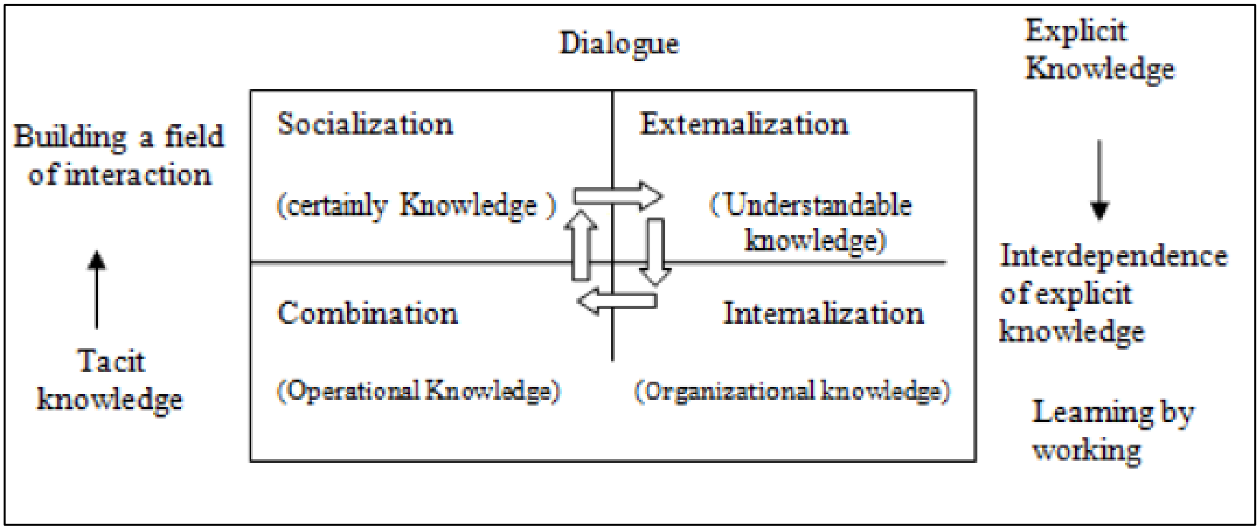


**Figure 2-5: SECI Model for KM (Hussi, 2004)**

As shown in Figure 2-5, KM is purposed for knowledge in the light of present knowledge. This happens through the development of an area of association among people and expanding tacit knowledge amongst people that is affirmed by discussion as well as separated as unequivocal knowledge. Through the connection between explicit knowledge, change happens towards a more standard knowledge that will probably be utilized in the organisation's work. Finally, through learning, fundamental knowledge is broken up as well as converted into recent operational knowledge in people's thoughts. In this way, increasing new information develops the extension by SECI processes.

***Comptroller model*** displays KM as a result of the interaction between knowledge management elements, as outlined in Figure 2-6.

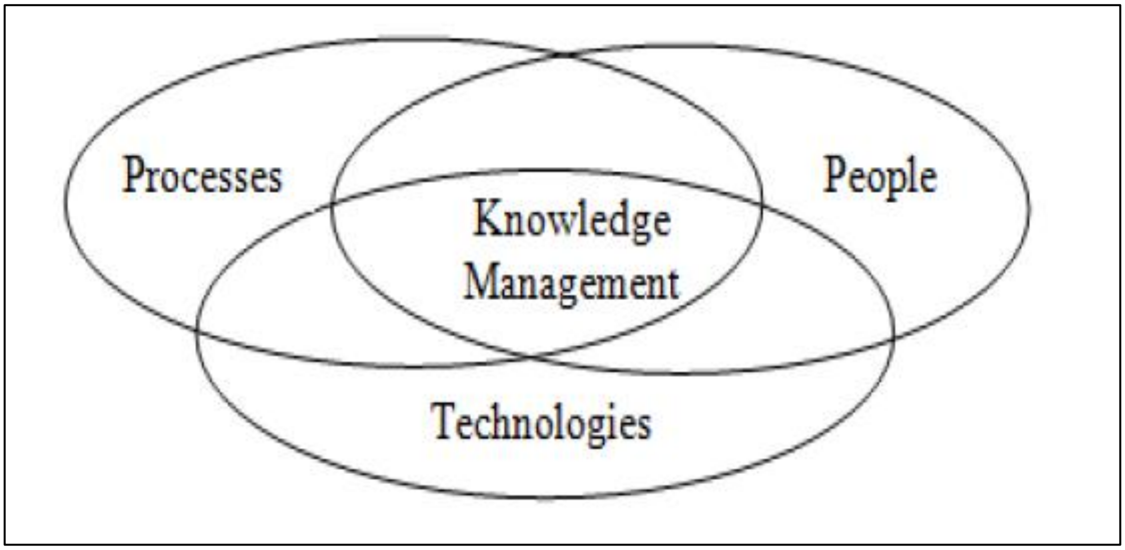

**Figure 2-6: Comptroller Model for KM By OSD**

**Hope Model**: Hope proposed a knowledge management model which contains these main areas (Yassin, 2004, pp. 47-48):

- Knowledge as well as growing experience which results in innovation in resolving problems.
- Application along with a combination of the techniques and tools of the new method in order to improve the processes from the inside.
- Organisation research in order to create capabilities which will be a benefit in the long run.
- The Importation of activities of knowledge as well as skills from overseas in order to enhance the organisation capabilities.

The idea of knowledge management is being crystallized; it can also be used within the organisation. It mainly consists of individuals, KM processes as well as IT.

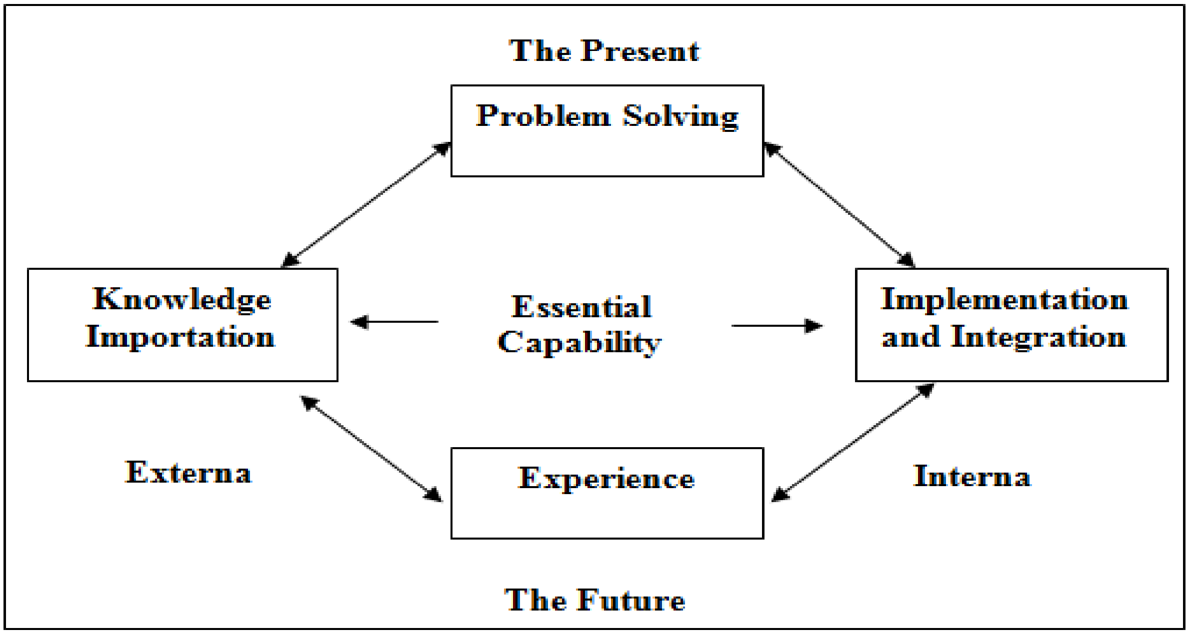


**Figure 2-7: Illustrates a model of KM as proposed by Hope (Source: Yassin, 2004, pp. 47-48).**

### 2.3.5. Elements of KM

Gunjal (2019) found that the leading global KM case studies incorporate 3 KM components, they are people, processes and technology. As they are important to create an environment within organisations that allows workers to learn and exchange new knowledge. Moreover, Moffett (2003) conducted a thorough analysis into the existing literature to help him build a KM model, he found that there are 5 factors that influence adoption of KM within organisations, the factors were: macro environment; culture; technology; information and people.

A number of researchers (such as Desouza and Paquette, 2011; Hosseini, 2014; Chan, 2017; Rodriguez and Edwards, 2010; Mohajan, 2017 and Omotayo, 2015) have found that in order to manage knowledge correctly, organisations should focus on three major elements: people, technology, and processes. Moreover, many construction organisations believe that it is valuable to explore KM in terms of people, technology, and processes (Anumba et al., 2008).

The majority of useful knowledge is tacit and cannot be documented nor recorded. KM strategies should be aware of this and therefore deliver the most suitable tacit knowledge at the right place and time. The construction industry is rich in experiential knowledge, once an employee decides to leave or retire from their organisation, they take tacit knowledge and a possible source of competitive advantage along with them. Consequently, organisations try to encourage employees to take part in KM processes (such as cooperation and knowledge sharing) by changing their conventional culture; this happens by promoting knowledge sharing instead of keeping knowledge hidden and not sharing it. Furthermore, combining motivation and reward systems helps to leverage people's skills into business success. Epetimehin and Ekundayo (2011) believed that people are a source of knowledge, meaning that KM processes should be based upon human interaction.

The second element of KM is process. This element should be clear, straightforward, well-described and recognized by people across all departments. It is clearly crucial to describe different work processes in order to plan them correctly. If a process is planned well, it allows the organisation to recognize the way and the reasons why different projects are successful. The process element consists of many levels and stages. For example, to create, distribute, store and apply knowledge (Kirn and Lee, 2010).

The third KM element is technology. KM can be achieved smoothly through the utilization of developed and specialised technology systems. KM technology primarily aids and promotes workflow, communication, along with knowledge sharing processes (Marr, 2003 and Shadbolt et al., 2003). Organisations are able to establish their KM investment plan and aims by choosing an appropriate technology decision. The staff in organisations can exchange essential information and assist each other through a safe key area in order to allow clearer decisions to be made. People-based KM tools are specific to help develop the understanding of people as well as their skills and capability to utilize these skills at the appropriate time and place. However, process-based tools (such as extranets) focus on making sure that for projects the most suitable piece of explicit knowledge is utilized at the right time and place.

#### 2.3.5.1. KM Processes

Organisations understand that knowledge is the main essential intangible resource. The majority of organisations have used the idea of knowledge in one way or another. However, others have not utilized it in a proper way. The inappropriate adaption of KM will, possibly, be because of the shortage in staff knowledge. Several organisations have tried to discover the reasons for the possession as well as the management of asset components. In addition, KM started to develop a reputation as sophisticated and intellectually important in the business world. For the most part, KM is formed because of various processes that provide the idea that prompts the comprehension of managing knowledge as the best way to implement it in an organisation. Different scientists have shown that KM is affected through the interior and exterior environment. In this regard, isolating KM to its sub-components is indispensable to progress. Alavi and Leidner (2001) partitioned the processes of managing knowledge into a number of different components: creating knowledge creation, knowledge storage and retrieval, sharing of knowledge, and the application of knowledge. Marquardt (2002, p. 26) proposed other phases to processing knowledge, namely: acquisition, generation, storage, extraction, analysis of information, transport, publishing application, and consent. Different specialists (Anantatmula, 2012; Han and Zhong 2006; Silver, 2000) recognized the importance of knowledge management processes including the accompanying stages; organizing knowledge, creating knowledge, distributing knowledge, as well as applying knowledge. In addition, Mertins et al., (2001) has also proposed KM processes (Figure 2-8).

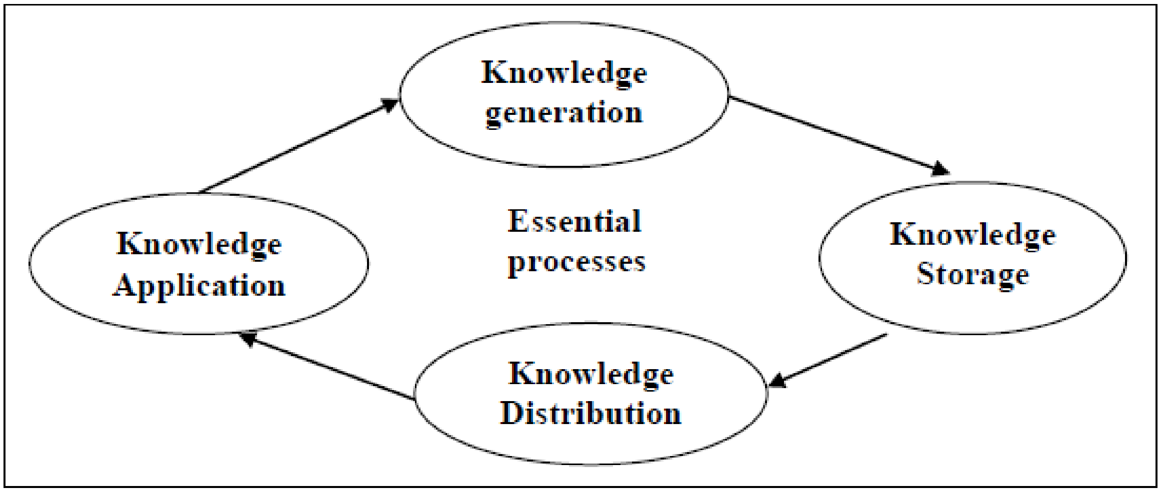


**Figure 2-8: Essential processes for KM. (Source: Mertins et al., 2001)**

There is no particular KM process that can be approved among specialists. It relies upon the area of the research field. Nonetheless, after reviewing recent studies' identification of KM processes, it can be argued that the key KM process is able to be categorized into separate sub-processes: creation or acquisition, distribution/exchange, retention or storage, usage/application (Alavi and Leidner, 2001; Chang and Lin, 2015; Arpaci, 2017; Donate and Pablo, 2015, Anantatmula, 2012; Ragab, and Arisha, 2013; Kirn and Lee, 2010).

As these sub-processes are involved in the research, the researcher was able to identify an additional crucial argument.

##### *2.3.5.1.1. Knowledge Creation*

Knowledge creation is "innovation knowledge", which is knowledge created through the involvement of people and work groups with the aim of recognising an issue and discovering solutions to that issue in an innovative way. Additionally, the creation process helps an organisation establish its aims and achieve a strong market position in a variety of areas. These involve finding new ideas for products and services and a faster problem-solving process, sharing the best experiences, enhancing expert skills and helping the administration in employing and retaining talented people. This highlights the for innovation and knowledge to follow two processes: innovation follows from knowledge and the source of new knowledge is innovation

(Alian, 2008, p. 196). It appears because of the communication between tacit knowledge and explicit knowledge; this occurs in multiple conversion modes of knowledge transfer.

## Conversion modes of knowledge transfer

Research by Faith and Seeam(2018), Kaur (2015), Jashapara (2011, p. 167) and Tawfik (2004, p. 127) indicated that conversion modes of knowledge transfer is the place where knowledge is generated due to the interaction between tacit knowledge and explicit knowledge which is determined within four conversion modes:

- **Socialization** incorporates the exchange of tacit knowledge with community normalization, which contributes to the process in experience as well as the formation of tacit knowledge, for example, technical skills. People are able to acquire tacit knowledge specifically through other people's use of language. This knowledge is learned through observing experienced people, imitating them and practicing the methods that they have learned. With regard to businesses, practical training is implemented in a similar way to job performance, knowing that obtaining tacit knowledge is through skills gained from experience. In addition, the absence of knowledge sharing means it is difficult for people to become familiar with the required tasks without observing experienced employees. Indeed, knowledge generation does not occur if we subtract the sharing of experiences from related emotions and specific contexts in which they are embedded.

- **Externalization** incorporates the exchange of tacit knowledge with explicit knowledge and is known as "Manifesting or Output", a process identification of tacit knowledge from which it changes to tacit ideas. This is a process of discovering vital knowledge which appears as concepts, ideas, speculations, as well as; but converting tacit knowledge into explicit knowledge is usually insufficient and unreliable because it is not easy to recall the knowledge learned from interacting with people, as the situation and expressions are hard to remember.

- **Combination**. This pattern of knowledge transfer contains the combination of various groups of explicit knowledge, the transferring of knowledge among people, as well as integrating it over mass media, for example, reports, seminars, phone discussions, and PC systems. This result in the combination of explicit knowledge and the development of new knowledge.
- **Internalization** incorporates an exchange of explicit knowledge with tacit knowledge; it also connected closely in order to gain knowledge through working. At the point where the skills are identified through shared knowledge it is presented and incorporated inside the guidelines of tacit knowledge to people as normal mental models and here knowledge turns into an important resource.

##### *2.3.5.1.2. Knowledge Storage*

This process refers to the significance of organisational memory, knowing that organisations confront huge hurdles due to losing knowledge that is retained by people who leave an organisation. Consequently, knowledge storage becomes critical and is particularly aimed at organisations that suffer from high rates of labour turnover. This produces knowledge in light of the fact that these people use the tacit knowledge they have created. This is off the record knowledge that belongs to them, as well as recognized knowledge that is kept databases (Alziyadat, 2008).

It is a guaranteed choice of knowledge in two straightforward arrangements. The first arrangement is people, such as the keepers of expertise. They also have to provide the organisational procedures which guarantee the conservation of people's experience by motivation as well as methods. The second arrangement regards personal computers (PCs), due to their competence, accuracy and expandable huge storage. Furthermore, PCs have the ability to manage digital file storages along with the skill to process it in dissimilar methods, guarantee the greatest fit to provide responses to organisational staff and react to their inquiries. Alian (2008, p. 197) affirms that knowledge storage links create knowledge as well as its retrieval process simultaneously. Therefore, a significant part of the known added worth of KM is a consequence of the different components of knowledge, its topics, and also links each other and updates them.

##### *2.3.5.1.3. Knowledge Distribution*

Knowledge distribution is viewed as the initial phase within the process of knowledge use. Within this context, Dalkir (2013) demonstrated that knowledge distribution is the process of knowledge exchange as well as the transfer of it to the employees who require it in an opportune way so as to complete several tasks. This implies the distribution of experiences as well as practice amongst employees, requiring employees to associate with one another and to utilise knowledge to solve problems inventively. Knowledge is a developing component when it is shared and utilized. Consequently, knowledge distribution relies upon the presence of effective machines. They can be formal, such as reports, guides and training. Or they could be informal, for example, gatherings, symposia and workshops that take a formalized classified way, and often happen outside of work hours. This informal mechanism can be a viable component within minor groups. However, informal mechanisms can result in the fractional loss of knowledge, as there is no assurance as to which knowledge is exchanged effectively starting with one individual and moving onto the next. In addition, there is the challenge regarding the capability of the recipient to work, purify, as well as understand the knowledge as indicated by the person's terms of reference. On the other hand, formal mechanisms could be more effective and guarantee a more prominent exchange of knowledge. In this way, joining the two machines, formal as well as informal, can develop more prominently the expertise within the distribution of knowledge (Alwani, 2006, p. 315).

##### *2.3.5.1.4.* ***Knowledge Application***

The fourth component in the KM process includes applying knowledge to new conditions so that clients are able to study as well as deliver innovative knowledge through influential and efficient storage and retrieval techniques which enable an organisation get to this knowledge effortlessly (Lawson, 2003; Lin and Lee, 2005). The motivation behind KM is the application of knowledge that is accessible to an organisation and which stands out amongst the greatest noticeable tasks. Knowledge application intends to make knowledge further suitable for utilization within the usage of an organisation's tasks. This is due to the fact that organisations desire to apply knowledge successfully in order to take advantage of stored and captured knowledge, along with creating a way for the organisation to retrieve and transfer knowledge to their staff. McShane and Glinow (2000, p. 23), demonstrate that KM is useful when identified with the utilization of the current knowledge in an opportune way, without avoiding the opportunity to accomplish a target or solve an issue.

Martensson (2002, p. 211) has created some system techniques for knowledge application.

- Directives: Directives specify " a specific set of rules, procedures, and instructions that are placed to transfer tacit knowledge of experts to explicit knowledge of non-expert ".
- Routine: Routines refer to the improvement of designs in execution as well as details of processes which enable people to implement as well as incorporate particular knowledge through the necessity to interconnect with others.
- Self-contained task groups are groups that will be utilized in the case of sophisticated tasks which are described through the level of ambiguity, in addition to mandating routine techniques which cannot be utilized by them.

Knowledge application is a definitive motivation of KM. It implies knowledge investment: creating, storing, sharing, as well as implementing, is not sufficient. The critical angle is the exchange of knowledge with the application. Knowledge which is not mirrored within usage is only an expense. In addition, the accomplishment of an organisation within its KM programmes relies upon the size of applied knowledge contrasted with accessible knowledge.

#### 2.3.5.2. KM Technology

The technological strategies as well as the activities that are used in changing the organisational inputs to outputs appear to be the many concepts and organised data which are within a consistent movement. It is a current challenge for directors to spread awareness and guarantee an accurate utilization of technology.

IT and computer systems are related to KM improvements. The process of access to knowledge coding and in addition the importance of contribution, dissemination, and construction as well as arrangement is significant as it helps in securing its structures as well as the fundamental foundation of IT. Furthermore, the utilization of IT implementation is viewed as the most up to date tool of KM. Technology specialists view KM as involving investigation, design, and the application process of systems. They concentrate on the following aspects: knowledge storage, access techniques, utilization methods, information networks, consumer loyalty, organisational culture, and practical programming bundles that take care of the expense (Baserda, 2006, p. 63).

**Computers:** Computers date back to ancient times, where humans used several environmental tools for computing, including fingers, an abacus and other tools. In the early 1940s, the first electronic computer emerged, where vacuum tubes were used in its construction and the decimal system was used in its work; but they did not have the ability to store programs.

At that time, computers evolved rapidly and scholars could classify them with reference to four generations, depending on the physical components used and their calculation capacity (Yahya, 2006).

Developments in IT assumed a vital part in the unexpected rise in KM. In addition, IT provided sufficient tools to enhance the efficiency of KM to accomplish its objectives. The developing capability and the expanding utilization of IT prompted an information evolution which helped to recover data effectively. Organisations were able to produce and perform processes based on the implementation of KM efforts.

Information technology (IT) refers to the capabilities of the technology infrastructure that supports the building of KM architecture (Allameh, Zare and Davoodi, 2011). IT structures include resources and tools that help enable the development of processes and allow knowledge to be stored and distributed (López, Peón, and Ordás, 2009). The tools of IT comprise technologies for communication e.g. video conferencing and e-mails, they also include technologies that help make decisions such as DSSs (Song et al., 2001).

Technology is the mainstay of KM which provides the foundation for automation solutions, a centre for knowledge distribution, as well as provision for the inventiveness process (Microsoft, 1999, p. 6). IT drives advancement in employment, culture and business. Technicians, who comprehend technology and who are capable can utilize it, and can build and enhance individual effort, depending on the information systems. These comprise hardware, software, staff, procedures, as well as databases. IT is utilized to support the organisation's connection with clients and providers and is also able to create products as well as enhance the value of work completed within an organisation.

#### *2.3.5.2.1. Types of Knowledge Management Technology:*

KM technology is the main reason for growth within IT and communications technology.

**Knowledge Work System (KWS)** is a system for producing new knowledge and information. A KWS provides rapid, cheap tools to organize knowledge within different organisations. It includes computer-aided design (CAD), virtual reality systems, as well as investment workplaces (Laudon and Laudon, 2001, pp. 364-365).

- Computer-aided design (CAD): The personal computer as well as advanced programming are utilized to create products, so that they can examine designs quicker and be less costly. It provides extra products and higher value/quality.

- Virtual reality systems: Virtual reality systems include CAD systems through the use of computer simulation as products and are verified more credibly by the computer.

- Office Automation Systems (OAS): OAS are used in automating administrative tasks to be fully combined; these systems consist of document management systems, message handling systems, as well as teleconferencing systems.

The KWS incorporates distinctive kinds of systems, these include knowledge-based decision support systems (KBDSS) as well as artificial intelligence systems (AIS). KBDSS helps decision makers to make a wider variety of advanced decisions. Another system or AIS utilizes a PC which completes behaviour similar to a human. The system can perform predictable physical actions and can simulate human abilities. These functions are viewed as extremely valuable for associations (Laudon and Laudon, 2001, pp. 370-371).

#### *2.3.5.2.2. Knowledge-Based Decision Support Systems*

Decision support systems (DSS) that are knowledge based empower administrators to create an additional complex decision with a larger variety of choices. These systems offer help as follows:

- They support DMP steps, for example, choosing the proper information inputs which need expertise and additionally evaluation.
- They support the process of creating, storing, as well as the administration of the different models of DSSs.
- They support the analysis process if there is a risk; this is the characteristics of the present field of business.
- They support the client's organisation which has a noteworthy part in the usage of DSS.

Numerous models of DSSs are being produced on knowledge bases (Turban et al., 2005), for instance:

- DSSs are a critical part of the process of interaction between humans and machine and also execute operations to give information in addition to reacting to typical directions which assist in tackling unusual as well as sophisticated issues.
- Self-managed DSSs: This is a design development of DSSs since they are able to provide information on how to use these systems.

***Artificial Intelligence Systems*:**

Artificial intelligence (AI) develops a computer system so that it behaves in a similar way to humans. For example, it has the ability to study languages, accomplish physical tasks as well as the ability to simulate a person's skills. This is because AI is capable of mimicking thinking, creativity, as well as other human-related traits. However, AI does not have the intelligence of humans. AI is very beneficial for an organisation for the following reasons (Laudon & Laudon, 2001, pp. 370-371):

- They have the ability to compensate for any lack of expertise within the organisation. This may have been lost due to retirement or the withdrawal of expert staff.

- They have the ability to store, retrieve and share information effectively.

AI systems use several tools as well as methods, such as calculation machines, and Intelligence Quotient (IQ) agents, as well as providing relationship analysis. They are explained briefly in Table 2-4 (Turban et al., 2005, p. 344; Laudon & Laudon, 2001, p. 382):

**Table 2-4: Number of AI tools and techniques**

| Tools and Techniques | Definition |
|---|---|
| **Calculation Machines** | Learning machines through which the historical data of patterns can be examined. The clients will be provided with these machines to participate in tremendous databases and to recognize potential clients for new products |
| **Expert Systems** | Computer intelligence systems that have the ability to solve complex problems using knowledge and methods of reasoning |
| **Natural Language** | Natural language programs allow the user to connect with the computer through the user's language; the program works as an "ear" for the computer |
| **Neural Networks** | Neural Networks are designed to work in a similar manner to the neural network of the human body, where the electrical key works as the cell in the centre and the electrical wiring resembles nerves |
| **Hybrid IT Systems** | Many IT systems can be integrated to create specific applications to gain the benefits of each of the individual applications. Such systems are called hybrid IT systems (Laudon & Laudon, 2001, pp. 381-382) and are increasingly used in many Japanese companies as the applications of these systems have expanded to include office equipment, industrial machinery and household appliances. |

#### 2.3.5.3. The Knowledge Team

During the development of knowledge management, several organisations needed to develop confirmation for technological solutions before understanding the human factor in managing knowledge. However, they later decided that effectively combining technology with employee skills is valuable for an organisation (Baserda, 2006). KM is partially a response and a continuation of the designs of the most recent period, due to the modifying of business processes which resulted in the removal of expert staff within organisations. At a later stage organisation comprehending the exchange of technology-based benefits to competitive organisations implied that the benefit remaining is their work force (Baserda, 2006).

The improvement and maintenance of those that are able to lead the organisation in order to be at the top of the market by responding to clients and the opportunities provided by technology, is an organisational risk, demanding the ability to recruit, select, integrate, improve, as well as retain employees that are skilful (Ulrich, 1998, pp. 126-127). Moreover, those who create knowledge alongside the employees in charge of the client's knowledge, are all part of the knowledge team within an organisation. The members of this team represent the tacit knowledge that is controlled by human resources; this provides the organisation with a competitive advantage in terms of their knowledge and technology. Human Resources count this as a major component of knowledge management.

##### *2.3.5.3.1. Knowledge Workers*

Knowledge workers can produce information and knowledge and might be organisational experts. Knowledge makers include scientists, designers and authors. Kubaisi (2002, p. 6) states that knowledge creators are frequently part of a recognized occupation, for example designers, researchers and analysts. They oversee creation, improvement and the combination of new knowledge into current knowledge. Bennet et al., (2015) have shown that knowledge makers are fundamental to an organisation as well as their Chief Executive Officers (CEOs.) They are able to retain the value of knowledge within the organisation and link its growth to the external environment of technology science and expressions of the human experience. They can also provide and assess the process of organisational modification.

Despite the difficulty of estimating the productivity of knowledge makers because of the barrier of essential production items, there are six primary elements which impinge on the productivity of knowledge makers (Drucker, 1999).

- The mission needs identifying and to concentrate on the job.
- Knowledge makers should be able manage themselves so that they can assume their responsibilities independently.

- Continuous creativity should be an essential part of the assignment and accountability must be achieved through knowledge makers.
- Knowledge work needs to be continuously studied by knowledge makers.
- Knowledge work does not concentrate on the number of products but on quality.
- Their method needs to provide a solution in order to be an asset rather than a cost. This results in a higher efficiency in the workplace and increases the organisation's competitive advantage.

##### *2.3.5.3.2. Knowledge Managers*

Knowledge managers**:** as defined by Rastogi (2000, p. 41), their title is Chief Knowledge Officer (CKO). This is the first stage in managing an organisation through their knowledge. They carry straightforward tasks around the gathering of numerous aspects of knowledge, particularly knowledge in regard to staff, the sorting and sharing of the knowledge base to obtain results, maintain standards, and formulations that are required in order to enhance work. Organisations must include the post of chief knowledge officer in order to provide a measure of technical and regulatory infrastructures and need to pay attention to the critical initiatives. This helps guarantee the success of KM. The most important roles played by CKO (Herschel, 2000, p. 37) are the following:

- Responsibility for the expansion and implementation of KM programmes.
- Developing the strategy which directs the organisation so as to retain and develop the organisation's intellectual assets.
- The acceptance of an organisational culture which concentrates on constant learning and development. Turban et al., (2001, p. 40) specified that the role of the CKO represented combination of knowledge with the method of IT and that it has three responsibilities: creating an infrastructure for KM, constructing a knowledge culture, and distributing the knowledge culture.

### 2.3.6. Knowledge Management in the Construction Sector

KM is essential to the development of construction companies (Serpell, et al., 2018). It enhances the business's performance and this is essential in the construction industry (An & Ahmad, 2012; Yusof et al., 2015). Yusof et al., 2015 highlight the proper and effective use of KM. It is the means with which organisations identify their needs in order to achieve better performance and creativity. The performance of a business depends on effective KM (Ferraresi, 2012; Shannak, 2017; Lee, 2012; Davenport and Prusak, 1998)

Upon the resignation or retirement of staff with knowledge and experience, the companies lose a significant knowledge base. This is especially true of construction companies which value this expertise and their importance.

In recent years, there has been wide acceptance in the construction industry that knowledge is a valuable asset (Omotayo, 2015; Takhtravanchi and Pathirage, 2016; Serpell et al., 2018; Yusof et al., 2015; Rezgui et al., 2010). There is no doubt that the industry must fully implement KM. Therefore, if the construction industry wants to reduce costs, increase profits, achieve efficient work and improve customer service, it must adopt KM (Walker, 2005). In this regard, many working in the construction business recognize KM as a comprehensive strategy for the construction industry in achieving its aim (Serpell et al., 2018; Yusof et al., 2015; Carrillo et al., 2004). Furthermore, construction organisations have clearly adopted KM because of the obvious benefits in improving their performance as well as achieving a competitive advantage (Hsu, 2008; Khalfan et al., 2003).

A few of the main advantages of KM to the construction industry are (Anumba et al., 2008):

- The adoption of a clear KM strategy; this will achieve better prosperity.
- Providing the required knowledge more efficiently for time and resources, thus improving performance.
- KM contributes dynamically and continuously to improving the implementation of construction projects where expertise can be transferred to future projects to avoid past mistakes.

- One of the most important results of effective KM is the rapid response to customer needs, its improved ability to reply to the organisational changes and its ability to reduce risk.
- KM is essential for enhanced construction project delivery; the lessons learned from the previous project can be a benefit to the new project. This results in continuous development.
- KM can ease knowledge sharing through multiple project interfaces (participants, disciplines, organisations, and stages); through effective KM, organisations and project groups are able to stay away from repeating previous errors and/or recreating it.
- KM provides an enhanced support for teams of knowledge employees within an organisation or project team; distribution of the best practice is the outcome in knowledge sharing – which can occur within as well as through the organisations.
- Organisations can store tacit knowledge which would have disappeared as staff decide to leave, stop working or pass away.
- Greater value is given to the clients of construction organisations by an improved KM.
- Through effective KM, construction industry is better able to adapt easily to organisational changes.
- Risk reduction is a very important advantage in KM, meaning that the improved knowledge base means that organisations include fewer uncertainties to deal with.

Much KM research and several publications within the construction sector are being undertaken that focus on different aspects in KM. While attempts have been made to reveal the human as well as the organisational aspects of KM (Dainty et al., 2005; Mohajan, 2017 and Omotayo, 2015), other have discussed the correlation between KM and a company's performance (Robinson et al., 2001; Kale and Karaman, 2001; Yusof and Bakar, 2012; Charlesraj and Kalidindi, 2006; Abu Bakar et al., 2016). Critically, authors have also developed technological tools that facilitate KM (Jan et al., 2013; Al-Ghassani, 2001). Furthermore, many researchers have discovered the knowledge processes role (Fong and Choi, 2009; Bahtiar, 2012), the impact of knowledge sharing (Styhre, 2008; Rezgui et al., 2011; Low et al., 2005) and the effect on construction innovation

(Maqsood and Finegan, 2009; Wynn et al., 2008; Zhen and Zhenmin, 2008). In addition, some researchers have pointed out the role of KM in achieving a competitive advantage in the construction industry (Bakar et al., 2012; Magenuka, 2004; Schulte and O'Sullivan, 2009; Virgiyanti, 2014).

Applying KM within the construction industry using numerous techniques and tools enhances the industry. Research ranges from the implementation of decision support systems, external provision of KM services, internal exertion of KM, studying the past, and providing inspiring practical experiences within KM implementation within the construction industry.

### 2.3.7. Knowledge Creation in the Construction Sector

Both Nonaka and Takeuchi (1995) state that there are four separate modes of interaction which lead to knowledge creation. Construction project knowledge is created by the behaviour of individuals, project teams and construction organisations, as well as the interaction between explicit and tacit knowledge throughout the concept design.

Tacit to tacit interaction happens via socialization. For example, a designer could provide a description of the design model to a customer during a meeting. Apprentice mechanics, plumbers and builders for example work with their seniors regularly to learn about important skills. This is done by watching them followed by imitating them and finally repeating what they have learnt later.

A variety of craftsmen learn to depend on their tacit knowledge to overcome many issues faced. They are taught this in apprenticeship schemes where they develop skills and experience through communication with others. Likewise, new employees enhance their training via mentoring; this includes receiving help and guidance from their seniors in order to develop knowledge.

The process in which knowledge is converted from explicit to tacit knowledge is called internalization. An example of this would be a sound engineer reading a book about sound standards; they could integrate this into their own sound model fulfiling the client’s requirements.

Tacit knowledge is transferred into explicit knowledge to enable people to share knowledge with each other; this is known as externalisation. For example, this happens when an employee transforms and interprets an idea into a visual model or plan for the client to understand.

A combination is when there is a form of communication between two obvious knowledge types. Nonaka and Toyoma (2003) have argued that combination includes gathering, integrating, transferring, diffusing and editing knowledge. In the construction sector individuals as well as project teams generate knowledge by combining and processing several files and records, such as contracts and design drawing. This happens with the help of technology e.g. e-mails, databases and Microsoft Outlook.

A large number of other types of techniques and technologies are utilized to enhance the knowledge transfer process, for example meetings, face-to-face communication and brainstorming meetings. Many of them will be reviewed in the KM tools section.

The training and experience amongst experts are centred on the balance between the types of knowledge; this means that there should be dynamic communication between both explicit and tacit knowledge in order to enhance decision making. Therefore, project documents are processed by people who have the same type of training such as architects who are able to obtain knowledge and understand design drawings easily whereas an HR manager, for example, cannot. It is also known that managers acquire the majority of their information from conversations with people (tacit knowledge) and some from files (explicit knowledge).

### 2.3.8. KM tools in the Construction Sector

The literature review documented the KM technologies and techniques utilised to enhance the process of KM. They comprise creation, storage, sharing and application knowledge. The following tables, as proposed by a number of researchers (Egbu et al., 2003; Yap and Lock, 2017; Tan et al., 2010; Lu and Yang,2015; Nasimi et al., 2013; Al-Ghassani et al., 2005; Anumba et al., 2008; Egbu and Suresh, 2008; Egbu and Botterill; 2002), show a variety of technologies and techniques used to support the processes of KM in the construction sector. In order to guarantee that the sharing and the management of knowledge is effective and is consistent with the organisation's objectives, KM technologies and techniques are used.

**Table 2-5: KM technologies in the constrution organisations (Egbu et al., 2003; Yap and Lock, 2017; Tan et al., 2010; Lu and Yang,2015; Nasimi et al., 2013; Al-Ghassani et al., 2005; Anumba et al., 2008; Egbu and Suresh, 2008; Egbu and Botterill; 2002)**

| Technologies | Description |
|---|---|
| Data and text mining | As useful knowledge is gained from the data found in several large databases, this technology is utilized to determine the hidden relationship between the data provided, which is then used to create new knowledge. |
| Groupware | Groupware is a common and widespread technology in most of the construction industry. It assists members who are far away from each other to better communicate so that the information can be shared easily. There are many examples of groupware tools that are commonplace such as communicating through email, instant messaging, and forums that can be a discussion area and document repository |
| Intranet and extranet | An intranet is a private organisation internet, which prohibits access from outsiders. This method usually involves numerous trade secrets. An extranet is a link between an outsider and the intranet that means outsiders can have limited access to the intranet of an organisation |
| Knowledge bases | Knowledge bases are like a storeroom of knowledge. The knowledge is stored according to different topics in a clear and structured way. This technology exhibits facts that can be found in various sources. For example, a book, a collection of books, websites or even human knowledge and experience. |
| Helpdesk | This supports the client when an issue is faced regarding software, hardware and telecommunications. They are commonly known as support or contact centres. |
| Knowledge mapping | This is utilized by employees to allow them to perceive the required knowledge, as it helps them examine the knowledge areas and see the knowledge gaps. This also allows them to identify the connections between a variety of knowledge that is relevant to the business goals and objectives. |

**Table 2-6: KM techniques in the constrution organisations (Egbu et al., 2003; Yap and Lock, 2017; Tan et al., 2010; Lu and Yang,2015; Nasimi et al., 2013; Al-Ghassani et al., 2005; Anumba et al., 2008; Egbu and Suresh, 2008; Egbu and Botterill; 2002)**

| Techniques | Description |
|---|---|
| Brainstorming | This happens when employees (or staff) meet up with each other and use this opportunity to share their ideas based on their experiences. All the ideas from different employees will be used to solve problems faced. |
| Communities of practice | Employees work together as a team to achieve specific goals and objectives provided by the organisation. This is beneficial because the team has a variety of employees that have different skills and experiences. |
| Face-to-face interaction | This is an easy way for organisations to help employees interact with each other, as the employees gain the opportunity to meet each other and share knowledge. This also allows the employees to earn trust which encourages employees to learn during this process. |
| Post-project reviews | This is a technique which allows employees to go through reasons why the previous projects failed and the strengths and weaknesses of it. This helps employees gain knowledge to implement in a successful way. in the new project. |
| Recruitment | This is when new concepts and knowledge is introduced to an organisation by new staff when they join the construction industry. This helps the foundation of knowledge to increase. |
| Apprenticeship | This a process which allows new employees to learn new skills and knowledge required by the organisation; they learn their tasks supervised by another experienced employee. |
| Mentoring | This is a process where new staff are mentored by a coach over a specified period of time. Over time, they develop skills needed to complete their given tasks. |
| Training | This is used by organisations to ensure that their employees are capable of conducting the tasks required by enhancing their knowledge. This can be split into external and internal training. |
| Job rotation | This is when employees exchange tasks ~~from~~ with employees from different departments within the organisation. The tasks are given for a short amount of time, so that employees have gained more experience and knowledge. |
| Interaction with supply chain | This refers to a network of involved organisations, which link the subcontractors and suppliers with the consultant's team, main contractor and client. The participants coordinate their business plan, resources and capabilities in accordance with a network pattern. They share and exchange the latest information with each other to achieve mutual goals |

### 2.3.9. KM Challenges

Nasimi et al., (2013) and Alhamoudi (2010) found that one of the main challenges faced to ensure that KM is applied accurately is how involved the employees are. They state that this challenge can be condensed once the employees start working together and are able to realize that they play a major part in KM in addition to understanding the advantages of applying KM within their organisation. Moreover, Nasimi et al., (2013) and Egbu et al., (2007) believe that organisations are trying to create and find sufficient ways to overcome the barriers of KM and raise the chance of accomplishing a successful KM system. Therefore, Nasimi et al., (2013) have identified the barriers to KM:

1. People factors: This is a factor that focuses on the importance of knowledge sharing amongst staff, this is done through effective communication amongst staff. As very valuable knowledge can be captured by many employees that come from experienced and professional people, this can be a benefit for the KM. This means that the organisation must increase the significance of KM to reduce the resistance of employees who are against knowledge transfer.
2. Cultural factors: This factor could lead to a negative consequence over the efficiency of KM, as specialists in certain fields may be hesitant to share their knowledge with other employees within an organisation. This could also mean that staff could not be eager to apply KM to their experiences.
3. Political obstacles and unstable political atmospheres.
4. Technology can have a negative impact on organisational knowledge. If the company does not have in place a suitable centre or identified reference for maintaining knowledge, KM might not be achievable. As many organisations in the construction sector have a restricted financial plan, this means that there is minimal acceptance for the latest technology, this could result in more work being produced within the workplace.
5. Organisational factors: As proposed by Nasimi et al., (2013) there are five factors that can have an impact on the accomplishment of KM. These relate to wages, occupation, training the employees, structure and management. However, in order to achieve success with KM the organisation should increase awareness regarding the importance of sharing knowledge. This could be done by motivating employees which should help the organisation gain their loyalty.

Yap and Lock, (2017) found that the challenges faced when implementing KM within SME construction, relate to three factors of the five listed above. These factors are:

- People factors: as staff can face a lack of self-confidence as they are unwilling to share knowledge. In addition, staff might not be committed to sharing knowledge. There might be a lack of communication amongst employees, and an inability of staff to use any KM tools. In addition, poor business turnover causes people to move within teams.

- Organisational factors: there is a possibility that the organisation will allow staff to share a limited amount of knowledge; staff may not be highly encouraged by the business to participate in meetings that share knowledge. The organisation does not train its staff and often the organisation allocated tasks and resources randomly which is time-consuming for employees to utilize.
- Cultural factors- the different languages spoken by employees affects their ability to understand each other, and moreover, the organisational hierarchy is a challenge faced within any business. In addition, many organisations might not be able to afford up-to-date technology which could result in inefficient work being produced.

Construction organisations might find it difficult to implement many processes which would executing similar tasks (Hackman et al., 2017), Hackman et al., (2017) believed that organisations in the construction sector have a strength in the managing of projects but are often much weaker in organizing their internal business processes. This means that organisations find it difficult to learn from mistakes that were made in prior projects, and therefore, any errors that happened before are likely to be repeated again.

Due to the lack of understanding of the significance and potential advantages that KM has, organisations need to choose a more coherent and structured way for handling and using different types of knowledge (Hackman et al., 2017; Hari et al., 2005). In order to ensure that employees understand the advantages and the importance of KM, it is essential to have a clear and a structured method for managing and using different types of knowledge in an organisation.

Several KM challenges include managing data efficiently, enabling cooperation, giving employees the support needed to contact and find specialists to help them, and promoting continuous learning and improvement within an organisation (Mishra, 2009). Another challenge is the importance of making decisions built upon thorough, reasonable, effective and well understood information, knowledge and data (Abdelrahman, 2013; Mishra, 2009).

# 2.4. Business Process Management (BPM)

## 2.4.1. The Concept of Process and Business Process.

Businesses comprise a group of processes rather than functions. Processes cut crosswise over organisational functions and underline methods for accomplishing a certain task. They concentrate on the objective and the essential activities. The greater portion of organisational activity (surpassing 90% in some cases) can be described as being related to processes (Amaravadi and Lee. 2005).

ISO9000 describes a process as a set of correlated activities which transform inputs into outputs. Business processes are a group of related tasks, activities or behaviours completed by people or machines which deliver a particular object to a particular client or marketplace in order to accomplish particular business objectives.

Process is an exceptionally recurrent term appearing in a wide range of disciplines. With regard to individuals, process comprises diverse definitions (Gulledge Jr and Sommer, 2002), such as programming-engineers who see process as a correlation between static operations whereas manufacturing-engineers deal with process as powerful in connecting operations (for example process streams). Hammer, (2001:53) characterizes process as "…an organized group of related activities that together create a result of value to customers". Zairi (1997) states that "a process is an approach for converting inputs to outputs. It is the way in which all the resources of an organisation are used in a reliable, repeatable and consistent way to achieve its goals". Furthermore, Bulletpoint (1996), thought that there are four main features to any process, they include:

- "predictable and definable inputs;
- a linear, logical sequence or flow;

- a set of clearly definable tasks or activities;
- a predictable and desired outcome or result, which gives us a clear picture of what processes are".

To distinguish an organisation's processes from some other types of processes, the term business is included in the firm's business process (Andersen 2007, 32). In the context of an organisation, BP is a collection of an organisation's activities to increase value for clients. It is a progression of opportunities which unite people, technology and information to create significant yields (Mentor 2010). BP comprises at least two independent business activities. It is essential for them to be completed and consecutively connected and include an input and an output that improves the value for a client. Any missing connection may result in a distortion of the final product.

BP plays a crucial role in the reallocation of capabilities, skills and assets to accomplish detectable results, such as, a competitive advantage, market share, effectiveness and efficiency (Chen, 2001). Moreover, BP should satisfy objectives through a corporate strategy as well as produce outputs that fulfil the desires of clients. This implies that the BP approach can be the establishment for a re-innovation of association and work systems.

Various definitions of the term BP are provided in Table 2-7.

### 2.4.2. The Definition of Business Process Management (BPM)

Over the previous decades, numerous associations looked to embrace different system change initiatives to deal with its BPs to generally enhance the organisation's performance (Harmon, 2010). These systems change initiatives reached out over organisational functions to incorporate clients and providers, resulting in a change from a function to a process in the business. The changing of the system within the marketplace has been termed business process management (BPM).

**Table 2-7: Definitions of the term 'Business Process'**

| Reference | Definition |
|---|---|
| Harmon, (2003:459) | "…at its most generic, any set of activities performed by a business that is initiated by an event, transforms information, materials, or business commitments, and produces output. Value chains and large-scale business processes produce outputs that are valued by customers. Other processes generate outputs that are valued by other processes" |
| Davenport, (1993: 5) | "A specific ordering of work activities across time and space, with a beginning, an end and clearly identified inputs and outputs: a structure for action" |
| Hammer and Champy, (1993: 35) | "A collection of activities that takes one or more kinds of input and creates an output that is of value to the customer". |
| Johansson et al., (1993: 12) | "A set of linked activities that take an input and transform it to create an output. Ideally, the transformation that occurs in the process should add value to the input and create an output that is more useful and effective to the recipient either upstream or downstream". |
| Hinterhuber, (1995: 65) | "A set of integrated and coordinated activities required for producing products or offering services". |
| Bruce Silver Associates, (2006) | "a coordinated chain of activities intended to produce a business result". |
| Aguilar-Saven, (2003) | "the combination of a set of activities within an enterprise with a structure describing their logical ordering and dependence, whose objective is to produce a desired result". |
| Bund, (2005) | "a collection of related, structured activities that produce a service or product that meet the needs of the organisation's clients". |
| Harrington et al., (1997) | "a logical, related, sequential (connected) set of activities that takes an input from a supplier, adds value to it, and produces an output to a customer". |

The above table consists of a wide range of definitions for business processes, one of the good definitions of BP is that business processes are a set of activities or tasks operated by the organisation, and they are created based on materials, knowledge or an event and they produce an output, this output could either benefit customers or benefit other processes (Harmon, 2003:459). Another beneficial definition is by Hinterhuber (1995:65), he defines BP as a set of activities that are essential for creating products and services.

Business processes are normally divided into three different categories, the first one is a primary process, this type is the most important process because it is an essential organisational process that is needed to be performed by the organisation to meet the objectives. For example, the development of a website could be an essential process this could result in meeting different objectives such as gaining profit and reaching customer satisfaction. The second category is a support process, the process is created to help the performance of the primary processes, this type of process does not result in profit and has no benefit for the customer, for example marketing and human resource management. The final category is a management process, this provides organisations with activities on how to grow and develop their organisation, they focus on the control and the organisation systems. Some examples of a management process are strategic planning and internal communications.

BPM will result in being exceptional amongst the most mainstream business and technology management strategies in the future (Song and Zhu, 2011). According to various studies (Brocke, and Rosemann 2014; Hammer 2015; Gartner 2009; Rosemann and Brocke, 2015; Dumas et al., 20118), BPM is extremely important for development within organisations.

It is recognized that BPM has progressed from focusing only on IT, to a management practice, and has now been transformed from an overall order devoted to a process-centric, client-centred association with the objectives of coordinating management, individuals, processes, and both operational and strategic activities (Hill et al., 2006). What is more, an effective BPM action needs wide BPM knowledge and solid business focussed expertise (Antonucci and Goeke, 2011).

BPM emphasises the enhancement of a business's performance by organizing an organisation's BPs. It is contended that BPM empowers organisations to focus on being productive and has the capability to adapt easily to change. It is more than a functionally attentive, old-style ranked management method. However, these business processes can affect the expenses and revenue generation of an association.

BPM aims to coordinate IT and BP. The BPM approach can help an organisation to balance its resources such as people, processes and technology (Segatto et al., 2013).

BPM impacts job performance across all industry sectors, Aldiabat et al., (2019) argue that BPM helped to significantly improve the performance of the organisations, as it enhanced its quality, service and speed. Moreover, they concluded that strategic alignment (a factor of BPM) helps organisations take the customers' needs into consideration, and helps to develop specific strategies and plans to increase the value of the process design.

Bank services (BS) utilize BPM, one of the obstacles that the BS faces is inadequate alignment between processes strategies and the corporate strategy, therefore BS has focused on the improvement of their performance and they did that through the integration between processes and new technology (Shra'ah, 2009). It was necessary to integrate processes with new technology as there was an increase in the use of IT for example e banking or online banking were getting popular and started to attract more customers. Moreover, the implementation of BPM within banks helps organisations improve the efficiency and effectiveness of their processes and services, and it benefits the organisation through enhancing customer satisfaction and developing the worker's skills and knowledge (Shra'ah, 2009).

It improves product quality, in addition to organising, improving, controlling and maintaining operations. It permits participation between operations inside and outside the association, enhances work proficiency and reduces time and costs. In addition, BPM needs to help an association's applications to coordinate processes, data and people through a range of operational technologies. BPM involves high adaptability that can be adjusted to market variances, assets and organisational structures (Zhang and Wang, 2010). Currently, there is no adequate definition for BPM (Palmberg 2009; Lee L. L. 2005). See Table 2-8 which consists of several BPM definitions.

**Table 2-8: Definitions of the term 'Business Process Management'**

| Reference | Definition |
|---|---|
| Zhang and Wildebrand, (2013) | "BPM is a systematic way of identifying, designing, implementing, documenting, measuring, monitoring and controlling both computerized and non- computerized BPs to achieve consistent and results-oriented in line with the strategic objectives of the organisation". |
| Elzinga et al., (1995) | "a systematic, structured approach to analyse, improve, control, and manage processes with the aim of improving the quality of products and services". |
| Zairi, (1997) | "a structured approach to analyse and continually improve fundamental activities such as manufacturing, marketing, communications and other major elements of a company's operations". |
| Weske et al., (2003) | "supporting business processes using methods, techniques, and software to design, enact, control, and analyse operational processes involving humans, organisations, applications, documents, and other sources of information". |

The above table consists of a number of different definitions of BPM, an example of these definitions is that BPM is a method that is systematic and coordinated, this method analyses, develops, regulates, and manages processes in order to improve the quality of a service or a product (Elzinga et al., 1995). Furthermore, Zairi (1997) defines BPM as a structured approach that analyses and helps to enhance the basic processes such as communication and marketing. This research adopted Zhang's and Wildebrand's definition of DMP, because their definition incorporates the different stages for BPs that helps the organisation achieve results that are consistent with the organisation's objectives.

Apart from the above descriptions, other studies have diverse focuses on BPM. Lee and Dale (1998) state that BPM is a customer focused method to improve every process within an organisation. Within organisations there are customer service experts that generate processes and activities that benefit the customer, they focus of the improvement of the customer service experience. Customer service experts cannot generate business processes by themselves as sometimes they could lack the experience needed to improve and adapt processes to fit their needs, therefore BP and customer service leaders tend to work together in order to adapt and improve the customer service experience. BPM tools and software aid with this process as they provide the needed technology the enables processes to develop so that they meet the customer service goals. Furthermore, organisations could use the computer facilities that come with BPM software in order to allow customers to interact with the organisations affectively.

Jarrar et al., (2000) contend that BPM needs to concentrate on process development as well as change management and development. Harmon (2003) states that the management of business process is informational -technology oriented, that attributes BPM through the viewpoint of BP automation. Rosemann and De Bruin (2004) state that, even though different methodologies have been utilized in the investigation of BPM, the fundamental focal point of BPM is on process and process development.

### 2.4.3. The BPM Life Cycle

BPM has the ability to comprise a group of ideas and methods that are utilised in the design, management, setup and analysis of processes (Weske, 2012). However, BPM also includes diverse directions of activity in the objective-oriented control of the value chain of an organisation: quality, time, cost and consumer loyalty (Gaitanides et al, 1994).

With regard to these definitional approaches, the processes in the business process management can be resumed in a life cycle (Dumas et al., 2013). The BPM life cycle incorporates the accompanying stages (see Figure 2-9):

- Process identification: Based on the objective of the perception of reality, the applicable processes are determined and identified with one another. Since generally more than one process is considered, process models can be made.
- Process discovery: In this phase, the processes are demonstrated in detail in their genuine state (as it stands). Contingent upon the objective of the process documentation, diverse levels of points of interest are helpful.
- Process analysis: the aim of this phase is to uncover mistakes and conceivable approaches to deal with enhancing the processes. These approaches ought to be archived.
- Process redesign: The errors and proposals for development recognized in the last stage are considered in this phase to redesign one or many processes. For the most part, the progressions result from a nearby interaction with the analysis phase. In this way, it might be valuable to outline these phases or to accomplish the desired enhancements in the process through several iterations of analysis and redesign.
- Process implementation: the process is moved into practice and the conceptual changes are executed. The execution requires organisational and technical changes.
- Process monitoring and controlling: in this phase, the accomplishment of the redesigns of the process is confirmed. This check incorporates the meaning of important measurement criteria and the supply of instruments. If deviations from the defined criteria is revealed, the process keeps on being observed or it will follow another iteration within the life cycle.

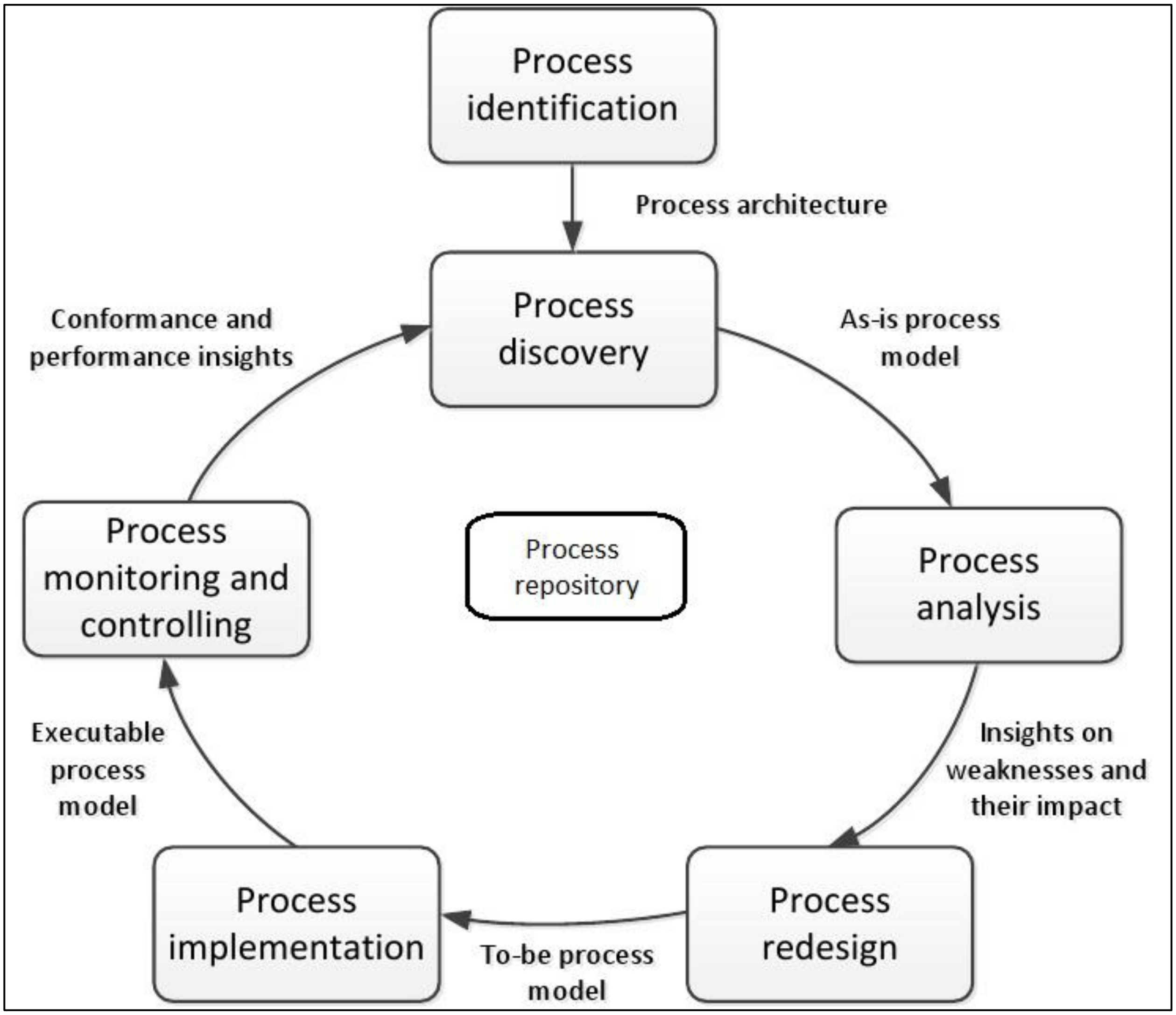


**Figure 2-9: Business Process Management Life Cycle, (adapted from [Dumas et al, 2013])**

### 2.4.4. Critical Success Factors of BPM

Pradabwong et al., (2017) found that BPM focuses on business processes that consists of 4 factors which are: strategic alignment, IT, employees involvement, and processes improvement. Also, Rok et al., (2010) found that there are 9 different factors that could create business process elements: (1) strategic view; (2) process definition and documentation; (3) process measurement and management; (4) process organisational culture; (5) people management; (6) market orientation; (7) supplier view; (8) process organisational culture; and (9) IT/IS support.

This research has adopted the BPM model created by Rosemann and Brocke, (2015) in order to identify the six main elements of business process management, this model was implemented in this research for a number of reasons. One of the reasons is that this model was formed based on a new understanding that sees BPM as a holistic management approach. Other reasons include the fact that this model was developed academically as the literature review was very thorough and the model itself was validated, moreover, many organisations have utilized this model which proves that this model is applicable.

As demonstrated in the introduction section, several studies concentrate on the critical success factors of BPM. These consist of: strategic alignment; governance; methods; information technology; people; and culture (Fisher 2004; Rosemann et al., 2005; Melenovsky & Sinur, 2006; Rosemann and Brocke, 2015). They are critical factors and are the main emphasis of this thesis. Each factor will be discussed in detail to form an improved evaluation of the BPM components.

#### 2.4.4.1. Strategic alignment

As indicated by Brocke and Rosemann (2015), the strategic alignment of business process management is to improve the connections, organisational needs and enterprise processes including with the prime aim of reaching the organisation’s targets. It is imperative for the association to create a strong connection between competitive strategy and the operational role in order to enhance its performance from BPM (Rhee and Mehra, 2006) In addition the active usage of BPM as a feature of an organisation's strategy combined with a client focussed centre is considered an essential indicator of the management business process. O`Neill and Sohal (1998) contend that BPM goals build up dependency upon the strategic direction and will help the organisation to achieve many advantages. It has also been discovered that organisations that lack connections and BPM in their strategy will result in disappointing results. (Bandara et al., 2007). Strategic alignment is significant regarding organisational targets and BPM objectives. In other words, it is a very important component for the accomplishment of tasks (Bandara et al.,2009).

Processes should be designed, performed, organised as well as assessed by strategic priorities and dynamic situations (e.g., the stage of a product's lifecycle, position in a key portfolio) Burlton, (2010).

Several distinguished capability regions have been recognized as part of an assessment of strategic alignment in BPM.

- A strategy-based process enhancement plan aligns with the association's general methodology with respect to BPM. The process enhancement plan ought to be specifically obtained from the association's strategy and pave the way for process enhancement activities to meet specifically organized objectives. This permits a clear explanation of the business advantages of BPM activities. The process enhancement plan likewise provides processed data showing how the BPM activity identifies with fundamental ventures. For example, the execution of an organisation system.
- A central component of strategic alignment, with regard to BPM, is the two-way functioning connection present in the strategy as well as in the BPs. Can BPs specifically help the strategy? Can the strategies of an organisation expressly consolidate process capacities? By what method for instance, do organisations determine which BPs are affected through a change in the strategy? Are there any processes that hinder the implementation of the strategy? Is the strategy outlined as well as persistently investigated with reference to present and rising process capacities? By what means should rare assets be allocated to contending processes? Which processes are central to the organisation and ought to be performed within the organisation? Are there any BPs that are selected for offshoring? (Bhat et al. 2010)
- A highly focussed organisation's process design clearly reveals any significant BPs that occur. It also reveals the processes which help the value chain in an organisation, such as information technology facilities. Having a distinctive design

of the process makes it easier to understand the process vision and supplements rather than repeats. Similarly, it fills in as the primary process scene and provides an initial stage to more detailed process structures.

- Keeping in mind that the ultimate goal is to assess genuine process performance, its important to have a clear as well as communal comprehension of process outcomes related to key performance indicators (KPIs). Process focused, as well as price efficient estimated KPIs provide a profitable basis to the interpretation of strategic goals to specific objectives. In addition, it encourages a viable process controller. Applicable KPIs can vary. These include cost, quantitative, qualitative, or time-oriented information. (vom Brocke et al. 2010). Beyond what many would consider possible, such KPIs ought to be standardized over the different processes and specifically over the distinctive process variations (e.g., in various nations). Also, important, yet more difficult to measure, are those KPIs identified with attributes of a whole process. For example, adaptability, reliability or consistency.
- Usually, strategies are firmly connected to people and partners. Accordingly, a strategic assessment of BPM needs to measure the genuine needs of the main clients as well as the different partners, for example, senior management, investors and government bodies and so on. For instance, it is often the case that a new CEO has a huge effect on the reputation (sometimes not) of BPM regardless of whether the authorized strategy continues as before. Such a view can go mean that associations intentionally design processes the way business partners see them, and following that begin to locate their facilities in these processes.

#### 2.4.4.2. Culture

Culture is a broad concept that incorporates values, beliefs, mentalities and practices within an individual’s awareness. It recognizes one team or classification of individuals from another (McSweeney, 2002). As indicated by Bandara et al., (2009), organisational culture points to the standard direction which individuals need to adopt within their associations. Its exceptionally difficult to alter an organisation's culture within a brief timeframe; thus, the attributes of culture are viewed as main features which impact BPM project success (Grugulis and Wilkinson, 2002). Roseman and De Bruin 2015 and Rosemann et al. (2005) affirm that culture is a significant factor with respect to managing the business process. It is also critical for associations which recognize the possible protection from alteration or an absence of process when initially establishing BPM.

Culture is about creating a helpful setting which supplements the different BPM activities. However, organisations need to understand that one of the risks of activities that are related to culture is that it is time-consuming compared to other activities that are based upon other factors.

Culture involves the shared values and beliefs which form process-based attitudes as well as behaviour in order to advance the organisation's value chain.

- Responding to the process adjustment is about the general responsiveness of the association to process adjustment, the affinity of the association to acknowledge process adjustment. It likewise incorporates the capability for process alteration to cross functional limits consistently as well as for individuals to use the most significant advantage of the process.
- Process values and beliefs determine the full process withing the association. For example, do individuals from the association normally consider processes to be the direction for everything to be completed? Can " processes " assume a conspicuous position within the business's mission, goals, value statements? (Vom Brocke et al., 2010).
- The process behaviour of the individuals who are associated with, and the individuals that are influenced through BPM create a supplementary evaluation entity in the " culture " component. It incorporates, amongst others, the eagerness to address current BPM activities to achieve a possible process enhancement.

#### 2.4.4.3. People

As per Melenovsky and Sinur (2006), people reveal who are the individuals as well as the groups who persistently improve and implement their expert information to the process-focused changes within the association. Schneider et al., (1996) contend that the essential aspect with regard to executing sufficient change within the association is changing the manner in which the workers carry out their occupations. On the off chance that they do not adjust their practices, it is challenging to complete the new strategy effectively. Meanwhile the majority of the alterations that occur within an association should be led by in the end by people. People are viewed as one of main components impacting the managing of business process (Paper and Chang, 2005). I Occasionally, it is exceptionally troublesome for individuals to pursue changes within the association; they may result in confrontations due to the absence of trust amongst the administrators as well as representatives and there is the dread of being unemployed as a result (Attaran and Wood, 1999). As it becomes more widely accepted that business process management is a process-based management to actualize BPM effectively, employees within the association should alter their behaviour and their conventional methods. They need to understand the way to coordinate their attempts to accomplish the process results (Jeston and Nelis 2006). This needs to be done in alignment with the goal and it is imperative for the association to organize proficiency training through the execution of BPM (Pritchard and Armistead, 1999).

While the IT factor secured Information-Technology-based assets, the "people" component is part of HR. This aspect is characterized by the individuals as well as the groups that repeatedly improve and implement their expertise and knowledge in business management to enhance the organisational objectives. Process aptitudes and skills are focused on the completeness as well as the complexity of the capacities of the stakeholders within particular standards of BPs. This is vital for process owners associated with the administration and tasks of a process.

- KM process combines the explicit as well as the tacit knowledge about BPM fundamentals as well as practices. These assess the rate of comprehension of the BPM, counting the KM methods and IT, as well as the effect it has on BP results (Karagiannis and Woitsch 2010).

- Process learning estimates the responsibility of the association to the continuous growth and support of the related process as well as process management expertise. The evaluation consists of presence and suitability as well as genuine achievement (as estimated through the rate of studying) of the BPM instruction programmes.
- Process collaboration considers the way people as well as groups collaborate to accomplish the desired process results. This incorporates the proper assessment of the communication patterns between process stakeholders and the way in which related process knowledge is found, investigated and disseminated.
- The final "people" ability zone is devoted to processing administration pioneers. The examination as indicated by this component assesses the ability to guide, assume liability, as well as remain responsible for BPs.

#### 2.4.4.4. Governance

Governance refers to the important and clearly role of decision making to control activities (Melenovsky and Sinur, 2006). As indicated by Lee and Dale (1998), it is essentially aimed at the organisation to characterize the process owner and ensure their roles in the process enhancement. A process owner has the duty of outlining processes, estimating its execution and preparing the employees that will execute it.

BPM governance sets up suitable responsibilities and roles regarding the distinctive rates of BPM. Additional attention is focussed on the design of DM and certain processes are recommending to manage process-based activities.

- The description and reliable implementation of BPM with DMPs that direct activities in predicted as well as unpredicted conditions is a serious challenge for BPM governance. Notwithstanding the importance of decision-makers, the rapid of DM and the range of impact asset allocations and business reactions to process change is essential. It needs understanding and right governance processes, such as for example, information technology change management.

- A central component of the combination between BPM and governance are the process roles and responsibilities. They include the whole scope of BPM-based roles, from BP analysts to process owners to potential chief process officers (CPO). The roles and responsibilities of every occupation should be clearly indicated, and exact revelatory formations should be determined.
- Processes should exist to ensure the immediate connection of process implementation with strategies. Although the real process yield is estimated and assessed as being a major aspect of the component strategic alignment, responsibilities and the process for gathering the essential measurements and connecting them with performance criteria are part of business process governance.
- Process administration standards should be clear and described. It incorporates amongst others, the harmonization of process administration activities in the organisation and rules for the foundation including administration process measures, problem resolution and compensation formats.
- Process administration is a major aspect of BPM governance and covers regular review cycles to maintain superiority and process administration values (for example, "process reuse before process improvement"). Suitable agreement administration forms is another important segment of process administration control (Spanyi , 2010).

#### 2.4.4.5. Methods

Methods refer to the approaches which an association adopts uses to help its process-based activities. It is viewed as one of the main factors of BPM (Melenovsky and Sinur, 2006). Various types of methods are produced to enable organisations to deal with their BPs (Mansar et al., 2003). Examples of these methods are, Six Sigma, Lean, Lean-Six Sigma, and Continuous Process Improvement. Vakola and Rezgui (2000) additionally, state that implementing the methods to direct the BP projects will add to their accomplishment as they are able to support the removal of obstacles. With regard to the procedure of BPM execution, it is necessary to create process ownership and allow business process owners to lead the managing of the business process to the entire organisation; this is a method which can be utilised (Fisher, 2004). Subsequently, it is for organisations to choose as well as execute suitable methods to advance BPM.

Diverse methods are used to improve, distinct phases of the processes' lifecycle. Its distinctive attribute, that is exclusive to "methods" as well as to "IT" factors, has brought about regions which mirror the process lifecycle phases as opposed to the capabilities of the BPM methods or IT.

As a consequence, methods measurement pays attention to the exact requirements of every process lifecycle and includes components, such as the incorporation of process lifecycle methods with one another in addition to more administration methods. In addition, there is support for methods provided through IT, as well as the complexity, suitability, accessibility, in addition to the methods that are regularly used in every phase.

- Process modelling is identified with the methods applied to recognize present BPs and future processes. The crux of such a method is not just to process modelling mechanisms but also to process analytic methods.
- Process implementation includes the following phases within the lifecycle (see Figure 2 9). Similar methods support change process models into implementable BP details.
- The process control phase of the process lifecycle is identified with the methods which give direction to the accumulation as well as combination of process proper information. This information is able to be identified with process control (for example, chance).
- The process change, as well as the advancement plan incorporates every method that encourages the improvement of enhanced BPs. It incorporates techniques which help the process improve activities (for example, resequencing stages within a procedure), process advancement (e.g., inventive reasoning techniques), process use (an improved utilization

of current assets, for example, individuals, information, or frameworks), and process deduction (reference models, benchmarking, and so on.).

#### 2.4.4.6. Information technology

IT that incorporates the software, hardware, databases and networks which help the process activities is a main component of business process management achievement (Melenovsky and Sinur, 2006). It is contended that information technology ought to be used in enhancing the efficiency of BP, instead of automating the processes (Akhavan et al., 2006). Information technology plays a vital part in BPM ventures as it encourages the process design stage as well as supports the completion of final last execution (Al-Mashari and Zairi 2000; Attaran 2004). Nonetheless, associations should be extremely cautious when they implement information technology, since it conveys impediments to the BP venture that will ruin the achievement of BPM (Al-Mashari and Zairi 2000). Terziovski et al., (2003) state that despite IT being critical, IT itself cannot provide a competitive advantage as the associations must modify their centre processes from a client centre.

Advance assessment criteria capture the complexity, appropriateness, accessibility and genuine use of IT within each stage.

- IT-empowered process usage and execution focuses on the computerized change of process models into executable determinations as well as workflow -based process implementation (Ouyang et al., 2010). It also incorporates similar solutions to solve problems, such as for example, file administration systems. This whole classification of programming is frequently marked " process-aware information systems " (Dumas et al. 2005).
- Process control encourages performance visualization (for example, dashboards), as well as process monitoring. These types of solutions to problems can be incorporated within the business (for example, through Stable Record systems).

- Tools for process change and development provide automatic help to the enhanced BPs. This may be a solution which provides agile (i.e., studying by yourself) tools which constantly modify BPs dependent on logical changes.
- Program management tools enable the organisation of all kinds of BPM initiatives. They provide, inter alia, DSSs for process owners.

### 2.4.5. BPM in the Construction Sector

Although the construction sector is important with an output approaching $7tn (Dave and Dave, 2017), it clearly suffers from problems related to the management of processes and lack of productivity (Teicholz et al., 2001).

The majority of BPM research has been directed towards productivity in various regions around the world during recent past years. But there has been a significant waste of time in non-value activities that benefit construction projects in terms of productivity and efficiency (Teicholz et al., 2001; Horman and Kenley, 2005), this means that organisations face problems with productivity and efficiency. From this perspective, the improvement of processes is extremely significant to the business field.

Construction has many major concerns concerning the requirement for enhancing processes (Wolstenholme et al., 2009). Several studies have paid attention to processes in the construction industry at both high and low-level stages (Kagioglou et al., 2000). Others have sought to improve a small part of the process across the organisation (Mohamed and Tucker, 1996).
Construction projects are characterized by a long-life cycle which produces large amounts of data and operation processes. Therefore, the construction sector has improved its focus on the possible advantage of using KM (Carrillo et al., 2004). However, the exceptional demands of construction organisations cannot be met if important knowledge essential for enhancing processes is not included.

However, there is a shortage of literature that concentrates on the improvement of BP in a construction organisation. Most studies focus on the analysis of existing circumstances as well as recommendations for enhancement (Green, 1998) or offer insights into the smaller subsection of process development in the organisation (Stewart and Spencer, 2006). There are limitations within the literature relating to the analysis of holistic process development in the construction industry as well as its efficiency in the short, medium and long term (Dave and Dave, 2017).

## 2.5. The Integration between BPM and KM

To ensure the effective utilization and improvement of the knowledge role throughout the business life cycle, the process of KM is an essential driver for any BP development and evolution as it affects planning, implementation, control, monitoring and improving processes and systems in an organisation. The combination of KM and BPs is indispensable. Once knowledge is implemented over an organisational activities, it will be beneficial in enabling creativity, shared knowledge, individual learning, collaborative problem solving, and organisational learning as a goal of KM (King et al., 2008). Furthermore, this combination will enable BP to be more extensive and better-aligned with the evolving organisational information systems' needs and requirements.

Additionally, the interrelation between KM and BPM, has the ability to help the process of BPs through merging KM techniques with the day-to-day operations. Knowledge can be applied, and all core KM activities interconnected with precise BPs (Schmid and Kern, 2014).

KM is business and process oriented (Zhang, 2013) KM can recognize the creation of value and merge with different kinds of management through BPs. Knowledge can be administrated and distributed actively with a dynamic BP in the organisation through the process-oriented KM which can prevent the overload of information and focus on useful information that is important for a firm's value chains (Kwan and Balasubramanian, 2003). The aim is to transfer suitable knowledge at the appropriate time to the right people in order to enhance the effectiveness of DM within the company.

Consequently, such a view based on the KM model enhances knowledge of the possibilities and visualizes the flow of knowledge and tracks knowledge processes and appropriate methods as well as technologies (Gai and Dang, 2010). Figure 2-10 explains the SECI model (Nonaka et al., 2000) which describes the procedure of conversion from tacit knowledge to explicit knowledge.

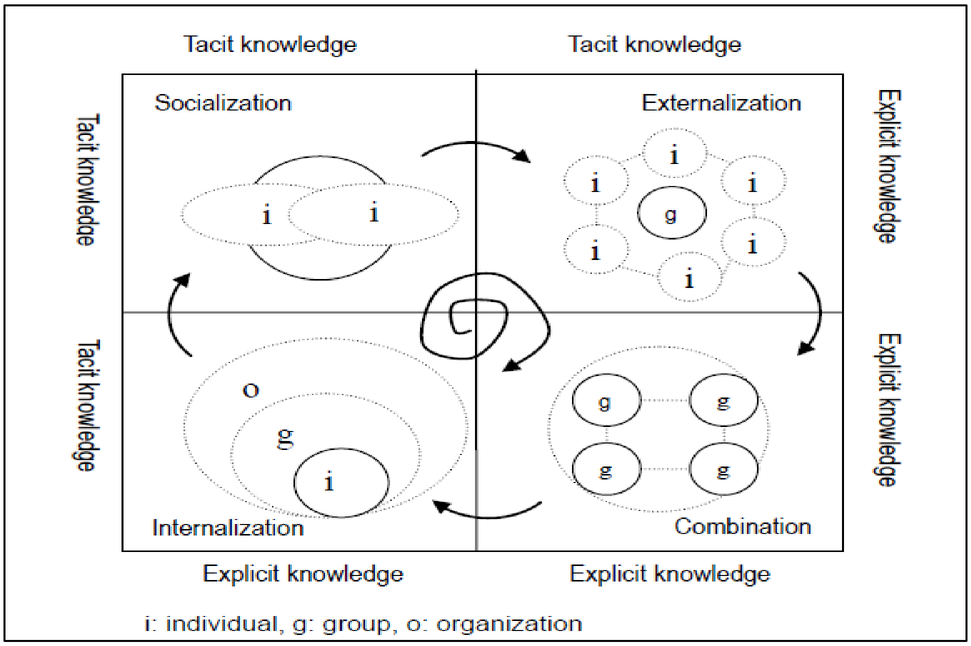


**Figure 2-10: Knowledge conversion process based on SECI Model (Source: adapted from (Nonaka et al., 2000)])**

The development of the GPO-WIM model (see Figure 2-11) by Fraunhofer APEC. GPO-WM®-Method- is a registered trademark of Dr. Peter Heisig and combines GPO-WM®-Processes-based templates with the GPO-WM®-SOLUTION PACE foundation to enhance operation groups with integrating KM activities in day-to-day BPs. The GPO-WM® framework has three layers: 1) BP: context as well as KM zone; 2) knowledge and KM: knowledge derives from the BP, while the main KM activities are "generation", "store", “distribute "and" apply". 3) Enabler: organisation, control, human resources management, culture, leadership, and information technology.

Recently, various attempts have presented the KM concept to BPM to merge the benefits of the two terms (Paschek et al., 2018; Vivas et al., 2014; Schmid and Kern, 2014; Cheng et al., 2012; Tabares et al., 2016; Massingham and Al Holaibi, 2017; Hassen et al., 2016; Zhang, 2012; Sarnikar and Deokar, 2017; Ranjbarfard et al., 2013; Febriantoro and Surendro, 2015; Baloh et al., 2008; Lee, 2008; Fuchino et al., 2008).

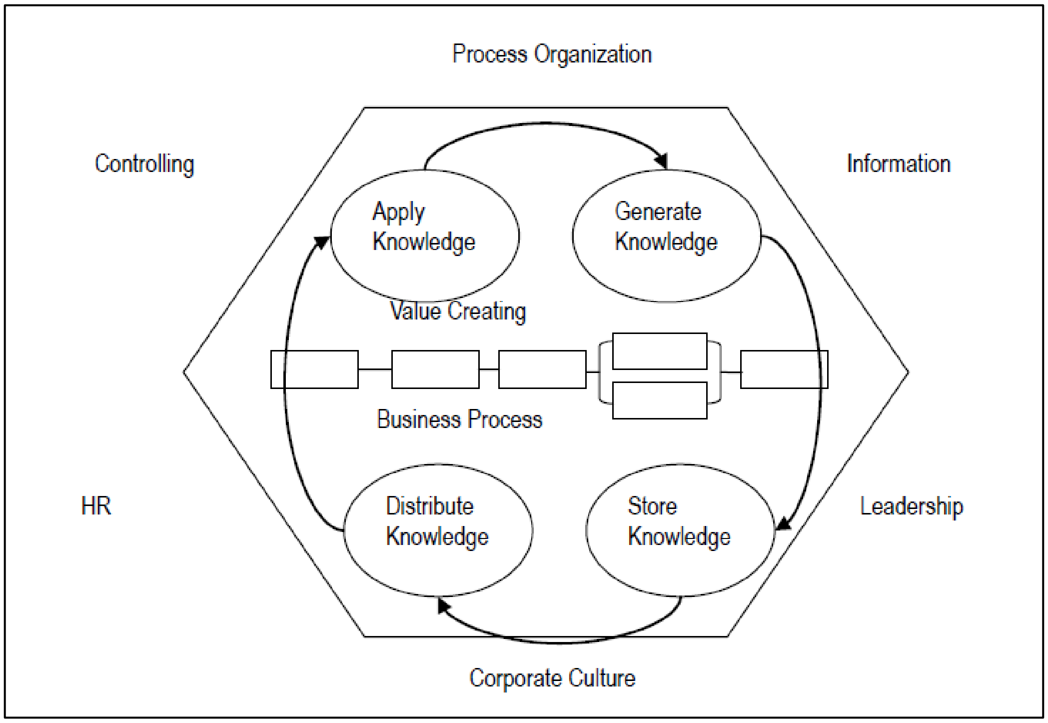


**Figure 2-11: KM process and business fields (Source: Mertins et al.; (2003))**

Traditionally, there has been some management of knowledge, but it was clear that there was a defect in how to take advantage of the knowledge, whether distributed or applied. However, In the interrelation, knowledge can be controlled actively with a dynamic BP. There are many advantages to the integration between KM and BPM (see Table 2-9).

Current research on the interrelation between KM and BPM discusses the importance of the interrelation between them on the performance of the organisation (Tabares et al., 2016; Malhotra, 2005; Cao et al., 2013; Wu & Chen, 2014; Suciu, 2014), the process- oriented KM (Gai and Dang, 2010; Maier & Remus, 2003; Kwan & Balasubramanian, 2003; Remus & Lehner, 2000; Sivri and Krallmann, 2015) and the effect of interrelation in DM (Zhong, 2008; Fu et al., 2004; Liu et al., 2013) with applying the interrelation in various sectors e.g health (Raghu and Vinze, 2007; Orzano et al., 2008), bank (Remus and Schub, 2003; Maier and Remus, 2003), education (Massingham and Al Holaibi, 2017; Febriantoro and Surendro, 2015), business intelligence

(Folorunso and Ogunde, 2005; Höpken, et al., 2015). However, there are very few studies focusing on some industries like construction, agriculture and manufacturing.

**Table 2-9: Advantages of the intergration between KM and BPM**

| Advantage | Source |
|---|---|
| Focusing on important and essential information and avoiding information that is not important to users and which is necessary for the company's value chains | Kwan and Balasubramanian, (2003). |
| Raising the efficiency of using knowledge in the organisation and improving the usability and implementation of KMS | Remus and Lehner, (2000). |
| Utilizing the different kinds of knowledge which are associated, the processes can distribute the exact proactive knowledge to the correct people at the right time during the enactment. | Jung et al., (2007) |
| Improving abilities which increase the efficiency of KM for instance knowledge storing, retrieval and combination. | (Raghu and Vinze, 2007; Linderman et al., 2010). |
| The required knowledge can be provided proactively for the required activity, thus saving time and effort and contributing to raising productivity and avoiding traditional methods of inquiry that consume much effort. | Jung et al., (2007) |
| KM moves towards organisational reality and follows the flow of knowledge along with the value chain, providing contextual application, and, in particular, it facilitates easy access to knowledge and its application to the daily work of resources. | Gai and Dang, (2010) |
| The interrelationship can assist the procedure of BPs by merging KM tools with the daily work operation and provide the right knowledge to employees in BPs. The BP is the implementation area of knowledge, and all core KM activities are interrelated with particular BPs. | (Armistead, 1999; Mertins et al., 2001) |
| It analyses the production, sharing and application of knowledge from the start of the process activity. It will also promote the efficiency and value of processes. Moreover, process orientation contributes to process controlling, as well as to designing and introducing KMS. | Maier and Remus, (2001). |
| The combination between KM and BPM benefits the organisations by providing the employees with the required knowledge needed for performing the organisation's operational business processes, enhance process performance, develop core competencies, and optimize business performance. | (Maier and Remus, 2001; Zhang et al, 2008; Han et al., 2008) |
| Knowledge is used by performers of BPs and new knowledge is created as a result of BPs. That is, BPs are an excellent delivery medium of knowledge as well as an arena for the creation of knowledge. Moreover, information about a process itself and process execution results in valuable corporate knowledge. That is, information derived from BPs can (or must) be gathered and formalized to enhance the performance of BPs, and hence, the organisation. Knowledge is generated by processes and applied in processes. | (Jung et al., 2007; Maier and Remus, 2001). |

Manuel (2014) believed that integrating KM and BPM is important when an organisation aims to align the needs of their customers to their business. This is done by transforming the organisation data that uses technology and applies their new learning system activities as ecommerce. This integration prepares the organisation for a competitive environment within the industry and allows the organisation to satisfy the needs of their stakeholders. Also, Marjanovic (2010) emphasise the importance of such integration as he created a model that integrates BPM and KM. In his model, he differentiates between various levels of complexity for processes (simple, more complex, and very complex), the lowest level of process complexity is carried out by normal employees, the next level is carried by knowledge employees, and finally the highest level is carried out by experts. The model focuses on both concepts of tacit and explicit knowledge, intensity of knowledge, the modelling of business processes, business process performance monitoring and business process improvement methodology. Marjanovic demonstrates that processes that are based upon knowledge are significant, as they have an important relationship to the organisational competitive strategy. Furthermore, his research proves that organisations utilize a holistic approach to BPM and an organized approach to their projects. In a similar context, Paschek et al. (2018) mentioned that there are two types of relationship between KM and BPM. The first type is when KM is placed on top of BPM which means that KM is given the strategic level. This allows KM to improve the BPM performance, because KM is used to generate, amplify, and accelerate the creation of value. The other type of relationship is when BPM is placed above KM. One of the reasons this could happen is because KM could be used to aid the customer relationship management. In this case KM provides BPM with data and information, this creates a database that is rich in knowledge which develops and enhances business processes. Overall, it is believed that KM and BPM highly rely on each other as knowledge helps identify new processes and develop existing processes. Moreover, according to Paschek et al, integrating Knowledge and BPM will support an organisation to survive in a competitive environment. Additionally, in order to make business processes increasingly developed, technologies such as artificial intelligence and robotics are utilized while integrating KM and BPM.

Many entrepreneurs and practitioners recognize the value of knowledge when presented in a theoretical context. However, there are still at shortcomings when it has to do with utilizing KM in BPs as they find it too slippery to handle (Quintas, 2004). Schmid and Kern (2014) surveyed much research directed towards the integration of KM and BPM including planning, analysis, implementation and utilization. However, it seems that none of these approaches concentrates on the integration between KM and BPM to support DMP in organisations in different fields.

The integration between KM and BPM has been discussed by researchers, but it is noted that there is a paucity of research focused on the interrelation and DMP in several sectors. Furthermore, “there are up to now few publications with the emphasis system evolution that chiefly deal with the challenges inherent in the evaluation of knowledge as well as with the evaluation of its handling. Moreover, the approaches dealt with in them are not fully developed” (Schmid and Kern, 2014).

## 2.6. Decision Making Process (DMP)

According to Heijden (1996), the content that is related directly to information and knowledge should support decisions. Turban, Aronson, and Liang (2005) define decision making (DM) as “a process of choosing among two or more alternative courses of action for the purpose of attaining one or more goals”. According to Simon (1977), “there are three phases of DM, which consist of *intelligence*, *design*, and *choice”* (Figure 2-12). Later, he added *implementation* as a fourth phase. Turban, Aronson, and Liang (2005) adapted the four - phase Simon’s model by inserting the aspect of *monitoring*. This model is very important to discover and analyse problems.

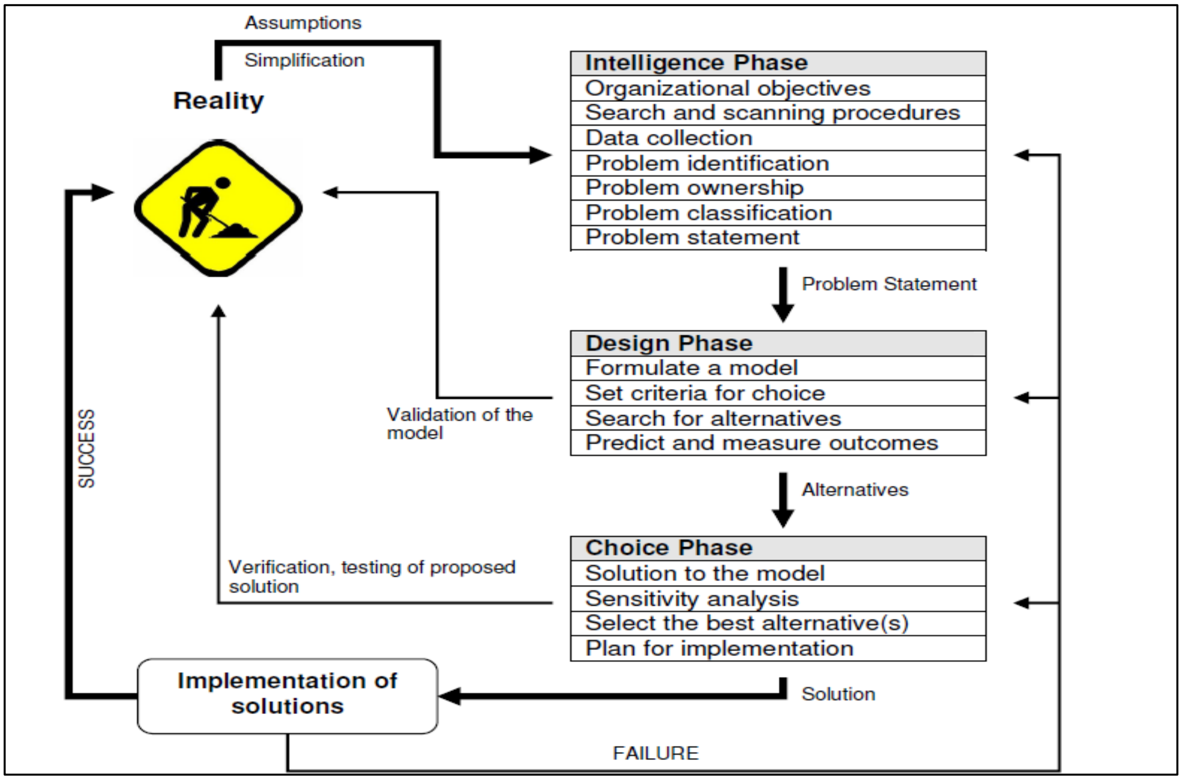


**Figure 2-12: DM phases/modelling process (Simon,1973) as adapted by Turban, Aronson, & Liang (2005)**

The complexity of DMP has affected several theories, which differ according to their nature and the circumstances of the environment within which a decision is made, as well as the order in which our thoughts occur.

Brim et al., (1962) suggested that a process consists of six phases customarily linked in a sequence:

1) identification of the problem;

2) obtaining necessary information;

3) production of possible solutions;

4) evaluation of such solutions;

5) selection of a strategy for performance and

6) actual performance of an action or actions, and subsequent learning and revision.” (p. 9)

These sequential activities look to be important for the people who face difficult conditions in an environmental setting. For example, people who do not have sufficient experience to make decisions; these phases can be used as a guide to lead them in their DMP.

Simon (1977) suggested another scheme which was more suitable at a collective level for the DMP employed by organisations:

1. "identify all the possible alternatives;
2. determine all the possible consequences of these alternatives;
3. evaluate all the possible consequences" (Pomerol and Adam, 2004, p. 649)

### 2.6.1. Decision Making Process Variables

AlHussayen (2009) mentioned several factors that are related to the DMP, they were:

1. Reliable information- decision makers utilize the information they are provided to make their final decision, therefore for the decision to be correct and successful it should be based upon reliable and consistent information.
2. Experience- when a worker has a good level of experience it means that they have a good level of knowledge as well. This can enable decision makers to make good decisions.
3. Time- decision makers need to be given enough time in order to make a good decision, if they are provided with a good amount of time it gives them a chance to base their decisions on thorough and well analysed data.
4. Objectivity- the decision maker must be objective when making a decision, as this helps them generate a good decision.
5. Available resources- if decision makers are provided with a good amount of useful resources that they could use, this enables them to make a good decision.
6. Understand environment- this helps decision makers make well-informed decisions, as if they know how the organisation operates this would help them understand the requirements of the organisation, and help them make a decision that will benefit the organisation by meeting the organisation's needs.

There are numerous decision-making process variables which may be influenced by the utilization of ISs (Leidner and Elam, 1993, 1995). This research looks at the process of decision-making variables utilized by these scholars that have considered the recent improvement in theories regarding the effect of advanced IT usage on decision making. The variables were chosen because they were adopted by numerous researchers and have given in impressive and useful results, also this current researcher specializes in IT. These variables are problem identification speed (PIS); decision making speed (DMS) and importantly the extent of analysis in decision making (DMA).

Quick decision making grew to be important to organisations as the competitive environment has escalated. Clearly, knowledge plays a crucial role in the performance of an organisation (Mankins and Rogers, 2010; Ozcan, 2005; Huber, 2000). Rapid development within IT and rapid communication tools have affected the time-needed for decision-makers to distinguish issues in addition to making quick decisions. This is because decision makers including directors remain focused on circumstances which need decision-makers to create more decisions compared to the past. They need quicker response times (Mankins and Rogers, 2010; Leidner and Elam, 1993, 1995). These days, the KM system permitsrapid knowledge processing. Appropriately, their accessibility and usage by staff can add to the process of decision making by swiftly recognizing problems as well as the actual decision-making. Leidner and Elam (1993, 1995) believed that the speed of problem identification measured the time taken for a problem to be recognized once it starts, they also defined the speed of decision making as the time taken for a decision maker to feel the need to make some decisions. Furthermore, analytic comprehensiveness is how far circumstance finding, alternative generation and assessment, and decision combination are analysed (Fredrickson and Mitchell (1984)). Miller and Friesen (1980) describe the term analysis as giving a problem and the provided responses a lot of thorough thought and consideration.

As indicated by Regan and Holtzman (1995), decision analysis is seen as a precisely designed discussion that looks at the meaning of a decision in addition to looking at the level of commitment to an actual activity. The process of decision analysis can be grouped into phases; preparing the decision model that mirrors the decision problem, i.e. producing choices and distinguishing assessment criteria.

**Table 2-10: Decision making process variables with its measuring items**

| DMP Variables | Measuring items |
|---|---|
| **Problem Identification Speed (PIS)** | Identify potential problems more rapidly. |
| | Sense key factors impacting my area of responsibility. |
| | Notice potential problems before they become serious crises. |
| **DM Speed (DMS)** | Make decisions quicker. |
| | Shorten the timeframe for making decisions. |
| | Spend less time in meetings. |
| **Extent of Analysis in Decision Making (DMA)** | Spend significantly more time analysing data before making a decision |
| | Examine more alternatives in decision making |
| | Use more source of information in decision making |
| | Engage in more in-depth analysis |

Source: (Leidner and Elam, 1993; Leidner and Elam, 1995)

### 2.6.2. Impact of Knowledge Management on the Decision-Making Process

As discussed, KM is considered in a different way by several researchers as it is a difficult endeavour with several phases. However, diverse as these theories may be, KM has the same goal: the improvement of DMP. More specifically, KM is a set of activities which produce and manage knowledge to aid organisations to enhance DM with the target of achieving the objectives set by the organisations (Townley, 2001).

However, no matter what track is selected, making the right decision is the primary goal, since right decisions are made through the right KM. It appears that managing knowledge, tacit and explicit, enhances the chances of a successful DMP, since “the function of knowledge in the DMP is to determine which consequences follow upon which of the alternative strategies” (Simon, 1947, p. 78).

DMP may notably impact an organisation's capability to generate, keep, recognize as well as employ knowledge (Gharakhani and Mousakhani, 2012). Abdelrahman., (2013) highlighted the fact that KM as well as the process of decision making are indisputably linked in numerous organisations. Similarly, Nemati et al., (2002) claim that "knowledge provides the perceptual and conceptual filters which the decision maker uses to firstly select and organise data into information and then to use that information to support and inference, forecast or decision".

As always, organisations constantly produce new knowledge, so they need to continuously access KM processes efficiently to maintain expertise and accelerate DM effectively and therefore have a viable future (Chu, 2011). There is no doubt that KM is one of the most important factors in providing an optimal operating environment where it helps to obtain relevant information in a timely manner, thus improving the DMP (Chu, 2011).

Furthermore, through the economy of knowledge and the growing volume in the knowledge community, organisations keep exploring new methods of building knowledge to enhance DMP (DeTienne and Jackson, 2001).

Nemati et al., (2002) stated that KM can ease the capture, coding and sharing of knowledge within organisations; this improves the process of decision making. Zhang and Lu (2007) highlight the importance of the interrelation. Zhang and Lu (2007) highlight the importance of including a knowledge management model in an organisation's BPs, as it supports knowledge workers in making decisions efficiently and successfully. In other words, a KM model creates a platform that makes it easier for knowledge workers to share knowledge and utilize it efficiently and successfully in their daily work.

One of the factors that impacts the level of successful support that KMS and Information Systems can provide to the DMP is alerting and adapting Information Technology to suit their client's decisions. Consequently, KMS and information systems should include elasticity to match several decision designs which suit the DMP.

Therefore, the KMS is seen in different forms in different businesses. Indeed, there are several models for KMS. There is more than one role played by IT in KM, and there is more than one technology that involves DMP. Some of the popular applications of KMSs are: (1) arranging and transmitting best practices; (2) building corporate knowledge workers, for example through an individual's information documentation; (3) constructing networks of knowledge (Alavi & Leidner, 2001). However, even though research into KM has been observed within the literature, there is a lack of studies on how KM affects DMP. This study examines aspects of implementing KM.

### 2.6.3. Impact of Business Process Management on the Decision-Making Process

BPM has arisen as a key technology mainly in the past three decades with the goal of providing process support to organisations and supporting DM (Deokar and El-Gayar, 2008). Furthermore, BPM is more of a strategic imperative than ever before, as companies look within to fine tune operations to ensure the continued growth and market share of a company. By delivering better business results and influencing more improved, faster DM, BPM can ensure that companies are on the right path to continue process improvement and be successful.

Several research studies regarding the relation between BPM and DM have been conducted. Yi and Xu, (2013) introduce the DM model for business process outsourcing and enterprise content management which guide industry practitioners with the content management of organisation sourcing DM strategies. Related to the improvement of processes to enhance DM, Girald et al., (2015) applied data mining technology to support BPs to achieve organisational goals. Similarly, Ghattas et al., (2015) developed a semi-automated approach utilising data mining that improves the BPs' performance through initiating decision standards from the experience achieved through past process implementation. There are also some researchers focused on different topics such as the planning of BP (Völkner and Werners, 2000), the validation, diagnosis and DM support concerning data in BPs (Gómez, 2015) and the employment of textual information in the BP Lifecycle (Schmidt et al., 2015).

### 2.6.4. The Decision-Making Process in the Construction Sector

Construction is a field of research wherein decisions-making can mean the difference between achievement and disappointment (Espino et al., 2014). In general, the DMP is one of the most important aspects of a successful and sustainable company in different sectors (Dziadosz and Konczak, 2016), especially if the sector requires large amounts of information and numerous tasks and complex processes such as in the construction sector. DM, in such sectors, is therefore an arduous process to be addressed.

Recently, studies have shown a desire to develop the concept of DMP in the construction sector. In this respect, prior studies reveal the methods and approaches for analysing the data which support the DMP (Espino et al., 2014; Dziadosz and Konczak, 2016). Additionally, Mahbub, (2015) developed a sustainable DM framework for the implementation of advanced technology within construction considering the knowledge collaboration principles and sustainability issues. Similarly, Chuan, (2016) proposed a procurement DM model to optimize supplier selection within the Malaysian construction sector. A study completed by (Zeng, 2007) showed a risk assessment methodology to cope with risks in complex construction circumstances and suggested an effective tool to deal with the uncertainties and subjectivities increasing within the construction process.

## 2.7. The Jordanian Construction Sector

Small and medium organisations represent 90% of the organisations in Jordan. In order for these organisations to keep up with the strong competition both internationally and locally they had to strengthen their performance; this was accomplished through the usage of technology and employee experience.

The development of the construction sector began when the Modernizing Jordan project was initiated by the 1st King Abdullah, as he believed that the construction sector would lead to the development and the modernization of the country. The Jordanian construction sector plays a major role in aiding the Jordanian economy, as the construction sector in Jordan contributes 12-

18% towards the economy; this is evident from the Ministry of Public Works and Housing (JCCA 2018). In addition, the Jordanian construction sector contributes 15% of Jordan's GDP, allowing Gross Domestic Product (GDP) to grow by 12.2% (Toukan, 2018). This sector includes over a thousand construction and engineering organisations, as well as employing over 140,000 workers which represents 14% of the Jordanian population. Furthermore, the Jordanian construction sector specializes in a variety of skills, which allowed them to collaborate with international organisations to establish high skilled work such as high-rise buildings.

Moreover, there was a financial crisis in 2011, which resulted in the breakdown of a large number of sectors. However, the construction sector remained robust, as the construction industry is valued at hundreds of millions of dinars yearly. In addition, the construction sector had investments valued at billions of dinars. This led to an increase in the demand for real estate. Real estate investments have increased due to the fact that there is political stability and a safer investment environment and the government provided a number of measures to allow them to develop, such as granting organisations funds to support them.

According to the Ministry of Industry and Trade of the Kingdom of Jordan, Small and Medium Enterprises can be defined as:

**Definition of Companies according to size (JEDCO, 2013)**

| Classification | Capital Investment (JD) | No. of Employees |
|---|---|---|
| Micro | Less than 30,000 | 1-9 |
| Small | 30,000 | 10-49 |
| Medium | 30,000 | 50-249 |
| Large | 30,000 | 250 and above |

As shown in the table above, the size of the company is directly proportional to the number of employees working in the company. This means that as the size of the company increased, more employees will be needed, for example the table shows small companies are likely to have 10-49 employees while large companies have at least 250 employees. Moreover, it is clear that the only size of company that has an investment capital of less than 30,000 JD is Micro companies, whereas the other bigger companies have an exact capital investment of 30,000 JD.

To add to this, the construction sector is known as one of the most developed sectors in Jordan, especially in this generation. One of the main reasons that led to this rapid development is the availability of highly experienced contractors; another reason is the presence of an active local market. Jordan collaborates with Jordanian Construction Contractors Association -(JCCA) which consists of 3,175 contractors as well as Jordanian Engineers Association -(JEA) which includes 8,875 registered engineers and 1,244 engineering offices. Out of the 8,875 registered engineers almost half of them are civil engineers (4,379), and the rest specialize in either electrical engineering or architectural engineering, but there are only 720 electrical engineers compared to 2,929 architects. Furthermore, the Jordanian Bank states that small construction companies represent 90% of the current construction companies in Jordan in 2017. Both associations are related to the Ministry of Public Works and Housing. Additionally, due to safety problems in the Middle East (e.g. in Syria, Palestine and Iraq) immigration rates have increased significantly over the last two decades and this increase has resulted in a significant demand for schools, hotels, hospitals, houses and entertainment places.

The development of the construction industry in Jordan has helped reveal the importance of employing construction management experts in the construction industry. Furthermore, difficulties within the construction industry increased and management values began to change to become more useful. This led to a rise in interest to explore the utilization of knowledge acquired from manufacturing and other industrial sectors within the Jordanian construction management group.

The involvement of specialist and experienced people within the construction management projects resulted in an increase in the number of experienced construction management organisations and consultancy offices. Within the construction management organisations a contractor or an owner is held in charge for the entire organisation, including the planning and the project from beginning to end to be able in order to deliver a useful project that is submitted at the required time and within budget. This involves developing the construction project by managing the budget, organizing the project in logical stages and overseeing time-management in order to meet the time deadlines, develop the project design and its quality, including managing materials and suppliers and the inspection of the buildings.

## 2.8. Research Gap Analysis

Management involves making decisions within a construction organisation. Nonetheless, the complexity of construction projects created by large amounts of complex data, tasks and operation processes trigger several problems related to the decision-making process. At every phase of the decision-making process problems can occur, for example, choosing the most appropriate location for a new project, the design stage, problems regarding the management of the new project, the quality of the project, and the selection of the most appropriate technologies, contractors, suppliers, equipment and materials (Erdogan, 2017; Szafranko, 2017; and Omar, 2013).

Another issue associated with DM is the difficulty of making a solid decision in order to increase complexity and uncertainty in the construction environment. A solid decision means having to make a decision that has a very little number of risks, since the Jordanian construction organisations include complex tasks and roles which need to be completed carefully. The inability to make such a decision could affect the performance and delay the growth of the organisation. It is challenging to make a solid decision because the construction sector lacks the effective knowledge management where employees do not have the access to the relevant and basic knowledge needed in a daily basis to find solutions to problems in projects (Okere, 2017). One of the other issues that Jordanian Construction organisations face is not being able to exchange the suitable information at the most appropriate time and to the right people, this issue could result in information disruption which leads to the delay of the construction project (Al-Werikat, 2017).

Some research has been completed on investigating the relationship between knowledge and process efficiency (Cheng et al., 2011; Tabares et al., 2016; Massingham and Al Holaibi, 2017; Febriantoro and Surendro, 2015; Höpken et al., 2015). However, there is a lack of investigation into the effectiveness of such integration in DMP.

Research has only been directed towards the integration of KM and business process management including planning, analysis, implementation and utilisation (Schmid and Kern, 2014). However, none of these approaches has investigated a BP that adopts a KM framework that leads to the development in the process of decision making.

Construction organisations face an issue with implementing a large number of processes executing similar tasks (Hackman et al., 2017), Hackman et al., (2017) believed that organisations in the construction sector might have strengths in managing projects but are often much weaker in organizing their internal business processes. Furthermore, the organisations find it difficult to learn from previous mistakes that were made in prior projects, therefore any errors that occurred before are likely to be repeated. Thus, this initiates the need for the integration between knowledge (and experience acquired previously) and business processes.

The current study provides a method for acquiring a stronger knowledge of the importance of KM alongside BPM for the improvement of DM styles to attain organisational goals. It generates a strong operational as well as theoretical approach to the organisational utilization of knowledge and business processes through the development of an associated theoretical framework. While previous studies have indicated that knowledge enablers along with business processes guarantee organisational achievement across organisational DMP, this research shows that precise DM determination by decision makers could strengthen the relationship chain.

## 2.9. Theoretical Framework

The theoretical framework demonstrates the relationship between the variables in this research. With regarding to the theoretical foundations, these are reviewed in the literature and prior studies; a framework has been developed to explore the relationship between knowledge management (KM) and business process management (BPM) along with its influence on the process of decision making (DMP) in the construction sector. Figure 2-13 exemplifies these relations.

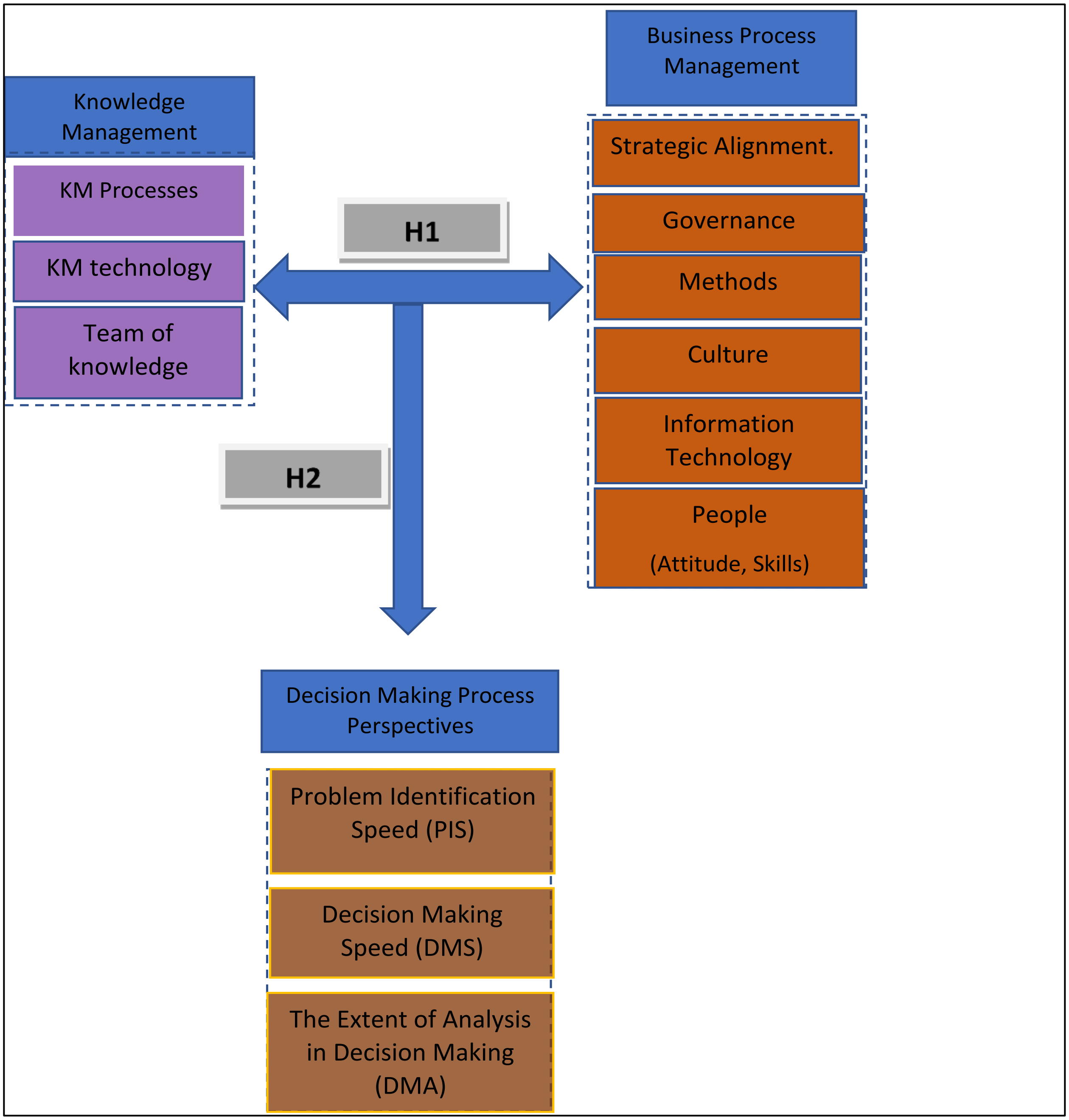


**Figure 2-13: The current study's research framework showing variables**

### 2.9.1. Variables in the Framework

This research has gone a stage beyond purely determining the variables that influence DMP in terms of KM and BPM. Specifically, the study explored which factors influence the interrelationship between KM and BPM and its impact on DMP and to specifically investigate the effect of integrating KM and BPM in the DMP of Jordanian construction organisations.

The first main independent variable is KM, which is subdivided into the following sub-variables:

a. Knowledge management processes.

b. Knowledge management technology.

c. The knowledge team.

The second main independent variable is BPM, which is subdivided into the following sub-variables:

a. Strategic alignment.

b. Governance.

c. Methods

d. Culture

e. Information Technology

f. People (attitude, skills).

The endogenous variable DMP is subdivided into the following perspectives:

a. Problem identification speed (PIS).

b. Decision-making speed (DMS).

c. The extent of analysis in decision making (DMA).

The framework states that integration between KM and BPM can provide employees with task-related knowledge in the organisation's operative business process system, improve process performance, promote core competence and maximize and optimize business performance. The rationale for the choice of sub-variables of the BPM and their influence on KM is explained in the following section.

### 2.9.2. Rationale for the framework variables

***KM and Strategic Alignment***

The development of KM in an organisation is dependent upon the direction of the strategy and the organisational goals. An organisational strategy allows the organisation to locate its clients and competition. To understand the strategic position of an organisation, some components of intellectual resources are certainly essential (Zack, 1999) and the strategic selections that organisations choose should also be a reflection of the types and volume of knowledge that is required in order to endure and succeed in the industry (Abou-zeid and Cheng, 2004). The demands of the strategic knowledge within an organisation is achieved using the knowledge management strategy. This strategy helps to guide an organisation during decision making along with gaining the anticipated knowledge management initiative outcomes. Moreover, the organisational requirements of the strategic knowledge within the process management of the knowledge resources can be effectively achieved by aligning knowledge management with the business's strategies (Wu and Lin, 2009). As indicated by De Bruin and Rosemann (2006), the strategic alignment of BPM is necessary to enhance the connections between organisational needs and enterprise processes including the prime aim of achieving the organisation's targets as BPM objectives are derived on the basis of the strategic course.

***KM and Governance***

Comprehensive knowledge can contribute to the effective functioning of the governance process through the setting up of suitable responsibilities and roles regarding distinctive levels of the BPM (portfolio, program, task, and activities) (Rosemann and Brocke, 2015). In such circumstances, the process of governance must be fulfilled more productively to ensure smooth service delivery. To guarantee the improved operation of governance, people ought to be naturally motivated to be collaborative regarding the governance process. Appropriate KM, having technical as well as human features, should produce an environment conducive to the development of governance.

***KM and Methods***

The term 'methods' refers to the approaches which an organisation practises to promote its process-based activities and is a major success aspect of BPM (Melenovsky and Sinur, 2006). Various types of method (e.g. Six Sigma and Lean) are utilised to enable organisations to deal with their business processing systems. Both KM and Six Sigma have infiltrated business management systems with problem-solving and process-optimization methodologies and, as indicated by Pinjari and Teli (2018), Six Sigma and KM need to be combined to provide a powerful management strategy. Although Six Sigma and KM are different from each other, both Six Sigma experts and the knowledge management arena can benefit from each other. For example, Six Sigma experts can use KM to learn to adapt and maintain change, whereas Six Sigma teaches KM how to utilize analytic and quality tools along with gaining the ability to encourage full-time employees to participate in major projects. Moreover, when they work together, they build an environment that eases learning within an organisation. Considering that they have different objectives, as Six Sigma focuses on improving processes and KM aims to deliver the right information and knowledge, when both are utilized together, they improve the process's performance. In order to help an organisation decrease costs, effort, and the time taken to complete processes along with gaining high quality and consistent process KM, variables need to be integrated with methods that support business processes.

***KM and People***

The organisational knowledge is shown and represented by its employees; this knowledge is gained through their work activities (Shamsi, 2017), which comprises their capabilities, practical experiences and skills. There are a number of ways that develop the employees' ability to create knowledge, e.g. being confident, having a full understanding of their job, understanding the importance of their role, feeling productive, getting work done in the given time, having the right to be involved in DMP, and enhancing their qualifications.

Sabokro et al., (2018) emphasised that directors ought to enhance their managerial skills (perceptual, human and operational) since knowledge sharing is a recognized need in organisations and is observed as a factor in human resource management. Shamsi (ibid) also considered the relationship between KM and the communication skills of directors;- improving their communication skills leads to greater  improved creativity of workers and enhanced expansion of the organisation.

BPM is process-oriented management and, to actualize BPM effectively, people in the organisation need to change their behaviours and conventional methods of work. They need to figure out how to coordinate their attempts to accomplish the process outcomes knowing that it is imperative for an organisation to develop expertise training through the execution of BPM (Jeston and Nelis, 2014).

***KM and Culture***

Along with the a knowledge capturing process, determining organisational cultural features is crucial for an organisation's ability to improve KM efficiently (Lee and Choi, 2003; Wei, 2005). Furthermore, Ajmal and Koskinen (2008) claim that achieving KM is attained by constructing a helpful culture while developing KMSs. Consequently, organisational culture is an important component of an organisation's ability to generate value within utilised knowledge assets.

Clearly organisational culture impacts KM activities, since KM includes human interaction. Knowledge-based culture is known by values as well as norms that cultivate and discover organisational knowledge and continuous learning (Cardoso et al., 2012). Rosemann and Von Brocke (2015) affirm that culture is a critical factor for organisations recognizing the potential protection from change or an absence of process understanding toward the start of launching BPM. KM variables and organisational culture need to work together to create a facilitating environment that supplements the different BPM activities to share values and beliefs which form process-based attitudes as well as forming behaviour to advance the organisation's value chain.

***KM and IT***

To develop the KM environment, advanced KM capability must be coupled with a more advanced quality of IT based upon the specific needs of an organisation (Sher and Lee, 2004; Tanriverdi, 2005) and the organisation's KM strategy should offer a path in identifying how IT can aid the knowledge activities of the organisation (Chen and Huang, 2010). The use of IT in the process activities is a critical success factor of BPM achievement (Melenovsky and Sinur, 2006) and IT ought to be used in enhancing the efficiency of BP, instead of merely automating the processes. Furthermore, IT assumes a vital role in BPM ventures, as it can help to control the development of business processes and encourage the process design phase.

***Integration between KM and BPM with the Decision-Making Process***

BPM has developed as a key technology mainly in the past three decades with the goal of providing process support to organisations and supporting better decision-making. Nemati et al., (2002) stated that in order to improve the DMP in organisations, it is required that KM initiatives capture, code and share knowledge within organisations. Merging KM techniques with day-to-day operations supports the operation of business processes.

The combination between KM and BPM benefits the organisations by providing the employees with the required knowledge needed for performing the organisation's operational business processes, enhance process performance, develop core competencies (Zhang et al., 2008), and optimize business performance (Han et al., 2008). The key aim of knowledge management is to deliver the right knowledge to the right people when needed. Also, the effectiveness of decision making within the organisations can be enhanced by the integration between KM and business processes (Chu et al., 2011).

## 2.10. Conclusion

This chapter pointed out the concepts of knowledge management, business process management and decision-making process and its related variables in the construction industry context. The above sections represent the reviewing of the literature which aim to build up a strong theoretical framework for DMP in terms of KM & BPM. Relevant theoretical and empirical studies have been reviewed and several studies in relation to KM, BPM and DMP have been outlined. Consequently, this chapter discussed the main fundamentals, including the background, the concept, associated terminology, models and other related problems. Also included are the research gap analysis and the theoretical framework variables, along with the framework variable's rationale. Additionally, prior studies emphasise that the integration between KM and BPM can provide employees with task-related knowledge of the organisation's operative BPs, enhance process performance, develop core competencies and optimize business performance. To this end, the literature review provides a limited insight into the first objective: "To present an appropriate literature review on the concepts of KM and BPM alongside their significance for construction organisations in addition to assisting with the theoretical framing of them" . It also provides insight into the second objective: "To develop a framework for the integration of KM and BPM to support DMP". The next chapter discusses the selected methodology for this research.

# 3. Chapter 3: Research Methodology

## 3.1. Introduction

The research methodology of any study reflects an integration between a researcher's mentality and the scientific methods of research into the researchable problem. It outlines the research process, research philosophy, the rationale of a mixed-method approach, research strategy, and the techniques undertaken in this study to collect data and analyse it in order to fulfil its objectives and answer the research questions. Lastly, this chapter considers the consistency and validity issues of the appropriate research methodology along with the research ethical issues.

## 3.2. The Process of Research

The research design process is described in Figure 3.1 below which aims to determine all the steps which have been implemented to fulfil the aims of the present study. These steps begin with identifying the research problem in step one and end with the derivation of outcomes and the conclusion of the present study. The aims of these steps are as follows:

1) Initiatives: to build up a clear and researchable tentative proposal for the present study.
2) Literature review (step 2): to build a strong theoretical background, and to determine any real researchable gaps in the literature.
3) The definition of the research aim, objectives and questions (step 3): this stage includes the finalisation of terms and limitations of the present study.
4) Research model (step 4): to create a researchable model and hypotheses to determine the nature of the expected contribution of the present study.
5) Methodology (step 5): to determine the research paradigm, philosophy and methods in this study.

6) Piloting (step 6): to conduct quantitative research (pilot study) depending on the literature review to explain to what extent the present study can be conducted in the context of the construction industry in Jordan.
7) Survey (step 7): to conduct quantitative research through survey questionnaires and statistical analysis (DA: descriptive analysis; and HT: hypotheses testing) using SPSS.
8) Qualitative research (step 8): to interpret in depth the results of the quantitative research using semi-structured interviews to validate the framework.
9) Discussion and Conclusion (step 9): to discuss and integrate the results of qualitative and quantitative investigations and to draw up a general picture of results and conclusions.

Finally, to determine the opportunities for further research.

## 3.1. Research Philosophy

Research philosophy is viewed as an indispensable component for creating points of view in the research. It refers to scientific practices dependent on assumptions concerning the cosmos as well as the type of knowledge (Collis and Hussey, 2013). In this regard it is critical to separate methodology from method. Although the two concepts are interconnected, the research methodology is the employment of ways to deal with an enquiry into particular issues and as methods are techniques used to accumulate data (Grix, 2002). As indicated by Blaxter et al., (2010) methodology refers to the logical importance of gathering the information, whereas methods refer to the procedure of gathering the information. Many academics extend the idea of research methodology to incorporate several problems: the place it is gathered from, the reason it is collected, the content of the data, and the way the data are accumulated as well as examined (Collis and Hussey, 2013). The ideas associated with recognizing anything that has never been recognized, and then acknowledging it by gathering and analysing data (Gall et al., 2007), is a reflection of the issues stated.


**Figure 3-1: Research Process**

Research philosophy creates significant assumptions concerning what scholars think of the universe. It helps and directs the choice of research strategy and the methods used within the strategy. Saunders et al., (2009, p.108) state that “the important issue is not so much whether our research should be philosophically informed, but it is how well we are able to reflect upon our philosophical choices and defend them in relation to the alternatives we could have adopted”.

Research philosophy includes more than one type: positivism, realism, interpretivism and pragmatism. The following section concentrates on the philosophy of pragmatism as the other theories do not relate to the research conducted., A comparison of the different research philosophies follows (Table 3-1), including their ontology, epistemology, axiology and data collection techniques.

The present study adopts the philosophy of pragmatism. Pragmatism is “a position that argues that the most important determinant of the research philosophy adopted is the research question, arguing that it is possible to work within both positivist and interpretivist positions. It applies a practical approach, integrating different perspectives to help collect and interpret data” (Saunders et al., 2009, p.598). This paradigm combines the assumptions of both the positivist and interpretivist paradigms, and also tries to find a balance between the assumptions of both paradigms. The weaknesses of the positivist paradigm can be compensated for by the strengths of the interpretivist paradigm, and vice versa. Furthermore, pragmatism is hybrid, and depends on the complementary role between objectively observable (measurable and reliable) knowledge and subjective views (to find the reasons or interpretations for the results of the quantitative methods and to increase the validity of the results). Wass and Wells (199b:3) state that "the middle ground is occupied by perspectives where the independence of external institutions is recognised but where an individual's response to these external factors is mediated by his or her subjective interpretation of them. This allows for combining methodologies which, it is argued, can generate complementary data about phenomena under investigation". As with the epistemology of the positivist paradigm, the pragmatic paradigm assumes that the researcher is independent from what is researched. However, in order to acquire more data, evidence and interpretations, the researcher can interact with what is researched, and this reflects the subjectivity of the interpretivist paradigm.

Moreover, this research is considered to be within the field of information management research where the terms ‘hard’ and ‘soft’ are broadly used in the construction management literature. ‘Hard’ indicates a focus on the tangible aspects or the tasks involved whereas ‘soft’ indicates a focus on the intangible or the people involved (Crawford and Pollack, 2004). A hard paradigm is associated with a positivist position while a soft one is related to interpretivism (Pollack, 2007). This research will investigate the tasks and people (both hard and soft) in managing the knowledge and business process in construction organisations in Jordan; therefore, pragmatism will serve as the worldview of this research.

This research is a combination of natural and social sciences as this research focuses on the improvement of the DMP in terms of KM and BPM in the Jordanian construction sector from a social science viewpoint that depends upon the insights and views of the research participants. However, analysing the acquired data regarding this research is dependent upon natural science research. A study completed on the area of managing construction shows that there are two major methods that lead research studies: the positivist along with the interpretivist paradigms (Dainty, 2008). This study is also following the industry trend, whilst the data collecting and analysis follow a positivist approach; the research data explanation follows a descriptive research approach.

Expanding on the above debate, pragmatism is the core appropriate research paradigm in this research, since it assists to develop a great understanding into numerous areas (that concern this research) that cannot be completely comprehended utilizing only a qualitative or quantitative method, considering that two interpretations are required: subjective (recognising the components which influence DMP through utilizing KM and BPM) and target (analysing the impact and the effect of these components). Furthermore, the pragmatist method adopts a practical research philosophy which can incorporate various points of view to support the gathering of data and making inferences from it.

**Table 3-1: Comparison between research philosophy**

| Research Philosophy | Ontology: the researcher's view of the nature of reality or being | Epistemology: the researcher's view regarding what constitutes acceptable knowledge | Axiology: the researcher's view of the role of values in research | Data collection techniques: most often used |
|---|---|---|---|---|
| Positivism | External, objective and independent of social actors | Only observable phenomena can provide credible data, facts. Focus on causality and law like generalisations, reducing phenomena to simplest elements | Research is undertaken in a value-free way, the researcher is independent of the data and maintains an objective stance | Highly structured, large samples, measurement, quantitative, but can use qualitative |
| Realism | Is objective. Exists independently of human thoughts and beliefs or knowledge of their existence (realist), but is interpreted through social conditioning (critical realist) | Observable phenomena provide credible data, facts. Insufficient data means inaccuracies in sensations (direct realism). Alternatively, phenomena create sensations which are open to misinterpretation (critical realism). Focus on explaining within a context or contexts | Research is value laden; the researcher is biased by world views, cultural experiences and upbringing. These will impact on the research | Methods chosen must fit the subject matter, quantitative or qualitative |
| Interpretivism | Socially constructed, subjective, may change, multiple | Subjective meanings and social phenomena. Focus upon the details of situation, a reality behind these details, subjective meanings motivating actions | Research is value bound, the researcher is part of what is being researched, cannot be separated and so will be subjective | Small samples, in-depth investigations, qualitative |
| Pragmatism | External, multiple, view chosen to best enable answering of research question | Either or both observable phenomena and subjective meanings can provide acceptable knowledge dependent upon the research question. Focus on practical applied research, integrating different perspectives to help interpret the data | Values play a large role in interpreting results, the researcher adopting both objective and subjective points of view | Mixed or multiple method designs, quantitative and qualitative |

(Source: Adapted from Saunders *et al.*, 2009)

# 3.2. Rationale for the Mixed Methods Approach

This study employs a mixed methods approach to allow for a subjective, interpretive analysis and a statistical analogy. Few studies have studied the effect of the integration between KM and BPM on the construction sector, with no previous research on DMP implementation in the Jordanian construction sector. Therefore, this research is exploratory in nature. Both qualitative and quantitative methods were needed due to the nature of this research. Mixed methods sequential procedures were adopted and the study began by applying a quantitative approach to investigate the impact of KM and BPM on the process of decision making in SMEs in Jordan. Following this, the qualitative methods were adhered to by implementing a detailed exploration of the practitioners regarding certain issues raised in the questionnaire study and literature review to verify and refine the framework. Equal priority was given to both the quantitative and qualitative data regarding the data collection and analysis. Data integration was considered with some combination of the collected, analysed and interpreted data. More details about the research strategy, data collection methods and methods of analysing the data will be discussed in the following sections.

Tashakkori and Teddlie (2010) depict mixed-methods research as being a framework which utilizes various approaches within a study's investigation. This includes the use of more than one research method (i.e. qualitative or quantitative methodologies). Creswell (2009) describes mixed-methods research as being "a way to deal with a request that consolidates or partners both subjective and quantitative structures. It includes philosophical suppositions, the utilization of subjective and quantitative methodologies, and the blending of the two methodologies in an examination".

Mixed-methods research is identified as the third methodological paradigm, including quantitative as well as qualitative methods (Tashakkori and Teddlie, 2008). Tashakkori and Creswell (2008) recommend the usage of a third paradigm as it helps the discovery of hypothetically conceivable answers to the study questions and overcomes the intellectual and practical obstructions related through leading this kind of study. Venkatesh et al., (2013) suggest applying a mixed methods when: it is proper for the research; the specialist knows how to find as well as create different discoveries from it; and the scientist can validate it. They proposed seven reasons for mixed-methods research (see Table 3-2).

Creswell and Clark (2007) recommended four key kinds of mixed-method design: triangulation (by combining qualitative and quantitative data to comprehend a research issue); embedded ( the use of either quantitative or qualitative data to respond to a research question in primarily qualitative or quantitative research); explanatory ( the use of qualitative data to clarify quantitative outcomes); and exploratory ( gathering quantitative data to examine as well as clarify a correlation identified in qualitative data).

**Table 3-2:Purposes of mixed-methods research**

| Purpose | Description |
|---|---|
| Complementarity | Mixed-methods are used in order to gain complementary views about the same phenomena or relationships. |
| Completeness | Mixed-methods designs are used to make sure a complete picture of a phenomenon is obtained. |
| Developmental | Questions for one strand emerge from the inferences of a previous one (sequential mixed-methods), or one strand provides hypotheses to be tested in the next one. |
| Expansion | Mixed-methods are used in order to explain or expand upon the understanding obtained in a previous strand of a study. |
| Corroboration/Confirmation | Mixed-methods are used in order to assess the credibility of inferences obtained from one approach (strand). |
| Compensation | Mixed-methods enable compensating for the weaknesses of one approach by using the other. |
| Diversity | Mixed-methods are used with the hope of obtaining divergent views of the same phenomenon |

**(Source: Adapted from Venkatesh et al., 2013)**

Quantitative methods have enabled the researcher to deal with scale questions (such as 'what' and 'which') and quantifiable data and information. On the other hand, qualitative methods have enabled the researcher to seek answers to questions such as "how" and "why", and to gather information and data in the form of words and other non-quantifiable materials. The qualitative methods have gone hand in hand with the researcher developing insights, interpretations and concepts. The methodological triangulation is an application of a realistic paradigm. Based on this paradigm, the weaknesses of the positivist paradigm can be compensated for by the strengths of the phenomenological paradigm and vice versa.

Insofar as the present study is quantitative, it employs a large-scale questionnaire as the main tool for data collection. The data collected has been analysed using SPSS statistical software to test the empirical research mode. The aim here is to explain, through analysis of correlations, multiple regression, and analysis of variance (ANOVA), the mutual effects amongst these variables. Chapters four and five demonstrate the hypotheses testing and the results of inferential statistical analysis. Additionally, the present study employs qualitative methods for data collection and analysis. The qualitative data and information have been collected through semi-structured interviews. Chapter six explains the validation of the proposed framework by domain experts.

As explained by Saunders et al., (2009), the main advantages of the quantitative approach are its objectivity, and the fact that it allows for the investigation of a large sample. However, the sample size needs to be chosen accurately. It enables the researcher to use statistical analysis to check for errors in the data. Additionally, it enables the researcher to test the research model or observe whether any meaningful relationships can be found. This can be implemented through testing the reliability of the data. On the other hand, the main disadvantage of the quantitative approach is its attempt to represent a whole population through a sample, which means it loses or misunderstands detailed opinions and feelings about specific phenomena.

However, the qualitative approach is more appropriate when looking at details and deep interpretations of specific phenomena (Silverman, 1997). As far as the present study is concerned, the use of this approach with its associated advantages is essential to gain a deep understanding of the relevance of the implementation of KM and BPM in the construction industry in the context of Jordan as a developing country and its impact on the process of decision making.

Given that there are advantages and disadvantages to both approaches, the researcher has tried to exploit and deploy the advantages of these approaches in all parts of the current study while minimising the effects of their disadvantages. In other words, the disadvantages of the quantitative approach are covered, or compensated for, by the advantages of the qualitative approach, and vice versa. For the reasons discussed above, there are three phases of data collection in this study; the first being a pilot study conducted through semi-structured interviews (face-to-face and telephone), the second a survey conducted through questionnaires and the third qualitative research through telephone semi-structured interviews.

The mixed-methods approach is utilized in this research since it contributes to discovering hypothetically conceivable results to the research questions as well as helping with overcoming the intellectual as well as practical obstructions related to directing this kind of study (particularly within the construction industry which involves complex data). The mixed-methods approach is empowering in that it creates connected discoveries that can be authenticated.

### 3.2.1. Rationale for Choosing the Triangulation Approach

The current study is based upon a combination of the positivist and interpretivist paradigms with the pragmatic paradigm, incorporating quantitative and qualitative methods and deductive and inductive techniques. Social studies rarely use a single paradigm, method or technique (Creswell, 2003; Saunders et al., 2003). The triangulation process increases the validity and reliability of research when dealing with social issues (Easterby-Smith et al., 2002). Gray (2013) suggests that the usage of different methods aids data triangulation and is also an efficient method to overcome the majority of the shortcomings of every method used. The researcher has reviewed the related literature (underpinning theories and theoretical and empirical studies in Chapter 2), in addition to a variety of research methods in social science. It has been found that the most appropriate and flexible way to conduct this present study is to use multiple methods with triangulation conducted through survey questionnaires and complementary semi-structured interviews.

This type of study is the first to be conducted using Jordan as a developing country in the context of the construction industry. The use of one single method may not achieve the goals of this research. In developing countries, there is insufficient transparency to provide real data and information; most of the participants in most studies try to conceal reality or conceal themselves behind the regulations and procedures. Therefore, the researcher should construct reality through a combination of methods and paradigms. The survey questionnaire (quantitative method) is suitable for exploratory study and for the "What" research questions, while semi-structured interviews (qualitative method) are suitable for explanatory study and for the "How" and "Why" research questions, as in the present research.

The use of multiple methods provides for a more rigorous approach to the topic under investigation because it allows quantitative and qualitative methods to play complementary roles. Saunders et al., (2003: 94) show that "semi-structured interviews, applied with other data collection methods such as the questionnaire, are very valuable ways of triangulating".

In addition to this, triangulation allows a researcher to investigate in depth the interrelationship between KM and BPM in the context of the construction industry to improve DMP. At this point in the methodology, it is relevant to examine the issues of research types and research methods.

## 3.3. Method of Data Collection

As indicated by Bryman (2006) the option to select a specific methodology must be made on its appropriateness to answer the study's questions. Mixed-method research includes the gathering of data in addition to analysing both the qualitative and the quantitative data (Creswell, 2007). Subsequently, a mix of qualitative and quantitative data gathering approaches has been adopted in this study, therefore the outcome of one can be used to improve, form, explain as well as approve the other (Oppenheim, 2000). The results are used to accept and examine the findings. This endorses the study's results by making it more credible and appropriate. Using both approaches create a more robust view of the phenomenon which is being examined and deeper understanding of the integration of KM and BPM that should improve DMP in the construction sector.

Bryman (2006) states that qualitative research provides knowledge about an organisation's practices through acquiring employees' interpretations of their organisation. Creswell et al., (2009) have shown that interpretative research is concerned with an employees' private records regarding their behaviours, attitudes and motivations. Quantitative research methods, from another point of view, supplement these discoveries by providing an arrangement of data which can be reproduced for accurate analysis. Berg (2004) separated qualitative and quantitative research contending that qualitative research reveals implications, ideas, meanings, qualities, signs as well as depictions of components, whereas quantitative research reveals the measurements of variables. Denzin and Lincoln, (2000) assert that qualitative research highlights how the definition of the social focuses on the link between the researcher and the subject studied. In addition, quantitative research depends on the estimation as well as the investigation of fundamental relations among variables.

There are numerous methods for collecting data which is accessible to the researcher. However, there are two key methods that were used to gather data from the organisations in this research. Semi-structured interviews were selected as the qualitative approach whereas the survey questionnaires were implemented as the quantitative approach. Using these techniques allowed data to be collected to provide results for the research questions in this study.

### 3.3.1. The Questionnaire.

A questionnaire is "a pre-formulated written set of questions to which respondents record their answers, usually with rather closed defined alternatives" (Sekaran, 2003: 236). Questionnaires are widely used in social science research and help in obtaining the required data from a huge number of participants. Saunders et al., (2009) argue that the main methods available in survey research are the postal questionnaire, the self-administered questionnaire, the e-mailed questionnaire and the telephone questionnaire. The choice of the most appropriate questionnaire depends on the nature of the study, the number of respondents or the sample size, the location of respondents and the way the survey is administered.

The main advantages of a questionnaire survey are that it is inexpensive compared with other data collection methods: it assures confidentiality, helps the researcher obtain a large quantity of data within a short period, it can be completed at the participant's convenience and it can limit and reduce the interviewer's bias (Sekaran, 2003). However, in spite of all these advantages, there are several disadvantages related to the use of questionnaires, including low return rates, partial responses owing to lack of direction and inability to deal with complex social issues (Sekaran, 2003).

#### 3.3.1.1. Questionnaire Design

In this phase of the study, the survey approach was applied to collect data in regard to the interrelation between KM and BPM and its support for DMP within the construction sector. This section clarifies the details of the design of the questionnaire. A survey design provides a quantitative or numeric research explanation of patterns, attitudes or sentiments of a group of people through studying a population sample (Creswell, 2009).

Tashakkori and Teddlie (2010) highlighted the importance of utilizing questionnaires as follows: suitable for measuring opinions as well as choosing other content from research respondents, inexpensive, anonymity of participants, they include top measurement validity as well as reliability from a well-designed, approved survey, and finally there is simplicity in data analysis. Saunders et al., (2009) state that the questionnaire might collect data by requesting that individuals react to the same questions; as a consequence the data gathered can be coded using a PC. In the design of the questionnaire, the researchers need to be clear about the data they want gathered, empowering the researchers to acquire precise data (Foddy, 1994).

The design of the questionnaire influences the response rate, reliability as well as validity of the gathered data. De Vaus (2013) states that response rates, validity and reliability may be amplified with an accurate outline. Also necessary is a logical design and clear clarification of the reasons for the study. A pilot study, carefully arranged and organised is also a prerequisite of the questionnaire.

McDaniel and Gates (2001) believe that a questionnaire design should include a sequence of stages that could change marginally from study to study, but at the same time have a tendency to follow similar general steps. The steps in Figure 3-2 were followed in designing as well as executing the questionnaire. The following sections provide further insights concerning the developmental process of the questionnaire.

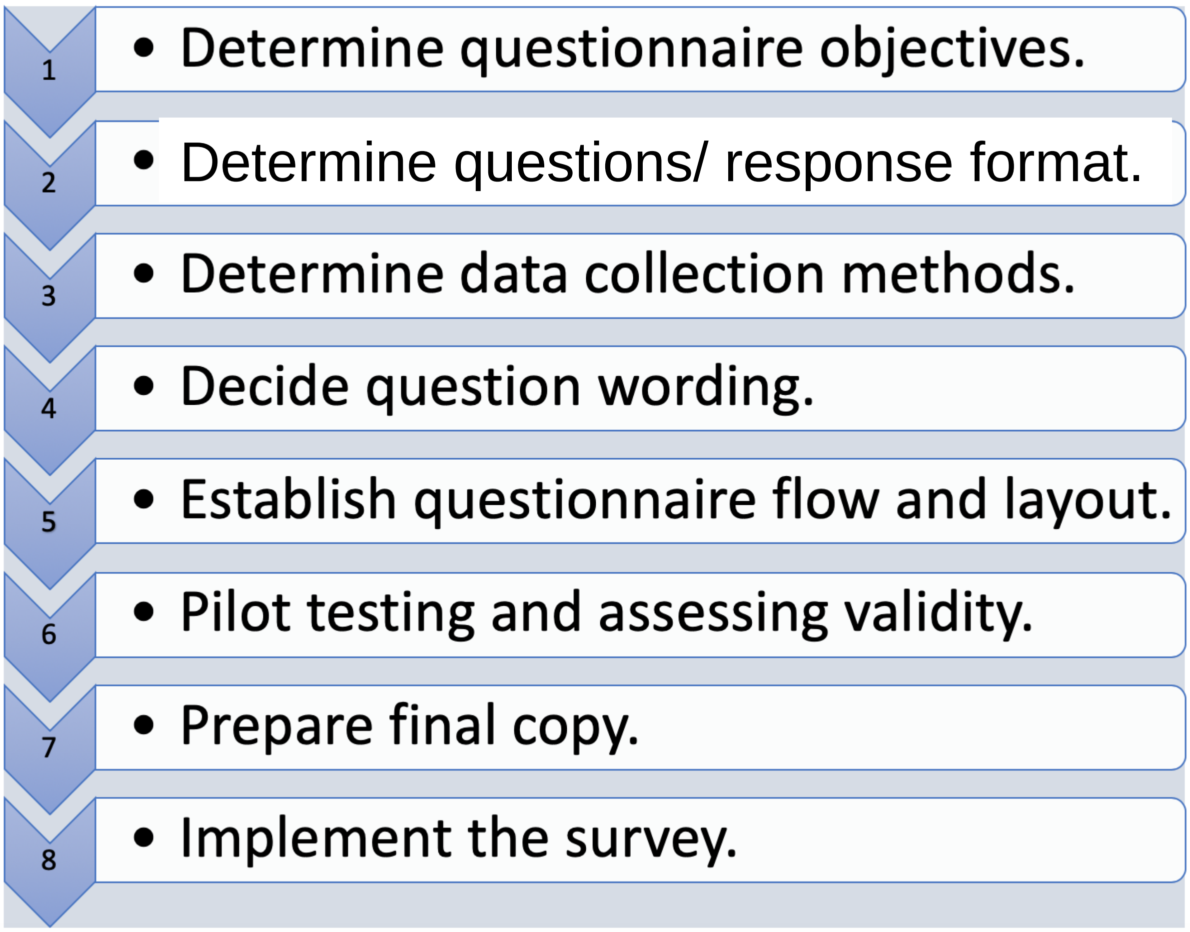


**Figure 3-2: Steps in designing a questionnaire (Adapted from McDaniel and Gates, 2001)**

##### *3.3.1.1.1. Determining a Questionnaire's Objectives:*

The reason for designing this questionnaire is to examine the research model planned in this research in line with the theories, relevant literature and prior studies in order to discover the integration between factors that influence KM and BPM to support DMP in the construction sector.

##### *3.3.1.1.2. Determine Question/Response Format: (Structure of the Questionnaire)*

A questionnaire contains a set of questions that measure the impression of participants quantitatively. The principle aim of the questionnaire is to transform the researcher's data requirements into a set of questions which participants are eager as well as ready to respond to. As a consequence, this study investigates the respondent's perceptions related to the integration of KM and BPM. These two terms are essential for DMP in the construction sector.

Consequently, an appropriate questionnaire was produced to mirror the aim of the fundamental focus of this research. The development of the questionnaire experiences various phases (Churchill and Iacobucci, 2010). The previous phases in this research are related to the planning of the core elements of the research such as determining the aims the research questions, objectives, and the hypotheses. These particular elements maintain a focus on the questionnaire's design. In this regard, relating the particular elements associated with KM, BPM as well as DMP in the construction sector are essential phases in designing the questionnaire. Accordingly, a frequent review of the appropriate literature was the key basis for realizing the elements of KM, BPM and DMP. The literature review was the core basis for creating the main variables and the measurement items which are shown in Table 3-3. The way that the KM measurement items were decided is found in section 2.3.5, the KM processes can be found in section 2.3.5.1 (page 46), KM teams is in section 2.3.5.3 (page 55) and KM technology is found in section 2.3.5.2 which is in page 51. Also, the method used to choose on the BPM is found in section 2.4.4, with regards to how the measurement items for DMP were chosen to refer to section 2.6.1 on pages 88-89.

**Table 3-3: Factors and measurement items**

| Variable | Measurement items | Sources | Number of statements |
|---|---|---|---|
| KM processes | • Knowledge creation.<br>• Knowledge storage.<br>• Knowledge distribution.<br>• Knowledge application. | (Chang and Lin, 2015; Arpaci, 2017; Donate and Pablo, 2015; Lawson et al., 2003) | 22 |
| KM technology | ▪ (LAN) web.<br>▪ Administrative units with a network of computers.<br>▪ Update information system.<br>▪ Email, automated retrieval of information, word processing, audio-video conferences. | (Shehabat and Berrish, 2018; Chan, 2017; Trigg, 2000) | 4 |
| Knowledge Team | ▪ Knowledge-makers.<br>▪ Knowledge managers.<br>▪ Employees' KM. | (Shehabat and Berrish, 2018; Baserda, 2006;Trigg, 2000) | 11 |
| Strategic Alignment | • Align the goals of the processes to the company's strategic goals.<br>• Share the decisions between top level management and the process managers.<br>• Make plans for improving the existing processes or your company is going to build new processes | (Rosemann and Brocke 2015; Fisher,2004; Rosemann et al.,2005; Melenovsky and Sinur, 2006) | 5 |
| Culture | • Everyone in the management team clearly knows what BPM is and how to apply it to an organisation.<br>• The top management encourages the continuous improvement of the existing process and pays attention to the process's values and beliefs<br>• Processes play a prominent role in the corporate vision, mission and value statements.<br>• The top management has the plan to change the company's culture towards the process-oriented approach. | | 5 |
| People | • The top management, process managers, and process owners receive an education in process measurement, control and improvement,in order for the employees to understand cross-functional department cooperation. As well as, what they should do to accomplish the process goals. | | 4 |

| Variable | Measurement items | Sources | Number of statements |
|---|---|---|---|
| | • Process management can be used to predict the future results in order to find suitable alternatives dynamically. | | |
| Governance | • The staff have the chance to engage in the decision-making. However, all staff should be aware of the authority of the process owner.<br>• The process roles and responsibilities are well-defined. (Such as the process management standard).<br>• The top management has a strong capability to deal with differences and contradictions between processes and polices.<br>• There is a plan to place suppliers and customers in the process management. | | 6 |
| Methods | • A functional team oversees BPM execution.<br>• There is a focus on process control and measurement.<br>• The top management provides plans to introduce new methods in order to support process management and identify/ conceptualize current and future business processes. | | 4 |
| Information Technology | • There is a system that is applied in the IT department that fits well with the companies' management structure.<br>• The IT department is responsible in relation to the BPM and provides the necessary support to the process management.<br>• The IT department jointly works with other departments during BPM implementation.<br>• The IT department provides a plan to make it more suitable for the process management. | | 6 |
| Speed and Problem Identification | ▪ Identify potential problems faster<br>▪ Sense key factors impacting my area of responsibility<br>▪ Notice potential problems before they become serious crises | (Leidner and Elam, 1993; Leidner and Elam, 1995; Abdelrahman, 2013) | 3 |
| DM Speed | ▪ Make decisions quicker<br>▪ Shorten the timeframe for making decisions<br>▪ Spend less time in meetings | | 2 |

| Variable | Measurement items | Sources | Number of statements |
|---|---|---|---|
| The Extent of Analysis in DM | ▪ Spend significantly more time analysing data before making a decision<br>▪ Examine more alternatives in decision making<br>▪ Use more sources of information in decision making<br>▪ Engage in more in-depth analysis | | 4 |

The next stage in designing the questionnaire was preparing statements regarding the best way to guarantee that they are understandable by the participants. Following this, the statements were arranged and sorted into various segments as indicated by the aim for this research. The researcher believes that this strategy is crucial in developing the questionnaire as it helps to provide a response to the research question in addition to helping to explain the research hypotheses. As mentioned above, sets of research questions as well as hypotheses were arranged based on the aim and objectives of this research.

Following Likert (1932) a five-option scale known as rating scales was designed. (Table 3-4). This allows the participants to choose the classifications that illustrate their insights on various statements. This rating scale was chosen due to its wide acceptance by researchers (Lopez et al., 2009). This phase in designing the questionnaire included observing and re-evaluating whether statements in various segments mirrored the aim of this research in exploring the viewpoints of the interrelation between knowledge management and business process management and its effect on the process of decision making. This was particularly pertinent in the Jordanian construction industry. Limited modifications were made prior to the design of the draft of the questionnaire.

**Table 3-4: The Likert rating scale used in this study**

| **Likert scale** | **Strongly disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly agree** |
|---|---|---|---|---|---|
| Symbol | SD | D | N | A | SA |
| Individual statement | | | | | |

The questionnaire was arranged in four parts and utilized four screen pages for clarification. All of the respondents were permitted to move through the pages in the survey and answer the questions in the order they wanted in addition to giving them the right to change answers whenever they wanted.

- Part One: demographics as well as specialized information concerning the participants in addition to their organisation type.
- Part Two: knowledge management variables.
- Part Three: business process management variables.
- Part Four: decision-making process variables.

To make it more friendly for the respondents, the structure and flow of subjects were a fundamental part of the questionnaire design. A well-designed structure provides a simple questionnaire for participants with the aim of eliciting important data as well as helping the researcher gather precise data. In this regard, logical as well as clear statements encourage participants to complete the questionnaire.

The questions and the conceptual framework were organised in line with the literature review and domain experts' opinions. In this research, ordinal scales (five-point Likert scales) were utilized to examine respondents' opinions with respect to the study concepts as well as to examine correlations in these concepts within the research model.

##### *3.3.1.1.3. Determining the Data Gathering Methods:*

The aim of the data gathering process is to collect data as well as views concerning the study topic from the target population (Churchill, 2005). Achieving a high reaction rate from the target population relies upon structuring the questionnaire properly and with clearly phrasing. Zikmund et al., (2013) refer to distinctive methods for gathering data utilizing a questionnaire, for example, postal, phone, web and distribution methods and gathering questionnaires, interviews, as well as combining these methods. The data for this research was gathered through the internet.

#### *3.3.1.1.4. Deciding on the Phrasing of Questions:*

The phrasing of the questionnaire needs to ensure that the reactions are valid as well as measure what was planned to be measured (Saunders et al., 2009). The phrasing for every question was kept brief to limit uncertainty and motivate the participant. To guarantee that sufficient responses were provided and member's bias and measurement errors were limited, the literature review and discussions with domain specialists aided the development of the phrasing of the questions.

#### *3.3.1.1.5. Establishing Questionnaire Flow and Layout:*

In arranging the flow of the questions, succeeding questions were positioned in order to omit unfit participants; “warm-up” inquiries followed to obtain the participant's goodwill.

#### *3.3.1.1.6. Pilot Testing:*

Piloting the questionnaire is a critical phase and was completed after the first draft. It is important to acquire a variety of different views in order to complete a sound questionnaire. The aim of pre- evaluation was to check the phrasing of the questions, the order of statements, (regardless of whether they were comprehended by participants), and whether the questionnaire was acceptable. Along these lines, a copy of the first draft was disseminated to six domain experts to determine issues which may require improvement. They were asked to provide remarks for improvements to the main draft of the survey. The study accentuated the clarity of the statements, the questionnaire design, as well as whether the content was firmly identified with the main topic. After adequate revision and updating of the digital questionnaire, a pilot study was provided, to aid adjustment to the questionnaire and remove possible issues prior to sending the questionnaire to the respondents. The pilot study was uploaded on the web and sent by email to 40 members for an assessment of its validity, readability, accuracy and usability. These members were asked to provide responses based on these measures, in addition to an average estimation of the time needed to complete the questionnaire. Altogether, eight questionnaires were not submitted; this indicated a response rate of 80%. The response from the respondents was helpful in deciding on the validity, timing, clarity and the wording of the questionnaire.

The reliability of the measurements applied within the questionnaire was examined utilizing "Cronbach's alpha", reliability test. This helps to know if the questions require a particular measure in order to examine the consistency of every variable. Pallant (2010) believes the scale is viewed as dependable as well as adequate if the alpha rate is over 0.7, while a reliability score of 0.6 is likewise viewed as adequate (Nunnally, 1978).

In this study Cronbach's alpha coefficient was computed for every variable in the questionnaire. Every variable's reliability score surpassed 0.9 (see appendix A). Although the variables were obtained from prior studies, the alphas show that the variables are consistent.

The following stage in the improvement of the present questionnaire was sent to the supervisor for evidence to accomplish the outcomes. The supervisor recommended a few alterations identified with the "sound" of the questionnaire. Accordingly, the final draft of the questionnaire was transferred to the web and samples were emailed to the sample population.
Following the pilot study, the feedback from the participants was discussed with the supervisor and some alterations were made to the survey, the alterations were:

- Modifying the layout of the survey, the sequence of the statements was reordered in the order of each variable, so that all of the statements and questions used to measure the same variable were put in the same section.
- Removing unnecessary statements, along with merging statements that had the same idea for example the statements "Training and openness in the exchange of thought and dialogue are applied to distribute knowledge" and "Making lecturers and conferences to share knowledge" were combined to make the following statement "There are regular symposiums, lectures, conferences, or training sessions to share knowledge and ideas". Another example was the deletion of the following statement "there is a system to control the tangible knowledge assets".

- Rewriting unclear and vague questions to make it simpler for the participant to understand and read, such as rewriting the statement “employees get knowledge in an easy form” to “knowledge in a form that is readily accessible to employees.”
- Long questions were shortened so that the participant is not overwhelmed by the long questions.
- Defining any academic key terms that participants might not be familiar with, this helps them understand the questions. For example, defining knowledge management, knowledge, knowledge-makers, knowledge base, the experiential knowledge, business process management, business process, decision making, and methods.
- Adding an introduction at the top of the survey to explain the aims of the survey and the research, so that participants can get an insight to the aim of the research (see A).

##### *3.3.1.1.7. Preparing the Final Copy:*

Amendments were made after the contribution from the pilot study and an information sheet and a covering letter (see appendix B) were prepared for the arrangement of the final questionnaire; an introduction sheet was sent by email to give basic information about the questionnaire content, guidelines, confirmation of secrecy matters of confidentiality. In addition, a concise definition of some terms used in the questionnaire was provided.

##### *3.3.1.1.8. Disseminating the Survey:*

Subsequently, a worthwhile sequence of questions was set up and the questionnaire was created using a website provided by the University of Salford and posted on the following site: https://salford.onlinesurveys.ac.uk/bpm-km-dm

This website provides a fast as well as simple method to make and automatically assess web questionnaires on every conceivable topic. Furthermore, it encourages intuitive help in creating the web questionnaire to connect to the online questionnaire form by email. In this manner individuals from the sample population were directly invited to participate in the present questionnaire. SPSS was employed in the data analysis; this online programming provided descriptive analysis, including charts, and arranged the information in an Excel spreadsheet. Questionnaires were circulated over a two-month time span from 27/08/2018 to the end of October 2018. Every questionnaire managed was accompanied by a cover letter, an introduction sheet which included the goals of the study, research descriptions, and the advantages of the research for the participants.

The electronic survey was conveyed and target members were reached via email. Email correspondence was used to follow up on the participants. Reminder e-mails were additionally sent to the target population after about 14 days following the underlying interaction. Invitations with a link to the questionnaire were sent through email with a consent form and an information sheet clarifying the motivation for the study and guaranteeing the confidentiality of the data collected. The questionnaire was designed with suitable phrasing and a response structure to make it simple for respondents to encourage them to react as well as ease data analysis; its design depended on the research objectives, hypotheses and past studies, along with the suggestions and rules for improved response results.

### 3.3.2. Semi-Structured Interviews

This section contains the explanation for choosing semi-structured interviews as the research approach for this research. The interview is a popular way of gathering data by those researching in built environment disciplines for its potential to produce insight and ideas. In addition, findings gathered from research can be confirmed with interviews (Haigh, 2008).

There are three types of interviews:

• Unstructured interviews: questions are not determined and the researcher is able to ask any questions they prefer about the topic. They are generally made in relation to the participants previous answer. An advantage is that the researcher could ask for extra details for the participant to elaborate on their responses. This supports the researcher in deciding which variables need more in-depth analysis and review.

• Semi-structured interviews include several prearranged questions which are open, whereas the subsequent interview questions are designed through the interview transmission (Sandy and Dumay, 2011). The structure of the predetermined questions within this type of interview could be adapted throughout the interview, and the question phrasing could be modified, excluded or added depending on the interviewer's opinion of the things that appear most suitable (Robson and McCartan, 2016).

• Structured interviews: throughout the interview all the questions asked are predetermined when the researcher clearly identifies what knowledge is required. Hence, the data collected is likely to be quantitative in nature. Generally, the better organized interview questions are, the better further a research can acquire qualitative data (Haigh, 2008).

In this research, the questionnaire survey allowed the researcher to gain insights into the topic of the research. Semi-structured interviews combine structured and unstructured interviews, they also allow questions regarding the proposed framework to be asked by the researcher. However, this type of interview allows the interviewees to reply to the questions in great depth and detail. Furthermore, semi-structured interviews are flexible which allows the researcher to adjust and enhance questions to steer, as well as concentrate on, the subtopics that the interviewee has a lot of knowledge in. Hence, the most suitable type of interview for this research is semi-structured, also it is chosen to collect qualitative data.

Ali (2011) found that the 3 most commonly methods used to validate the frameworks are:

- Carrying out the framework where it needs to be implemented, to do that a permission is required from the construction company to apply the framework in their organisation. Getting this permission is very difficult and can take a long time to carry out.
- Show and present the framework to expertise in the construction sector in a workshop so that the framework can be discussed, and they will be able to give feedback. However, it is time consuming and expensive to carry out a workshop and invite the expertise.
- To send the framework to the construction sector expertise and carry out an interview with them afterwards, the interview is a popular method within the research field and

some of the researchers that used this method were Motaleb, 2014; Allali, 2016; Saini, 2015; Alhusban, 2018; Mohd Zin, 2014; and Alqahtani, 2019. This method is well known because the expertise would be given enough time to review the framework with themselves and their colleagues, and to prepare themselves to give thorough and useful feedback during the interview. Also, this method is widely accepted in the research on the construction system.

#### 3.3.2.1. Justification for using the Telephone Interview Approach

The telephone interview method was chosen in this research, this is because this method costs less in contrast to one-to-one interviews. Moreover, one-to-one interviews absorb considerable time, as around 30 % of the time is undertaking the interviews and the other two thirds are used for meetings and locating the interviewees (Oppenheim (1996)). Furthermore, telephone interviews allow the interviewer to collect the data required from the interviewees quickly. The telephone interview is a sensible way to overcome geographical distance. In my case; the interview was carried out in the UK while the data was collected in Jordan.

#### 3.3.2.2. The appropriate number of Interviews

The number of interviewees in qualitative research is not important. Patton (1990) stated that, “there are no rules for sample size in qualitative inquiry”. Moreover, he stated further that, “Sample size depends on what you want to know, the purpose of the inquiry, what's at stake, what will be useful, what will have credibility, and what can be done with available time and resources” (Patton, 1990: p.244). He emphasized as well that, “the validity, meaningfulness, and insights generated from qualitative inquiry have more to do with the information-richness of the cases selected and the observational/analytical capacities of the researcher than with sample size” (Patton, 1990: p.185). In this interview, the number of interviewees was not as significant as important as selecting suitable interviewees who are able to provide a good representation of the views of the workers within the organisations. Therefore, people with the appropriate knowledge and familiarity in the area of KM and BPM were carefully selected for this interview.

#### 3.3.2.3. The Interview Process

Previous studies in addition to the results of the questionnaire assisted in developing the design of the interview guide. The interview questions were formed and established to support the semi-structured interviews when producing the preliminary discussion points. The layout of semi-structured interviews is neither structured nor entirely unstructured, as it is important to let the participants disclose their personal opinions (Flick, 2018). Silverman (2015) believes that applying a consistent design to the semi-structured interview helps every participant know that discussions contain all sections.

Twenty invitations were sent to the construction experts, but only twelve responses confirmed their attendance at the interview. All 12 interviews were completed over 3 months (January 2019 – Mach 2019). The interview questions were evaluated by three academics each originating from a different university and with experiences in KM, BPM and DMP. Recommendations were added to the initial edition which was guided by two directors from a Jordanian construction organisation. Ultimately, questions were once again altered as suggested to simplify the phrasing and to make it simple for respondents to complete the questions without ambiguity. Even though the supporting literature and the questionnaire outcomes are crucial in deciding direction and the perspective of the interview, the researcher did not indicate the previous studies or the questionnaire results while allowing the interviewees to direct the conversation. This decreased any bias prevented any pre-conditioned responses. To be confident that the questions were well defined and unbiased, they were developed many times over and created in a consistent and rational order.

Each interview was carried out in either Arabic or English but English terminology was commonly applied in the Arabic interviews. The transcripts in Arabic were translated into English by the researcher, who is fluent, educated, worked and lived in the UK for a number of years and was asked to provide constructive comments if any changes or interpretations were required. This assisted in decreasing any bias and increasing the reliability and validity of the research. Privacy and confidentiality of interviewees were maintained. The researcher used various methods to organize the interviews, reliant on phone calls and sending e-mails to make arrangements to participate in the research. It was the participants who selected the timing and approach. Every interview continued until the researcher acquired the necessary information, and repetition and redundancy in the data given by participants had been dealt with.

At the conclusion of every interview, the researcher displayed gratitude to the participants for their efforts, requesting the possibility of maintaining contact with them in the future for additional enquiries concerning the research. The researcher also offered to send a version of the outcomes to the participants when the study was complete.

Before the start of this study, an ethics application was submitted to the Science and Technology Research Ethics Panel (Ref No: STR1718-41) at the University of Salford (see Appendix B).

During the gathering of the data, participants were encouraged to offer true examples or practices to assist the credibility of their data. After the 24-hour rule (Eisenhardt, 1989; Miles and Huberman, 1994), the researcher transcribed all the case notes within 24 hours of every single interview. While data were being gathered, the researcher began to analyse them; the subsequent section highlights the feedback analysis.

## 3.4. Data Analysis

Analysing data is a critical stage in any research after the primary and secondary data have been collected. Furthermore, data analysis needs to be carried out using the most suitable methods, taking into account the nature of the data collected and the purposes of the research. This study aims to explore and explain how organisations in the construction sector can enhance the decision making process (DMP) by practicing knowledge management (KM) and business process management (BPM) activities. It employs both quantitative (questionnaires) and qualitative (interviews) data collection methods, and as such the appropriate method of data analysis varies accordingly in order to achieve the research objectives and answer the research questions. The process of analysis underwent two stages.

First, there was the quantitative analysis of the data collected through the survey. The questionnaire was the main tool of the survey and included 77 statements. SPSS (the Statistical Package for the Social Sciences) was selected owing mainly to the researcher's familiarity with it and its widespread use academically within the social sciences (see appendix A). In this phase of analysis two types of analysis were employed: descriptive and inferential. Hair et al., (2003: 252) state that "data is collected in business research for two broad purposes - discovery and hypothesis testing". The quantitative analysis was accomplished using triangulation of two types of analysis: descriptive and explanatory (see Chapter 4).

- The descriptive analysis focuses on the use of frequencies and descriptive tools such as measures of central tendency (mean, median and mode) and measures of dispersion (standard deviation).
- The explanatory analysis serves to explain empirically the relationships and mutual impact between the main and subsidiary variables in the research model. The main statistical tests are correlation, linear and multiple regression, and ANOVA. The correlation is used to test the internal consistency of each scale. Multiple regression is used to test the linear relationships in the research model and the hypotheses of this research.

However, before conducting all of these types of analysis, the researcher conducted a group of analyses to ensure the statistical fitness of the data collected. These analyses were tests of reliability (Cronbach's Alpha). Subsequently, the reliability and validity of the data has been tested using Cronbach's alpha. The reliability coefficient is the indicator of the positive correlation between items, whilst internal consistency reliability is considered high the closer the Cronbach's alpha is to 1.

Second, there is the qualitative analysis of the semi-structured interviews. The aim here is to interpret the results of the quantitative data analysis, to explore in depth the relevance of the implementation of KM and BPM to support DM in the construction industry in the Jordanian context and to increase the validity of the findings of this research. The researcher collected the qualitative data via twelve semi-structured interviews. The interviews, in general, lasted for three months because time was needed to establish mutual trust before information and opinions could freely be discussed. The qualitative analysis process began with the transcription of the interviews. The interviews were integrated with various documents which were given to the researcher by the interviewees to enhance the information they gave. A content analysis was conducted to discover and explore the important issues and information emerging from the collected data. In the content analysis, “the researcher interrogates the data for constructs and ideas that have been decided in advance” (Easterby-Smith et al., 2012). The researcher categorized and analysed each interview after it was completed. This allowed for the identification of the key themes for further investigation, to develop propositions based on these apparent patterns or relationships, and to validate the conclusions. Additionally, the researcher tried to quantify many questions to simplify the categorisation and analysis process. Saunders et al., (2009: 176) state that "quantifying qualitative data by using the frequency of certain events provides the researcher with the capacity to display a large amount of data that will be discussed through the use of text".

## 3.5. Validity and Reliability

Validity and reliability are among the extremely critical criteria with which to evaluate the credibility of study results (Hussey and Hussey, 1997). Validity and reliability must be mirrored in the measurements and variables of the study in particular, and in the results in general. Saunders et al., indicated that the measurements must be reliable and accurate, so that researcher would obtain the same results if another researcher used the same instruments or measurements.

### 3.5.1. Reliability

Sekaran (2003: 203) believed that having a reliable measure meant that the measure is not biased, therefore the consistency of the measure is guaranteed throughout time and across the various items in the instrument. In other words, having a reliable instrument and a measure scale implies that they are consistent and stable. Moreover, Easterby-Smith et al., (2002: 135) suggested that reliability focused on the stability of the results. For example, once an instrument is sent to the same person at two different times or in different situations, and the result stays consistent, this indicates stability in the results. Additionally, reliability is the extent of the consistency among the various measurements of a variable (Haire et al. (2005: 76)). Hussey and Hussey (1997: 57) indicated that a study is considered reliable once its findings are an accurate representation of what happens in the situation. Regarding this research, reliability has been tested by Cronbach's Alpha.

There are several different approaches for testing the reliability of a scale. The frequently applied measurements for the internal consistent reliability of a scale is Cronbach's Alpha (a) (Oppenheim, 1992). The Alpha (a) is ranged between 0 to 1. Henceforth, as the alpha value increases the reliability of the scale also increases. In terms of the most acceptable alpha value, there was no agreed value among researchers and writers as they all had different ideas regarding the best alpha value. However, in social science studies, a value of 0.60 is acceptable for hypothesis-testing (Sekaran, 2003; Velde et al., 2004), and with 0.7 or higher good reliability is suggested (Hair et al., 2010).

This research utilized composite scales as internal consistent reliability is thought to be crucial in composite scales (Bryman and Cramer, 2005). Generally, this research obtained 0.972 in the scale used; this value is considered high (Table 3-1: Chapter 4).

The reliability of the interviews carried out is implied by the repetition of the same information across most of the interviews. Saunders et al., (2009) explain that the reliability of information and data which are collected through interviews reflects the reality at the time they were collected. Regarding this research, the semi-structured interviews were reliable because the interviewees mostly gave the same answers to the questions and the same data when required. The researcher used several techniques to avoid bias error, such as requesting evidence, observing body language and making comparisons across interviews.

### 3.5.2. Validity

Validity refers to the extent to which the instruments or scales measure what a researcher actually wishes to measure (Easterby-Smith et al., 2002). Sekaran (2003) classifies validity tests into three groups. The first is content validity, which concerns the fitness of instruments or measures for the concepts being measured. Face validity, as a type of content validity, is the essential and minimum index of content validity. It indicates the variables or statements that are supposed to measure a concept.

The second is criterion-related validity. This is recognised when the measure discriminates against people on the basis of a criterion it is expected to estimate. Criterion-related validity can be tested using two types of validity: concurrent validity and predictive validity. Concurrent validity is the ability of a measure to distinguish what aids the prediction of a criterion variable concurrently, while predictive validity is the ability of a measure to distinguish people in a way that helps predict the future criterion.

The third is construct validity, which tests the extent to which results obtained from fieldwork or measures reflect or fit the relevant theories. Construct validity can be tested using two types of validity: convergent validity and discriminant validity. Convergent validity tests the correlation between two or more different instruments. A high correlation is the best convergent validity. Discriminant validity supposes that two or more variables are predicted to be uncorrelated. If a measure has a low correlation with a variable or construct it is thought to be unrelated to this variable or construct.

Saunders et al., (2009) explain that the validity is negatively affected by research errors such as poor samples, inaccurate instruments, ambiguity about causal relations, and faulty research procedures. Hence, a researcher should demonstrate accuracy and precision of instruments and of causal relations between variables if they are to ensure the validity of a study. The validity of this research can be seen from the following features:

- Its use of a multi-method approach, employing triangulation between quantitative and qualitative approaches. A combination of data collection methods such as questionnaires and semi-structured interviews enhances the validity of the study. This leads to minimizing the possibility of errors in the data collection and interpretation.

- The size of the response rates achieved. In the questionnaires this is 30%. These percentages emphasize a high level of validity, and therefore the results of this study can be generalised.
- The scope of the literature review. This research has included an extensive literature review, which was undertaken to define research questions, variables, hypotheses, scales and instruments. Most of the measures and scales used in the questionnaire and interviews for the present study were adopted from previous studies. Sekaran (2003: 173) indicates that it is better to "use already developed measures and scales since their reliability and validity have been established by their developers".
- The piloting of the questionnaire as the main tool of data collection. The first draft copy of the questionnaire was disseminated to six domain experts to determine issues which required improvement They were requested to provide developmental remarks and also for improvements to the main draft of the survey. After adequate revision and an update of the uploaded questionnaire, a pilot study was provided. The pilot study was situated on the web and sent through email to 40 members for assessing its validity, readability, accurateness as well as usability.
- The high construct validity of this research. It is high because it is dependent on theoretical triangulation. This study is based on theories of KM, BPM and DMP.
- Regarding the validity of the interviews, Saunders et al., (2009) state that flexible interactions between interviewer and interviewees increased the validity of interviews and enabled the researcher to elicit more information and data. Easterby-Smith et al., (2002: 41) state that the validity of interviews refers to the extent to which "the researcher has gained full access to the knowledge and meanings of informants".
- The interview questions were evaluated by three academics each working at a different university. They have experience in KM, BPM and DMP. Recommendations were added to the initial edition which was guided by two directors from a Jordanian construction organisation. With regard to this study, the researcher conducted 12 semi-structured interviews aiming to acquire further information and to interpret the quantitative data. All interviews were successfully conducted and achieved their purposes. The data and

information collected in these interviews will be used to interpret the results of the quantitative data analysis.

## 3.6. Ethical Considerations of the Research

The elementary ethical principal during the collection of data is that the participants should not be at a physical or mental risk resulting from the research (Oppenheim, 2003, p.83). Numerous ethical issues need to be considered when conducting research (Saunders et al., 2009) (Appendix B):

- The right to provide anonymity to the participants.
- Participants should have the right to withdraw their data from the research at any stage and participants should willingly choose to participate.
- Informed consent.  There should be no form of deception at any stage of the research.
- Confidentiality. Participants' data such as facial images or names must remain private.
- Inappropriate circumstances. There should be no awkwardness, pressure, uneasiness, agony and injury or damage with regard to research's participants throughout the data collection process.

All of these ethical issued were considered in this research. Prior to the process of the collection of the data, a research application was given to the Research Ethic Panel of the University of Salford for research ethical consent. This study's approval was established on the 25 May 2018.

## 3.7. Conclusion

This chapter has presented the research process, research paradigm, methodology, research type, methods of data collection and analysis techniques undertaken in order to fulfil its objectives and answer the research questions. It provides triangulation between theories, quantitative and qualitative approaches, methods and various data. This chapter also discussed the questionnaire and the semi-structured interview designs. Furthermore, this research triangulates between research types, so it could be argued that this study is descriptive and explanatory. This reflects the holistic approach to arriving at the reality behind the phenomena investigated. Finally, the chapter concludes with discussion around the validity and reliability of this research and research ethical issues.

# 4. Chapter 4: Quantitative Design and Analysis

## 4.1. Introduction

As suggested in the first chapter, the general aim of this research is to explore and explain how organisations in the construction sector can enhance the decision making process (DMP) by practicing knowledge management (KM) and business process management (BPM) activities. These concerns have received considerable attention in several studies in relation to the development of the process of DM in construction organisations (Chapter 2). This chapter concentrates on the practical statistical analysis produced by the questionnaire. In addition, it concentrates on the presentation and understanding of the data to explore how participants in Jordanian construction organisations observe knowledge management (KM) in addition to BPM in order to enhance DMP.

The Statistical Programme for Social Sciences (SPSS) has been applied to analyse the viewpoints of 110 participants, in an endeavour to achieve the third objective “Investigate the integration between KM and BPM in the construction organisations” and also the fourth objective “Investigate the effect of the integration of KM and BPM in the DMP of Jordanian construction organisations” of current study (Chapter 1). In this phase of the analysis two types of analysis were employed: descriptive and inferential. The quantitative analysis was accomplished by the triangulation of two types of analysis: descriptive and explanatory.

- The descriptive analysis focuses on the use of frequencies and descriptive tools such as measures of central tendency (mean) and measures of dispersion (standard deviation).
- The explanatory analysis serves to explain empirically the relationships and mutual impact between the main and subsidiary variables in the research model. The main statistical tests are correlation, linear and multiple regression, and ANOVA. The correlation is used

to test the internal consistency of each scale. Multiple regression is used to test the linear relationships in the research model and test the hypotheses of this research.

## 4.2. Sample Population

A sample population is a portion of the entire population. With a view to examining specific populations, it is important to utilize sufficient sampling methods (Collis and Hussey, 2013). They identified two classifications of sampling: probability and non-probability sampling. The two classifications are identified according to whether the population is identified or unknown. Because this study's sample population is identified, the sample population is categorised as probability sampling.

The benefit of this technique is that it is further representative of the whole population. Sample populations are frequently utilized when there is a large population. When large, it is inefficient to gather data from everyone in a specific population, it is also time-consuming and expensive, making it difficult to gather data with respect to each individual in the population (Kelley et al., 2003; Collis and Hussey, 2013, Saunders et al., 2007).

In the present study, the population size was 400. This questionnaire is aimed at decision-makers (senior management, managers, department heads, supervisors and other decision makers in the organisation) in the Jordanian construction sector for small and medium sized organisations. The selection of the sample was chosen from all the engineering companies and architectural offices officially registered with the Jordanian Engineers Association (JEA). The majority are small and medium sized organisations. The list of the population participants to be surveyed (sampling frame) has been acquired from a solid basis (JEA) to improve the exterior validity of the survey. The sample should be illustrative of the larger population to acquire a composite profile. (Kelley et al., 2003).

The survey was focused on the decision makers in the Jordanian construction organisations. Generally, the whole survey is associated with the issue of sampling. This study is interested in the interrelation between knowledge management with business process management and its effect on the process of decision making in the Jordanian construction sector. The sample should, as much as possible, be representative of the decision makers in Jordanian construction organisations. More significantly, considering the survey method, a minor sample size is appropriate for this study to be as generalisable as possible.

## 4.3. Response Rate

In this research, 400 questionnaires sent by email to the target population, a total of 38 questionnaires were returned undelivered. A total of 117 were successfully received online subsequent to two follow-ups. The response rate rose after each follow-up. Out of the 117 questionnaires, 7 questionnaires were received incomplete, enabling only 110 questionnaires that could be used. This generated a response rate of 30 %.

Cornford and Smithson (1996) stated that, 20% or higher response rate is desired and considered a suitable rate in the IS research in general. Also, 20-30 percent represents a standard rate of response within the construction business (Wong and Cheung, 2008, Al-Tmeemy et al., 2012). Therefore, the response rate of 30 % attained in this research was thought to be acceptable and suitable.

## 4.4. Respondents' Demographic Characteristics and Profiles

This section illustrates the first part of the questionnaire which includes general questions about the participants' profiles such as gender, age, work experience, the type of organisation, participant's position and their department.

- Gender: the chart below shows the respondents’ gender in the questionnaire. Figure 4-1 indicates that the majority of the respondents were male (65%) with 35% being female.

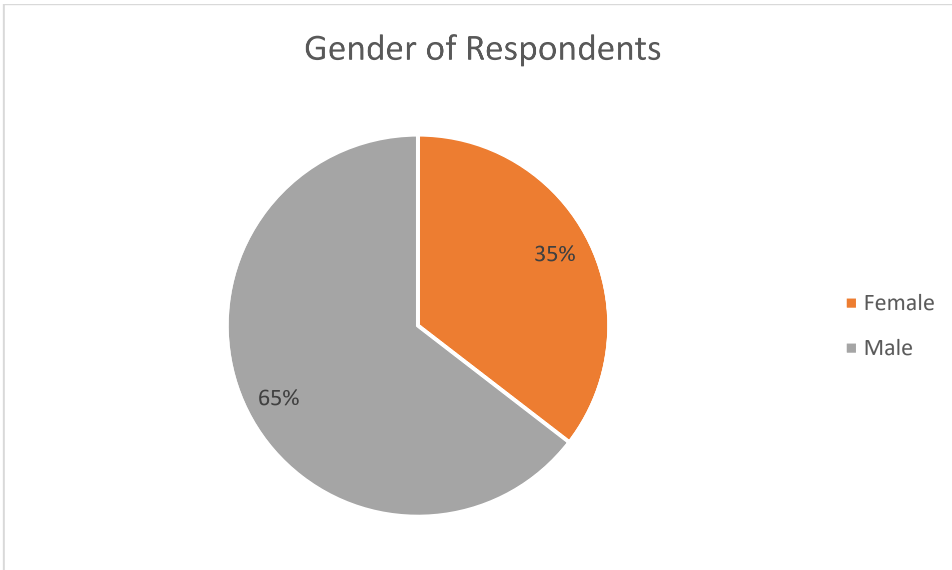


**Figure 4-1: Gender**

- Age: the chart below identifies the different respondents’ ages varying from 25 to over 60-years-old. It reveals the range of ages of the different employees in the Jordanian construction sector. The chart shows that most of the respondents were aged between 41-50. Participants aged over 60 represent the lowest number of people (2). There were 14 respondents aged between 25-30, and 34 respondents aged between 31-40. Lastly, 24 of the participants were aged between 51-60-.
- Work experience: Figure 4-3 shows that 26 of the respondents have a work experience of 11-15 years; this is the highest number of people. The results also show that those with 21-30 and 6-10 years of experience have the same number of people. This contrast in the years of experience indicates that organisations in the Jordanian construction sector have a wide range of employees with a different number of years with respect to experience. To add to this, only 11 participants have 1-5 years of experience, and, finally, those with 30 years of experience has the lowest number of participants (9) respondents.

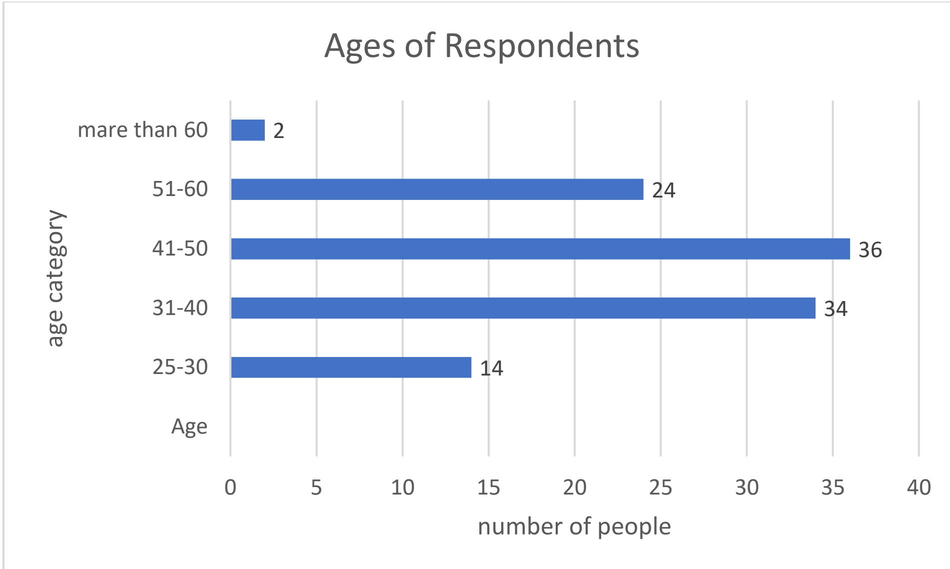


**Figure 4-2: Age Range**

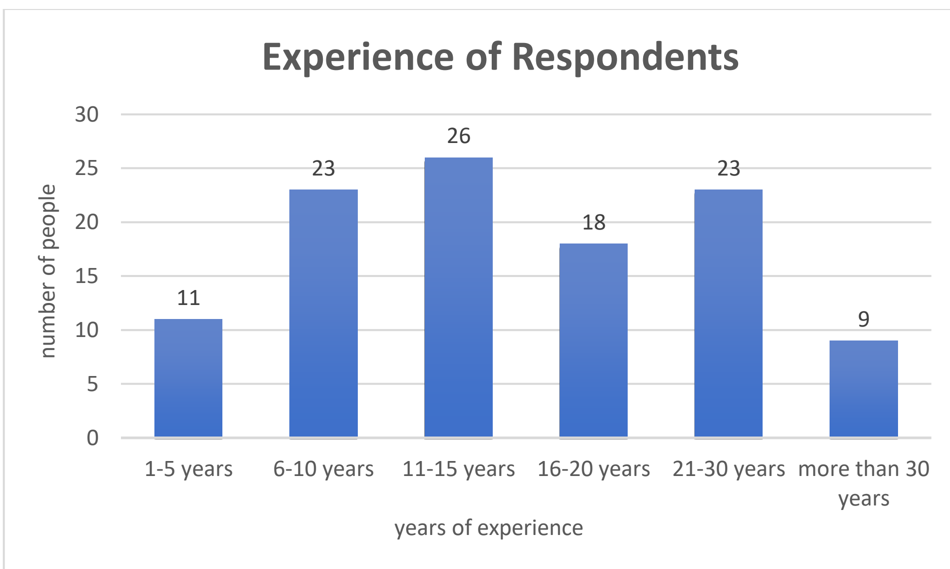


**Figure 4-3: Work Experience**

- Organisation type: the chart below (Figure 4-4) illustrates that many respondents are currently employed in medium-sized organisations in Jordan, however, only 23% of the participants are working in small-sized organisations. This suggests that the participants are mainly experienced in the medium-sized organisations in the Jordanian construction sector (Further information regarding how size is classified see section 2.7).

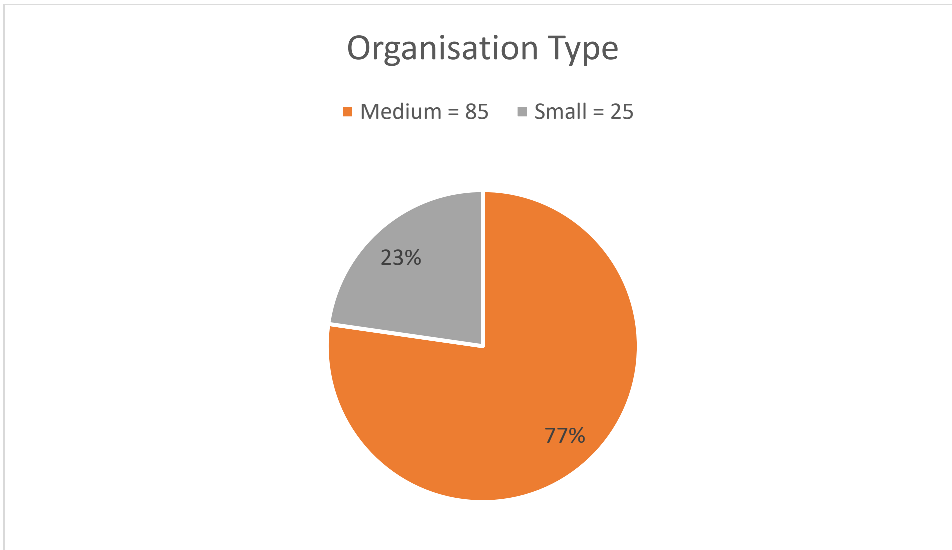


**Figure 4-4: Organisation Type**

- Department: Figure 4-5 indicates that the participants work in a wide range of departments, including departments such as IT, operations, development, accounting and architectural design. The construction and project departments have the greatest number of participants with 22 and 23 people respectively. Furthermore, 13 participants stated that they worked in the Decoration department, with 11 currently employed in Human Resources.

Having participants from a great range of departments is very beneficial, because having different responses from people who have different roles and work in different departments makes the sample more representative, this adds more value to findings. It would add value to the findings because obtaining responses from different people who work in different environments helps to understand the whole picture and acquire views from different perspectives. Also, having a representative sample makes the data more reliable, this makes it easier to make generalisation.

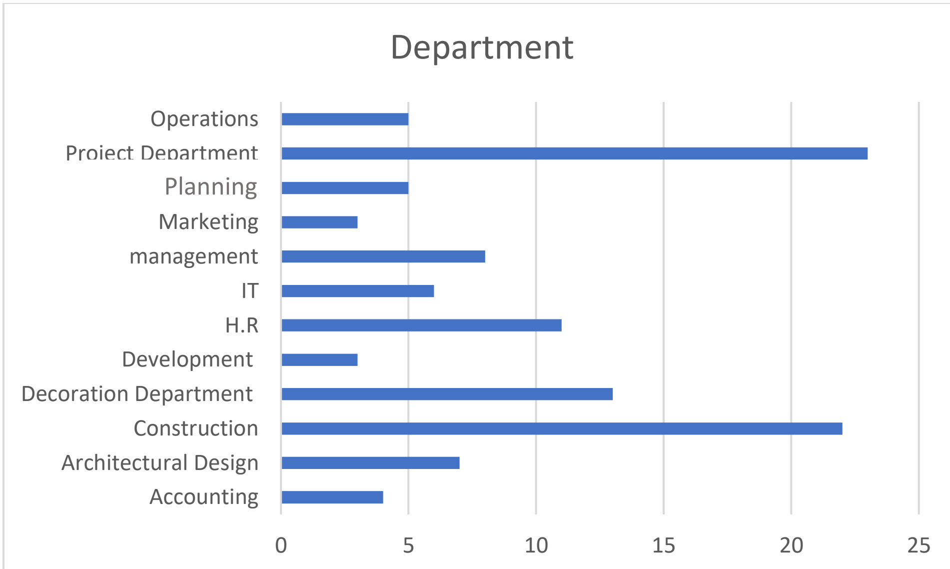


**Figure 4-5: Department**

- Position: the majority of participants occupied positions such as General Manager (GM) and Manager, with a total of 36 participants for both positions. Additionally, the bar chart above shows that architects (14 people), civil engineers (12 people) and project managers (13 people) are common positions amongst participants. Finally, there are also several positions that varied from 2-6 participants, for example, contractors and CEOs.

The study's questionnaire (which had a sample of 400) was aimed at everyone that was responsible for making any decision within the Jordanian construction sector for small and medium sized organisations, this included general managers, CEOs, senior management, project managers, department heads, supervisors and other decision makers in the organisation. All of the participants had experience of significant practices in KM along with BPs, and/or participated in numerous phases of KM, also they were still employed in their organisation. Moreover, in order to improve the validity of the survey the list of the population participants was obtained from JEA which is a solid basis.


**Figure 4-6: Position**

## 4.5. Assessing the Reliability of Respondents' Answers

The reliability of a study links essentially to the integrity of the empirical study and collected data. The reliability assessment is linked to the outcomes of the study, which could be considered reliable if the same results can be noticed if the study is repeated (Field, 2009, p. 673). Additionally, Robson (2011) suggested that if the research was to be performed again and a similar finding reached, reliability would be considered consistent. Cronbach's Alpha Coefficient is the pervasive statistical method applied to discover internally coherent reliability (Field, 2009, p. 674). Corresponding to Nunnally (2010) it is presumed that the reliability factor ought to be larger than 0.5. On the other hand, Field (2009, p. 675) contended that the lowest reliability factor for Cronbach's Alpha Coefficient could be 0.7; this factor and the one above enables the data to be considered reliable and appropriate.

In this research, as suggested by Pallant, (2010) the internal consistency test is utilized to accomplish consistency and the same results over time. The cut-off points for reliability as recommended in the literature is 0.70 α (Santos, 1999; Nunnally, 1978). Table 4-1 indicates the whole of α value to be 0.972 and indicates that the internal consistency for the whole scale was outstanding. As a consequence, the findings were deemed to be reliable and consistent (Nunnally, 1978). Therefore, the constructs are statistically reliable and the outcomes of this study show the actual views of practitioners in the Jordanian construction sector. As a result, all variables are maintained for additional analysis.

**Table 4-1: The internal consistency statistics**

| Constructs | Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|---|
| KM | 0.942 | 0.943 | 37 |
| BPM | 0.946 | 0.947 | 31 |
| DMP | 0.879 | 0.89 | 9 |
| Total | 0.972 | 0.973 | 77 |

## 4.6. The Quantitative Data Analysis of Respondent Perceptions in Jordanian Organisations

In order to analyse the responses from the Jordanian construction organisations, the average of the Likert rating scale was used. The data were classified according to their order in the questionnaire. Moreover, the analyses are organised by individual statement and analysed first by mean and standard deviations. Subsequently, the means of related statements were organised in descending order according to the Likert rating scale.

### 4.6.1. The Perception Towards KM

#### 4.6.1.1. KM Processes

To begin with, the statement ranging from 1-7 had a rank order mean of around 4. This shows that the participants agreed to some extent and that knowledge creation techniques are being applied within the participant's organisation, such as creating alternate solutions to promote construction projects. Furthermore, statement 4 'It is important to capture lessons learnt at various stages of the project had the highest mean with 4.266. This suggests that on average participants were more likely to record data created during their project. However, participants showed that they were less likely to convert staff knowledge into written documents. This had the lowest mean of 3.77. Additionally, statement 2 had the lowest std. deviation of around 0.787, whereas statement 5 had a 1.033 std. deviation. This is the highest number.

**Table 4-2: Rank order for statements related to KM processes (N=110)**

| | No. of statement | Statement | Rank order (Mean | Std. Deviation |
|---|---|---|---|---|
| Knowledge Creation | 4 | It is important to capture lessons learnt at various stages of the project | 4.2661 | 0.80095 |
| | 3 | It is important to capture the experiential knowledge of staff for organisational use. | 4.1560 | 0.79552 |
| | 2 | Policies are placed to allow employees to present new ideas without fear or ridicule. | 4.0275 | 0.78715 |
| | 6 | Staff are encouraged to find alternative solutions to promote construction projects. | 3.8624 | 0.95712 |
| | 7 | New knowledge is usually created to solve specific problems | 3.8073 | 0.96683 |
| | 1 | A number of mechanisms have been used to create or acquire knowledge from different sources such as volunteers, clients, donors or competitors. | 3.7798 | 0.87515 |
| | 5 | The experiential knowledge of staff is usually converted into written documents accessible to the organisation. | 3.7706 | 1.03309 |
| Knowledge Storage | 9 | Databases or information technologies are utilized to store reference material. | 3.9633 | 0.96154 |
| | 11 | There is digital information media storage or a database of skills, expertise and knowledge sources. | 3.8532 | 0.90088 |
| | 10 | Records or various written documents such as newsletters or manuals to store captured information from employees and others are available. | 3.7615 | 0.96128 |
| | 8 | There is a standard process for storing reference material such as policies, procedure manuals, standards, guidelines, strategies, directory of expertise, ideas, notable successes or other practical information. | 3.7248 | 0.95133 |
| Knowledge Distribution | 17 | Experienced staff members are encouraged to mentor the novice staff members | 4.0917 | 0.72701 |
| | 12 | Knowledge is in a form that is readily accessible to employees. | 4.0092 | 0.94766 |
| | 16 | Documents, publications and internal information network are used to distribute knowledge. | 3.8349 | 0.97671 |
| | 14 | Key domain experts are readily identified and contacted. | 3.8073 | 0.90755 |
| | 15 | There is teamwork and regular meetings to transfer knowledge. | 3.7798 | 1.00331 |
| | 13 | There are regular symposiums, lectures, conferences or training sessions to share knowledge and ideas. | 3.6422 | 1.09310 |
| Knowledge Application | 19 | Outcomes from previous experiments feed into the new organisation's projects to improve them. | 4.1743 | 0.77989 |
| | 22 | Staff members are encouraged to apply their implicit knowledge and experience to subsequent projects. | 3.9908 | 0.78758 |
| | 18 | Individuals are asked to keep stored knowledge current and up to date. | 3.9266 | 0.79006 |
| | 20 | There are mechanisms to convert knowledge into action plans. | 3.7431 | 0.88615 |
| | 21 | Barriers that stop individuals, experts and administrators from acquiring knowledge are removed. | 3.7431 | 0.87563 |

In addition, statements varying between 8 and 11 had a rank order mean of approximately 3.8. This means that participants 'agreed' that their organisation used knowledge storage. This may emphasise the fact that the participant's organisation uses storing methods most of the time, For example, it could be using documents and records to save in order to benefit other employees. To add to this, the following statement 'Databases or information technologies are utilized to store reference material' had the highest mean of 3.96, this shows that IT and databases are the most utilized techniques for storing knowledge within organisations in Jordan. However, many participants thought that their organisation sometimes uses a standard process to store knowledge. This had the lowest mean of 3.7. Moreover, statement 11 had a std. deviation of 0.9 which was the lowest, whereas statement 9 had the highest std. deviation of 0.96.

Furthermore, statements from 12-17 had an approximate rank order mean of 4 This means that the organisations in Jordan use methods of knowledge distribution the majority of time. This includes using transferring knowledge, meetings, easy and readily access to key domain experts. Furthermore, the results show that organisations in Jordan are more likely to use experienced staff to help, support and benefit beginners. This had the highest mean of 4.09. However, the results also show that the organisations rarely use seminars and meetings to share knowledge and ideas. This had the lowest mean of 3.64. Moreover, statement 13 had the highest std. deviation of 1.09310, whereas statement 17 had the lowest std. deviation at 0.72701.

In addition, statements from 18-22 had a rank order mean of 4 which suggests that knowledge was applied to some extent. For example, people are told to store present and up to date knowledge. Moreover, statement 19 had the highest mean of 4.17, which indicates that organisations are likely to use feedback from previous projects to develop the existing projects. To add to this, statement 20 and 21 had the lowest mean of 3.7431, demonstrating that it is less likely for organisations to use tools to convert knowledge and to abolish barriers that prevents employees from acquiring knowledge. Furthermore, statement 20 had the highest std. deviation of 0.88615, whereas statement 19 had the lowest std. deviation at 0.77989.

#### 4.6.1.2. KM Technology

Statement 23 to 26 in Table 4-3 has an approximate rank order mean of 3.7. This shows that knowledge management technology is frequently used within organisations in Jordan. This includes the use of office automation systems such as emails, as well as the use of modern technology. The above table also shows that statement 26 has the highest rank order mean of 3.96. This implies that employees within organisations are likely to use IT to communicate amongst each other. However, statement 25 has the lowest rank order mean of 3 which indicates that artificial intelligence is employed the least within organisations in the construction sector in Jordan. This may suggest, further, that IT is preferred and more commonly applied than artificial intelligence. Moreover, statement 26 has the lowest std. deviation of 0.74 and statement 25 had the highest std. deviation of 1.3.

**Table 4-3: Rank order for statements related to KM technology (N=110)**

| No. of statement | Statement | Rank order (Mean) | Std. Deviation |
|---|---|---|---|
| 26 | Information technology supports collaborative work and intra-organisation communication. | 3.9633 | 0.74444 |
| 24 | There is a use of office automation systems (E- mail, automated retrieval of information, word processing, audio-video conferences) to carry out administrative tasks. | 3.9358 | .86362 |
| 23 | Technology is up-to-date in organisation | 3.8349 | .91807 |
| 25 | Artificial intelligence systems are used in organisation. | 3.0550 | 1.31117 |

### 4.6.1.3. KM Knowledge Teams

Table 4-4 shows that the statements from 27 to 37 have a rank order mean of approximately 3.77. This means that the majority of participants, to some extent, almost agreed. This may emphasise the fact that the organisations' knowledge team (managers, employees and other decision makers) play an important role in KM. (For example, employee's motivation). To add to this, participants stated that managers identify results from knowledge bases and this statement has the highest mean of 3.9083. This shows that managers within organisations in Jordan are capable of analysing data from the results. However, many participants thought that their organisation was less likely to collate employees' needs. This had the lowest mean of 3.5872. Additionally, statement 27 had a std. deviation of 0. 72934. This was the lowest, whereas statement 34 had the highest std. deviation of 1.04714.

**Table 4-4: Rank order for statements related to KM teams (N=110)**

| | No. of statement1 | Statement | Rank order (Mean) | Std. Deviation |
|---|---|---|---|---|
| Knowledge Makers | 27 | There are qualified knowledge-makers that the organisation relies on. | 3.8807 | .72934 |
| | 28 | Knowledge-makers maintain modernity and the advancement of knowledge as well as communicate with the outside. | 3.8073 | .82189 |
| | 29 | Knowledge-makers act as consultants for the organisation in the field of knowledge. | 3.6789 | .92176 |
| Knowledge Managers | 31 | Obtain results from the knowledge base. | 3.9083 | 0.78812 |
| | 33 | Representation and adaptation of knowledge along with suitable application by organisation staff. | 3.8349 | 0.86617 |
| | 30 | Collection, classification and knowledge transfer to the knowledge base. | 3.8257 | 0.74342 |
| | 32 | Development of knowledge management programs and its implementation. | 3.7890 | 0.89312 |
| Employee's KM | 37 | Motivating employees to submit their suggestions, opinions and ideas. | 3.8349 | .91807 |
| | 35 | Linking-up employees to knowledge base system at the organisation. | 3.6697 | .80571 |
| | 36 | Linking employees to a group of experts. | 3.6147 | 1.03556 |
| | 34 | Collecting a great deal of knowledge about employees (their needs, their desires, and the degree of their loyalty to the organisation). | 3.5872 | 1.04714 |

**Table 4-5: Statistics of the overall ranks for KM variables**

| Variable | | Mean | Standard deviation |
|---|---|---|---|
| KM Processes | statements 1-22 | 3.896 | 0.8986 |
| KM Technology | statements 23-26 | 3.70 | 0.96 |
| KM Team | statements 27-37 | 3.77 | 0.87 |
| KM | statements 1-37 | 3.84 | 0.902 |

As shown in the table above, statements 1-22 have the highest mean followed by the KM team with KM technology having the lowest mean. This suggests that KM processes are utilized the most in the Jordanian construction sector. In addition, statements 23-26 have the greatest standard deviation followed by KM processes; the KM team has the lowest standard deviation.

Overall, KM had a mean of 3.84 and a standard deviation of 0.902; this implies that KM management is still a major component within organisations in Jordan.

### 4.6.2. Perceptions of BPM

#### 4.6.2.1. Strategic Alignment

**Table 4-6: Rank order for statements related to strategic alignment (N=110)**

| No. of statement | Statement | Rank order (Mean) | Std. Deviation |
|---|---|---|---|
| 41 | There are some plans for improving the existing processes of the company. | 3.9908 | 0.78758 |
| 39 | If strategic goals change, the goals of certain processes are adjusted correspondingly | 3.9633 | 0.80423 |
| 43 | Considered of the construction of new process dimensions to combine different function areas. | 3.9358 | 0.80824 |
| 38 | Goals are often related to the processes and are aligned to the company's strategic goals. | 3.9174 | 0.57941 |
| 42 | Some plans exist when organisations build new processes. | 3.8349 | 0.77596 |
| 40 | The top management team has good communication with the process managers or process owners, especially when the top management makes important decisions. | 3.8349 | 0.92810 |

Table 4-6 above shows that the statements from 38 to 43 had a rank order mean of approximately 3.9. This means that the majority of participants leaned more toward the 'agree' criterion and that there was a range of answers between 4 and 3. This may emphasise the fact that the participant's organisation sometimes uses effective strategic alignment, meaning that processes performed within the organisation sometimes do correspond with the company's strategic alignment. (For example, the organisation's new objectives). In addition, the following statement, 'There are some plans for improving the existing processes of the company' had the highest mean of 3.9901. This shows that organisations in Jordan are likely to consider new plans in order to enhance the process used. However, many participants thought that their organisation was less likely to develop a plan before the process was made and it was less likely that its managers considered a variety of processes when organizing a major decision. This had the lowest mean of

3.8. Additionally, statement 38 had a std. deviation of 0.77596 which was the lowest, whereas statement 40 had the highest standard deviation of 0.92810.

#### 4.6.2.2. Culture

Statements from 44-48 had a rank order mean of 3.7, suggesting that the organisation's norms and values sometimes correlate with the processes performed. (For example, the acceptance of the process value system). In addition, statement 47 had the highest mean of 3.87, indicating that organisations are likely to perform processes that fit the organisation's purpose, idea and values. To add to this, statement 44 had the lowest mean of 3.688, demonstrating that it was less likely for the organisation's management team to understand what was meant by BPM. Furthermore, statement 44 had the highest std. deviation of 0.89956, whereas statement 47 had the lowest std. deviation 0.7589.

**Table 4-7: Rank order for statements related to culture (N=110)**

| No. of statement | Statement | Rank order (Mean) | Std. Deviation |
|---|---|---|---|
| 47 | Processes play a prominent role in the corporate vision, mission and value statements. | 3.8716 | .75891 |
| 46 | The top management pursue the continuous improvement of the existing process and accept the process value system. | 3.8624 | .86568 |
| 45 | Everyone in the management team clearly knows how to apply process management in the organisation. | 3.7890 | .88269 |
| 48 | The top management team has a plan to change the company's culture towards being more process-oriented. | 3.7615 | .82663 |
| 44 | Everyone in the management team clearly knows what BPM is. | 3.6881 | .89956 |

#### 4.6.2.3. People

The statements ranged from 49-52 had a rank order mean of around 3.88. This shows that the participants 'agreed', which means that employees are frequently engaged in the organisation. (For example, knowing the cross-functional department). Statement 52, 'It is important to capture lessons learnt at various stages of the project had the highest mean of 3.99. This suggests that on average participants thought that their organisation's employees were more likely to fully understand the process goals. However, participants indicated that process management was less likely to be used to calculate the potential of the processes in order to create a solution immediately. This had the lowest mean of 3.77. Additionally, statement 52 had the lowest std. deviation of around 0.7757, whereas statement 50 had a 0.86745 std. deviation. This was the highest number.

**Table 4-8: Rank order for statements related to people (N=110)**

| No. of statement | Statement | Rank order (Mean) | Std. Deviation |
|---|---|---|---|
| 52 | The employees who work on the processes know exactly what they should do to accomplish the process goals. | 3.9908 | .77574 |
| 51 | The employees understand correctly cross-functional department cooperation. | 3.9174 | .78326 |
| 49 | The top management, process managers and process owners receive an education in process measurement, control and improvement. | 3.8257 | .81473 |
| 50 | The process management can be used to predict the future results in order to find suitable alternatives dynamically. | 3.7706 | .86745 |

### 4.6.2.4. Governance

**Table 4-9: Rank order for statements related to variable of governance: (N=110)**

| No. of statement | Statement | Rank order (Mean) | Std. Deviation |
|---|---|---|---|
| 54 | The process roles and responsibilities are well-defined. | 3.8440 | 0.79552 |
| 58 | Process management standards are well-defined and documented. | 3.8440 | 0.92471 |
| 56 | All staff members clearly know the responsibility and authority of the process owners. | 3.8165 | 0.84069 |
| 55 | The top management team has a strong capability to deal with differences and contradictions between processes and polices. | 3.7156 | 0.98217 |
| 53 | Staff have the opportunity to engage in decision-making. | 3.7156 | 0.97270 |
| 57 | There is a plan to incorporate suppliers and customers in process management. | 3.6881 | 1.04259 |

The table above shows that the statements from 53 to 58 had a rank order mean of approximately 3.88. This means that the majority of participants were likely to choose ‘agree’.

This may emphasise that the participant's organisation processes consider governance most of the time. (For example, allowing staff to contribute to the decisions made). To add to this, statements 54 and 58 had the highest mean of 3.844, showing that organisations in Jordan are likely to consider processes requirements, functions as well as responsibilities. However, many participants thought that their organisation was less likely to include suppliers and customers in the processes. This had the lowest mean of 3.688. Additionally, statement 54 had a std. deviation of 0.79552 which was the lowest, whereas statement 57 had the highest std. deviation of 1.04259.

#### 4.6.2.5. Methods

**Table 4-10: Rank order for statements related to variable of methods: (N=110)**

| No. of statement | Statement | Rank order (Mean) | Std. Deviation |
|---|---|---|---|
| 61 | Top management has plans to introduce some new methods and enhanced approaches to support process management. | 3.8991 | .73213 |
| 60 | There is a focus on process control and measurement. | 3.7982 | .82529 |
| 62 | The methods identify and conceptualise current (as-is) business processes and future (to-be) processes. | 3.6881 | .86813 |
| 59 | There is a team in charge of BPM execution. | 3.4862 | .93902 |

Statements 59 to 62 have an approximate rank order mean of 3.7. This shows that methods are used frequently within organisations in Jordan. This includes process control and method identification. Furthermore, the table above shows that statement 61 has the highest rank order mean of 3.899. This implies that the organisation creates plans to identify new methods to develop process management. Statement 59 has the lowest rank order mean of 3.486, indicating that a team that is specifically in charge of BPM is used the least within organisations in the construction sector in Jordan. Statement 61 has the lowest std. deviation of 0.73, whereas statement 59 had the highest std. deviation of 0.939.

### 4.6.2.6. Information Technology (IT)

**Table 4-11: Rank order for statements related to variable of information technology: (N=110).**

| No. of statement | Statement | Rank order (Mean) | Std. Deviation |
|---|---|---|---|
| 68 | There is a plan to improve the IT department to make it more suitable for process management. | 3.7706 | 0.87806 |
| 67 | The IT department jointly works with other departments during BPM implementation. | 3.7615 | 0.82663 |
| 66 | The IT department provides the required support to the process management. | 3.7523 | 0.84059 |
| 63 | There is a system that is applied in the IT department. | 3.7431 | 0.91696 |
| 65 | The responsibility of the IT department is clear towards BPM. | 3.7248 | 0.85928 |
| 64 | The IT system fits well within the company's management structure. | 3.6514 | 0.84301 |

Statements 63 to 68 have an approximate rank order mean of 3.73. This shows that information technology is repeatedly considered within organisations in Jordan. This could include the IT department. (For example, receiving a plan from the IT department to enhance the processes). Furthermore, the table above shows that statement 68 has the highest rank order mean of 3.77. This implies that the IT department is likely to provide a plan that works effectively in a specific process. However, statement 64 has the lowest rank order mean of 3.65 as shown above, indicating that the IT system is less likely to function properly within the management structure in the construction sector in Jordan. This may further imply that IT is less likely to be used to provide plans that are related to the company's management structure. Statement 67 has the lowest std. deviation of 0.8266, and statement 63 the lowest std. deviation of 0.91696.

Table 4-12 underscores the fact that the common technique used to approach BPM in the Jordanian construction sector is strategic alignment. This is because statements 38-43 (strategic alignment) have the highest mean of 3.91. In comparison to this the table also indicates that statements 59-62 (methods) are less likely to be utilized in the Jordanian construction sector. On the one hand, statements 53-58 (governance) have the greatest standard deviation. Whereas, strategic alignment has the lowest standard deviation. Overall, the table shows that BPM as a whole is considered and utilized to some extent with an overall mean of 3.80 and a standard deviation of 0.85.

**Table 4-12: Statistics realting to the overall ranks of BPM variables**

| | | Mean | Standard deviation |
|---|---|---|---|
| Strategic alignment | statements 38-43 | 3.91 | 0.78 |
| Culture | statements 44-48 | 3.79 | 0.85 |
| People | statements 49-52 | 3.88 | 0.82 |
| Governance | statements 53-58 | 3.88 | 0.93 |
| Methods | statements 59-62 | 3.72 | 0.84 |
| IT | statements 63-68 | 3.73 | 0.86 |
| BPM | statements 38-68 | 3.80 | 0.85 |

### 4.6.3. The Perceptions of DMP

The statistical analysis outcomes are presented in this section showing how participants within organisations in the construction sector in Jordan perceive DMP as dependent on three variables. These variables are: problem identification speed (PIS); decision making speed (DMS), and the extent of analysis in decision making (DMA)

Table 4-13 shows that the statements between 69 and 71 representing PIS (first variable) have a rank order mean of approximately 3.9. This means that the majority of participants almost agreed to some extent. This may emphasise that the participant's organisation can identify issues quickly to accelerate the DMP for the majority of the time. (For example, identifying major aspects that impact a certain area of the process). To add to this, participants showed that they can identify minor problems that have a potential to be major ones. This statement has the highest mean of 4, indicating that organisations in Jordan are capable of identifying major problems. However, many participants thought that their organisation was likely to identify problems rapidly. This had the lowest mean of 3.8. Statement 70 has the lowest std. deviation of 0.74, whereas statement 71 has the highest std. deviation of 0.7689. The second variable (DMS) was measured using two statements (72 and 73), They have rank order mean of 3.87. However, statement 72 has a higher mean (3.9450) than statement 73 (3.7982), implying that many participants agreed that they spend a long time in meetings, and that BPM and KM shorten the time to make decisions. Statement 73 has a higher std. deviation of 0.84743, whereas statement 72 has a lower std. deviation of 0.74330.

**Table 4-13: Rank order for statements related to DMP variabls: (N=110).**

| | No. of statement | Statement | Rank order (Mean) | Std. Deviation |
|---|---|---|---|---|
| | **In my organisation, both BPM and KM help me to:** | | | |
| Problem Identification Speed (PIS) | 71 | Observe potential problems before they become serious crises | 4.0367 | .76892 |
| | 70 | Identify the key factors that impact the area of my responsibility. | 3.8807 | .74193 |
| | 69 | Determine potential problems faster. | 3.8349 | .75171 |
| Decision Making Speed (DMS) | 72 | Shorten the timeframe for making decisions. | 3.9450 | .74330 |
| | 73 | Spend less time in meetings. | 3.7982 | .84743 |
| The Extent of Analysis in Decision Making (DMA) | 77 | Engage more in in-depth analysis. | 4.0000 | .82776 |
| | 75 | Examine more alternatives in decision-making. | 3.9908 | .75149 |
| | 76 | Use more sources of information in decision-making. | 3.9450 | .69168 |
| | 74 | Spend significantly more time analysing data before making a decision. | 3.8899 | .85353 |

The question focused on using both of the KM and BMP variables to see their influence on the DMP. This is because the interrelation between KM and BPM, has the ability to help the process of BPs through merging KM techniques with the day-to-day operations. Also, the integration between KM and BPM helps to increase the efficiency of utilising knowledge in the organisation by improving the abilities in the way knowledge is used and it would enhance the process of DM through determining problems more rapidly and increasing the speed of decision making and analysing decision making effectively.

Additionally, statements between 74-77 measured the third variable (DMA), which has a rank order mean of approximately 3.96, showing that many participants agreed to some extent. This suggests that KM and BPM provide considerable benefit to DMA. Statement 77 has the highest mean showing that both KM and BPM provide the greatest help with in-depth analysis. On the other hand, statement 74 has the lowest mean of 3.8899, indicating that both KM and BPM help the least with more time being spent on analysing data before conducting a process. In additions, statement 74 has the highest std. deviation of 0.85353, whereas statement 76 has the lowest std. deviation of 0.69168.

**Table 4-14: Statistics of the overall ranks for DMP variables**

| | | Mean | Standard deviation |
|---|---|---|---|
| PIS | statements 69-71 | 3.92 | 0.75 |
| DMS | statements 72-73 | 3.87 | 0.8 |
| DMA | statements 74-77 | 3.92 | 0.777 |
| DMP | statements 69-77 | 3.96 | 0.78 |

On the one hand, the table above shows that statements PIS and DMA have the same mean at 3.92. Surprisingly, PIS has the lowest standard deviation. On the other hand, DMS has the lowest mean and the highest standard deviation of 0.8. Generally, DMP (statements 69-77) has the greatest mean (3.96) out of KM and BPM. This may imply that DMP is highly utilized and considered in the Jordanian construction sector. Lastly, DMP has a standard deviation of 0.78.

# 4.7. Likert Scale Response Analysis

## 4.7.1. KM

### 4.7.1.1. KM Processes

#### a. Knowledge Creation

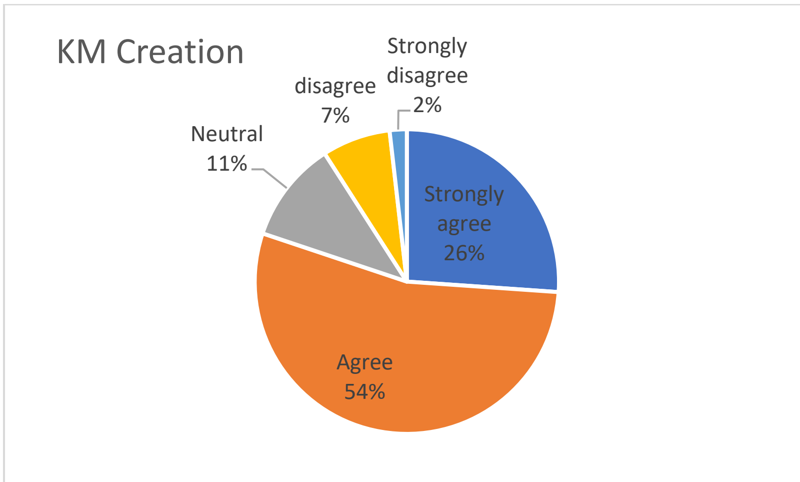


**Figure 4-7: Knowledge Creation**

Processes have 4 variables to measure KM with creation being one of them. As shown in Figure 4-7, the majority have agreed to the statements provided in the questionnaire followed by 'strongly agree'. This means that a number of mechanisms have been used to create or acquire knowledge from different sources such as clients, donors or competitors in the organisation. As a result, the participants were satisfied. A small number of people disagreed, which again encourages the idea that respondents were satisfied with the creation of processes within the organisation.

## b. Knowledge Storage

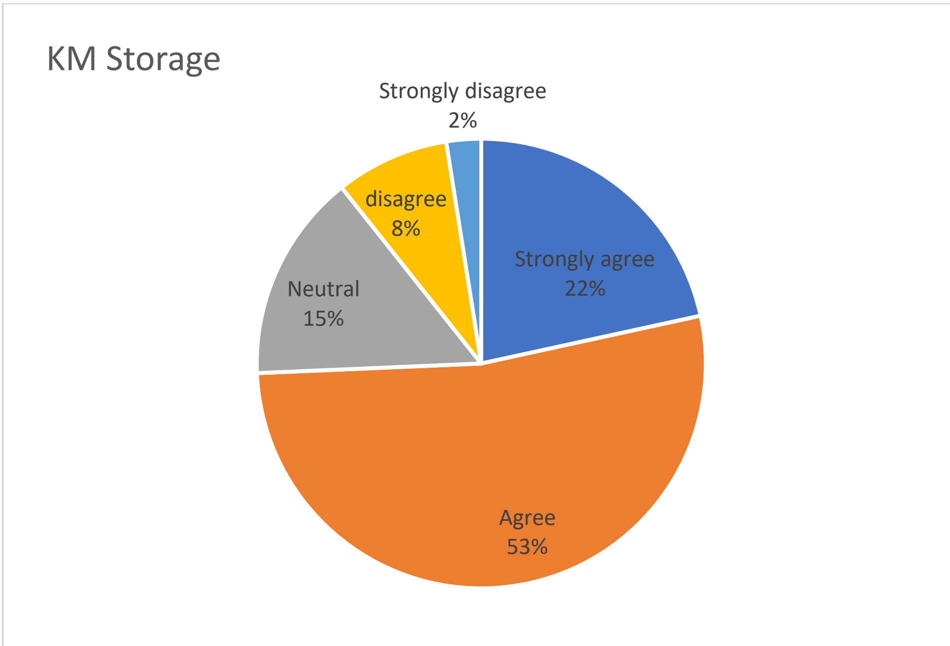


**Figure 4-8: Knowledge storage**

More than half of the respondents agreed to a large extent that they were satisfied (see Figure 4-8). This is encouraging and suggests that there are digital information media storage or a database of skills, expertise and knowledge sources available. Moreover, it may indicate that there is a standard process for storage reference material, including guidelines, strategies, policies, manual methods or processes, lists of expertise, significant successes and other applied information.

### c. Knowledge Distribution

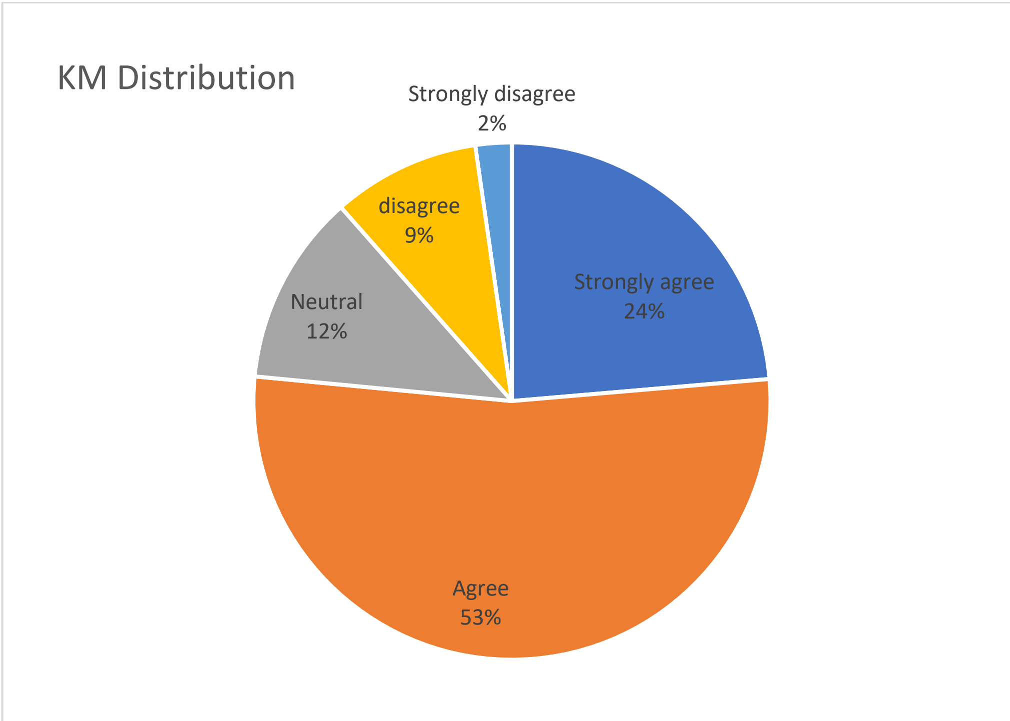


**Figure 4-9: Knowledge distribution**

Figure 4-9 above indicates that the majority have agreed to statements provided in the questionnaire. The fact that this number of people have shown their approval suggests that the organisations use documents, publication, and internal information networks to distribute knowledge. In addition, it shows there are regular symposiums, lectures, conferences, or training sessions to share knowledge and ideas. As a result, knowledge is in a form that is readily accessible to employees throughout these sessions.

### d. Knowledge Application

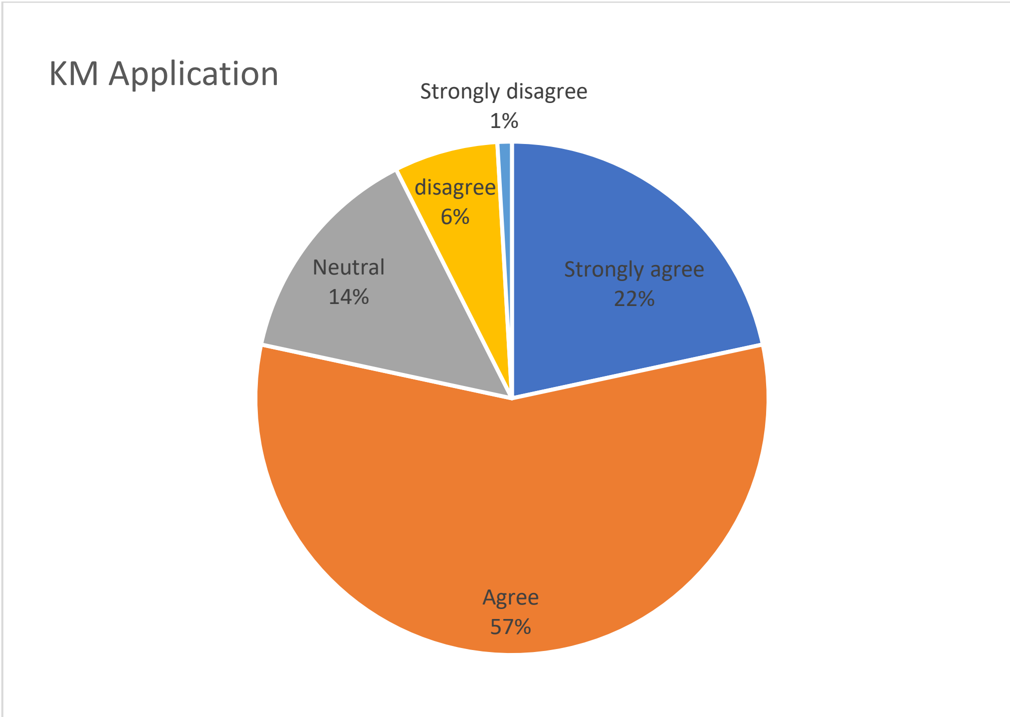


**Figure 4-10: Knowledge Application**

This pie chart (Figure4-10) shows that most people have both agreed and strongly agreed. This means that the organisation's staff members (decision makers) are encouraged to apply their tacit knowledge and experience to subsequent projects and are able to solve problems and therefore improve these projects. (For example, improving new projects based on the outcomes from previous experiments). In addition, they are able to convert knowledge into action plans and remove barriers that prevent individuals, experts and administrators from acquiring knowledge.

Overall, the majority of the respondents agreed to the statements provided in the section on KM processes, meaning that decision makers within the organisation are, to a certain extent, satisfied with the processes.

### 4.7.1.2. KM Technology

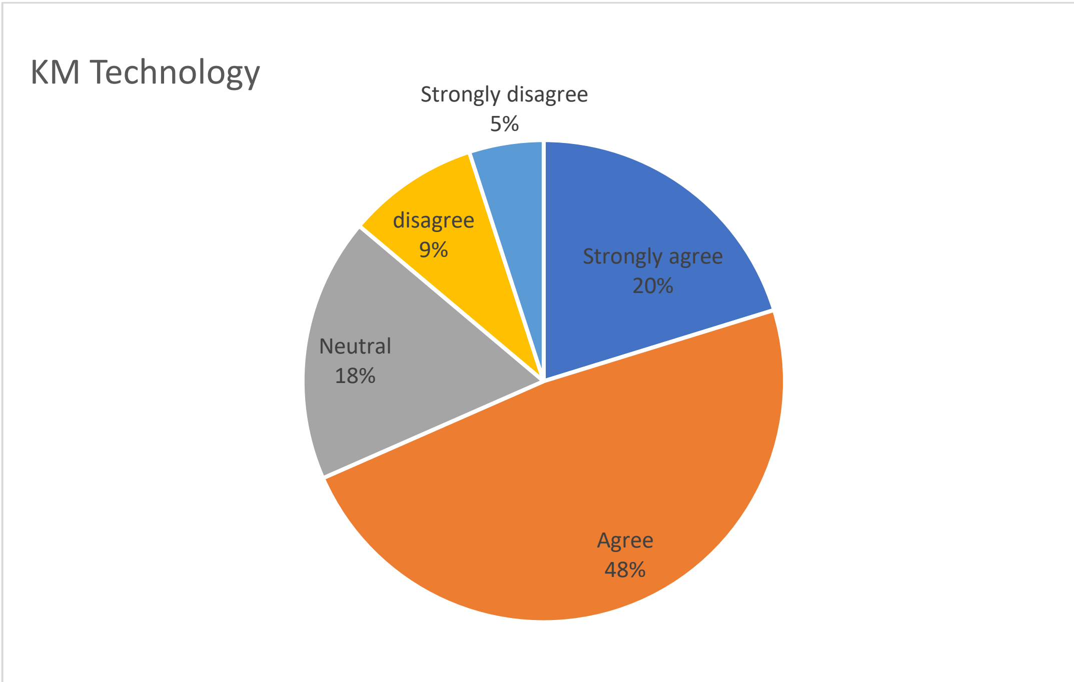


**Figure 4-11: KM Technology**

Respondents have agreed, as shown in Figure4-11, that technology is up to date in the organisation. This allows decision makers such as managers to use office automation systems to carry out administrative tasks. This may also suggest that information technology supports collaborative work and inter-organisational communication.

However, a small number disagreed and this may be because of the environment of the organisation. This means that the organisation does not provide their employees with up to date technology, and there is no use for office automation systems.

### 4.7.1.3. Knowledge Teams

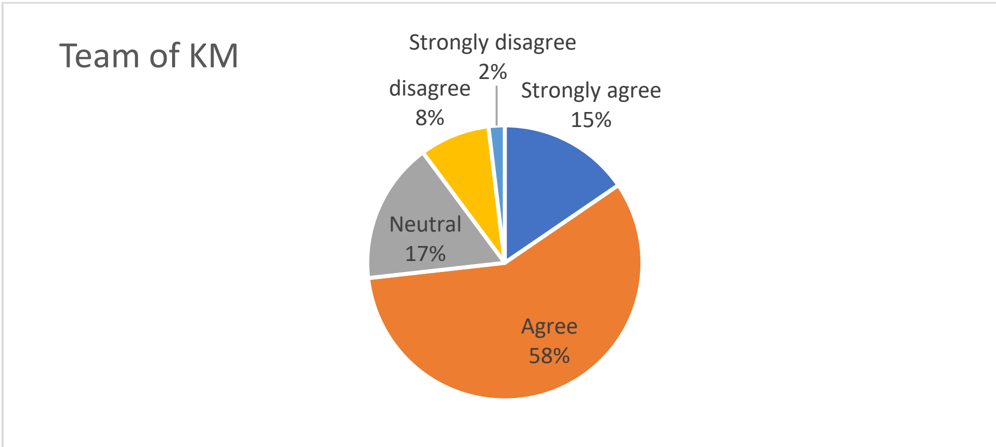


**Figure 4-12: Team of knowledge**

Figure 4-12 shows a significant difference between agree (58%) and disagree (8%). This means that there are qualified knowledge makers that the organisation relies upon. This also suggests that knowledge makers maintain modernity of knowledge and communication with external organisation. As a result, this supports the idea that respondents agree that knowledge makers are an important component of KM. In conclusion, this variable used to measure KM revealed an effective result on how important it is.

## 4.7.2. BPM

### 4.7.2.1. Strategic alignment

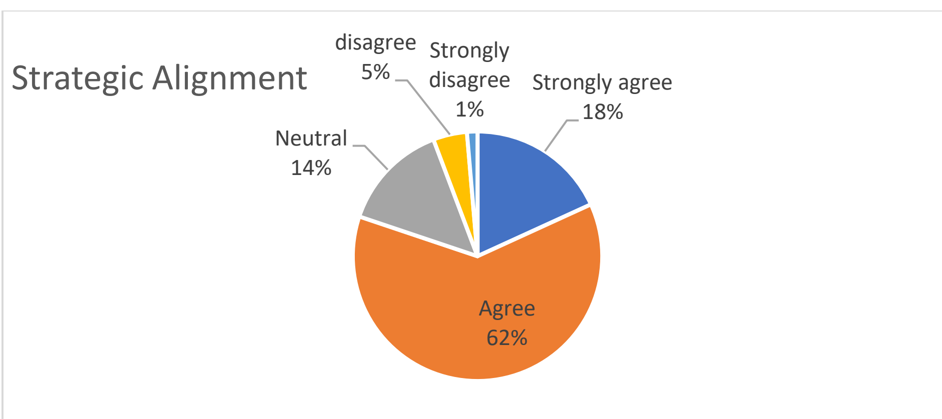


Figure 4-13: Strategic alignment

The majority of respondents agreed on various statements such as 'if strategic goals change, the goals of certain processes are adjusted correspondingly'. This shows that decision makers are aware that improvements are being made to link the organisation's needs and enterprise processes in order to accomplish their business targets. Additionally, goals are often created for the processes and are aligned to the company's strategic goals. Furthermore, a small number of people strongly disagreed, implying that certain plans such as building a new process dimension to merge various function areas are being formed.

### 4.7.2.2. Culture

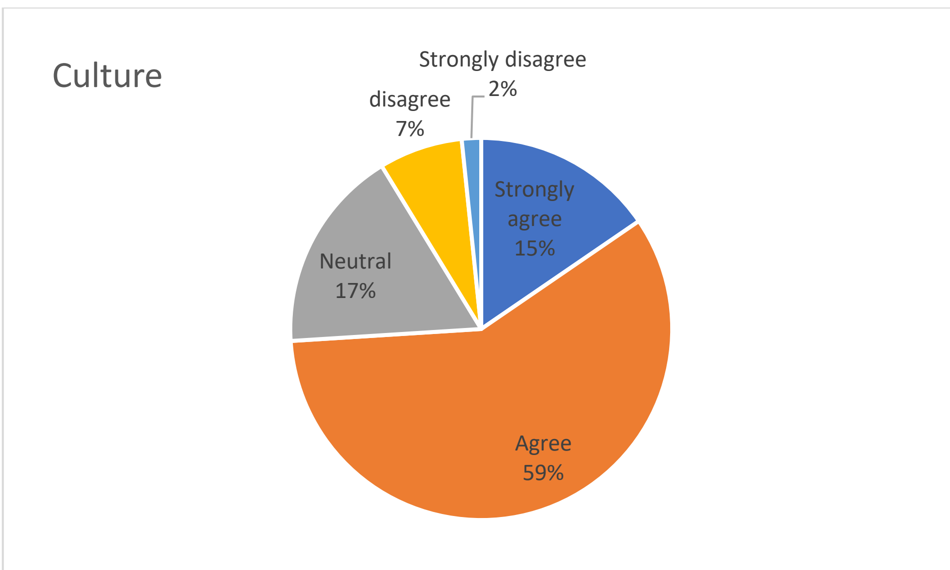


**Figure 4-14: culture**

Most respondents agreed that everybody within their organisation obviously knows the meaning of managing business processes and knows exactly how to utilize process management for the benefit of the organisation. Furthermore, more than half of the respondents agreed that top management has a plan to alter the organisation's culture to make it more process-oriented. This reinforces the idea that culture is still an important aspect of BPM.

Additionally, the respondents approve and accept BPM to allow top management to pursue the continuous improvement process. This benefits the organisation as it allows the process to occur without any conflict between decision makers.

#### 4.7.2.3. People

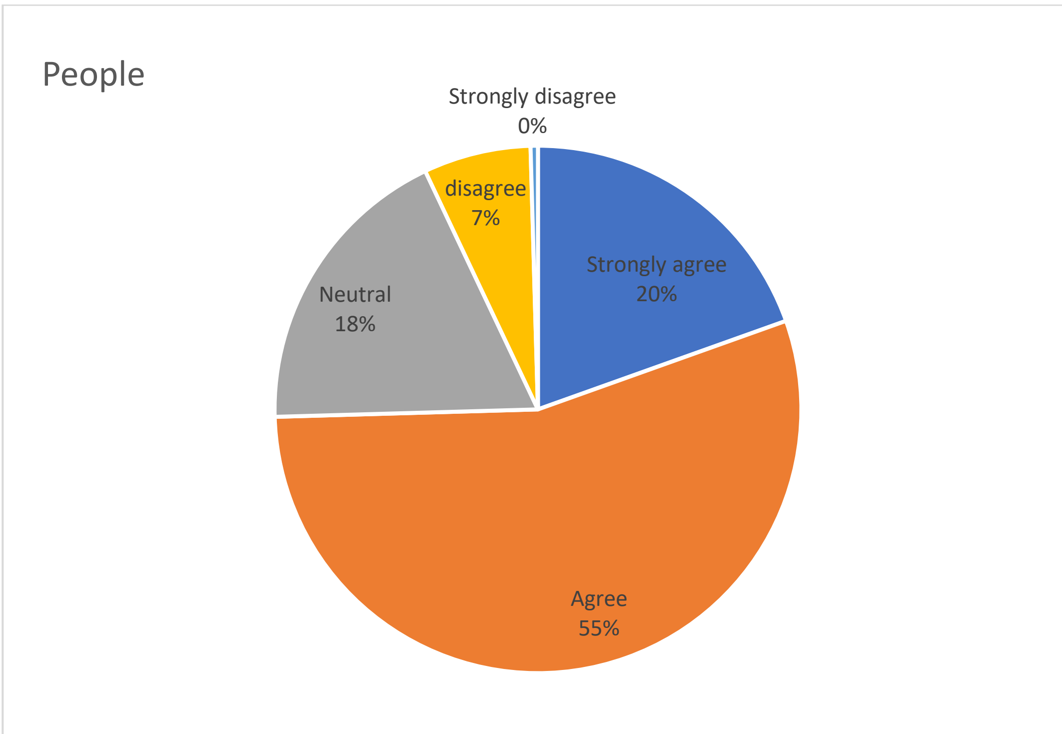


**Figure 4-15: People**

The results showed that this factor (people) has an effect on the productivity of the decision makers. This means that the manner in which employees carry out their everyday, duties is important and that if they do not alter their practices it will be difficult to adopt a new strategy. In addition, the fact that rarely any respondent strongly disagreed encourages the idea that decision makers have a full understanding of multiple areas.

Many decision makers in the sample agreed to statements about whether they received any education on measurement, control and improvement in order to be aware of what must be done to achieve the process's aims. The fact that rarely any respondents strongly disagreed encourages the idea that decision makers have a full understanding of many things. (For example, employees understanding cross-functional departmental cooperation).

#### 4.7.2.4. Governance

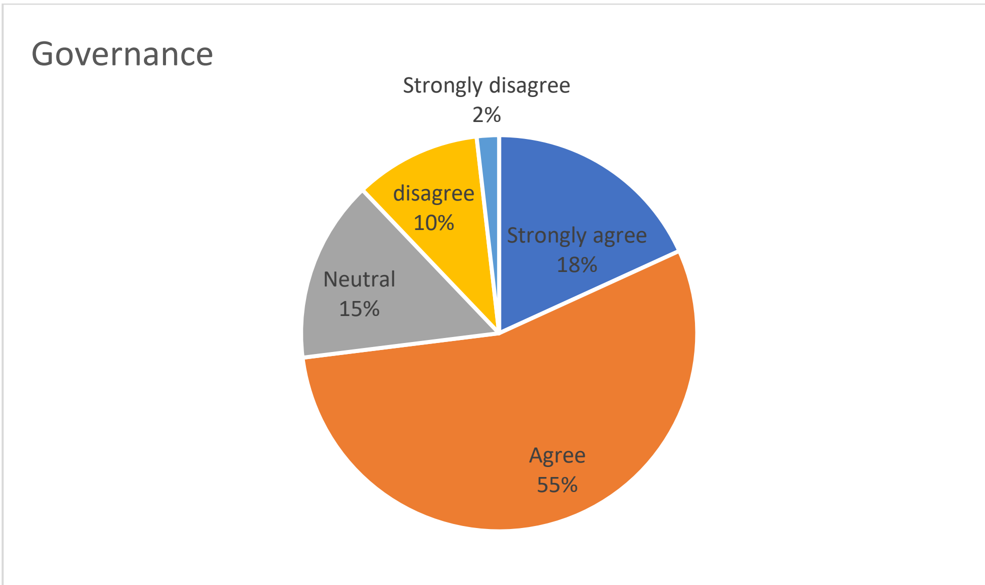


**Figure 4-16: Governance**

As shown in Figure 4-16, over half of the participants agreed and 18% of participants strongly agreed. However, only 2% of participants strongly disagreed. The fact that most people agreed shows that they agree that staff members are able to engage in decision-making, define process roles, are capable of dealing with differences and contradictions between processes and polices, and responsibility and authority is shown by the process owner. This suggests that the organisation’s processes are running smoothly and once again highlights the idea that governance is important to control roles.

### 4.7.2.5. Method

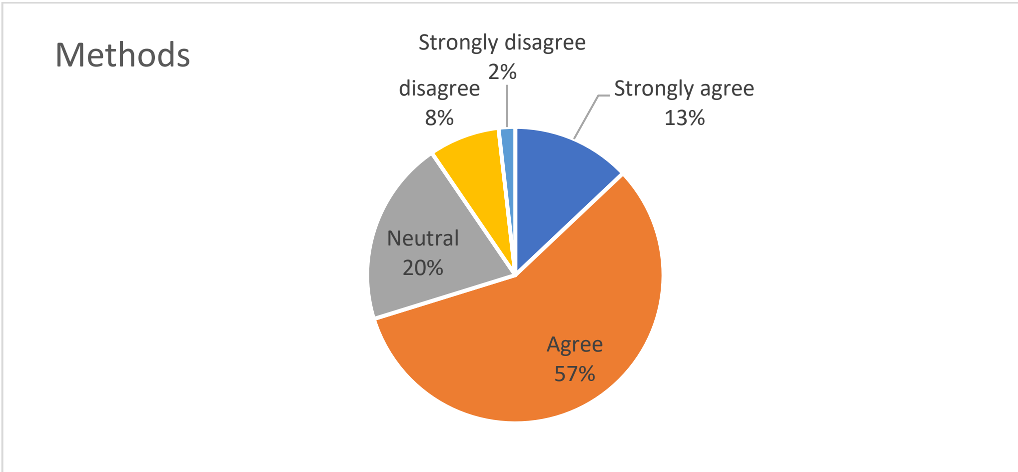


**Figure 4-17: Method**

As shown in Figure 4-17, the most common response was ‘agree’. They agreed to statements such as ‘The top management has the plans to introduce some new methods and an enhanced approach to support process management.’ This highlights the idea that methods identify and conceptualise current business processes and future processes within an organisation. Additionally, many respondents have shown their agreement that there is a focus on process control and measurement within their organisation.

### 4.7.2.6. Information Technology

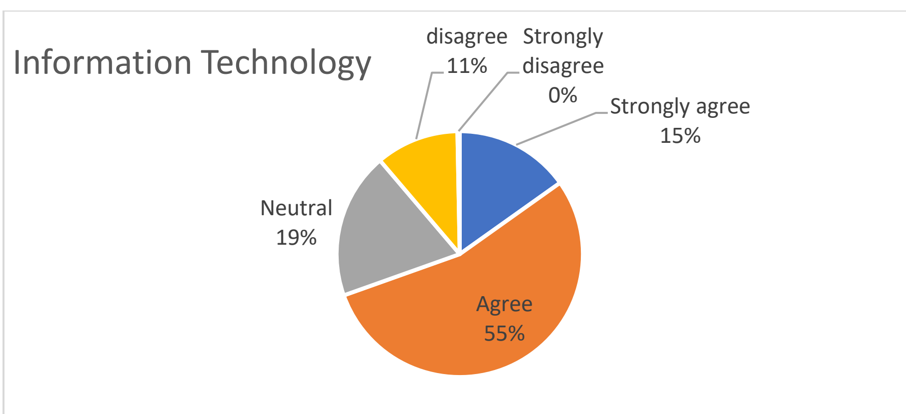


Figure 4-18: Information technology

Information technology incorporates software, hardware as well as information management systems. It is an important factor because it improves the process activities. The findings of this research (Figure 4-18) show that there is no lack in providing a system that works within the company's management structure. This means that the company's management is running effectively without any problems.

Decision makers have agreed that the responsibility of the IT department with regard to the BPM is clear and that there is a plan to enhance the information technology department to make it more effective for process management.

To sum up, the average of the responses in BPM is 'agree', implying that factors in an organisation such as people, IT and culture do have an influence on BPM , and on how the organisation works.'

### 4.7.3. DMP

#### 4.7.3.1. Problem Identification Speed-PIS

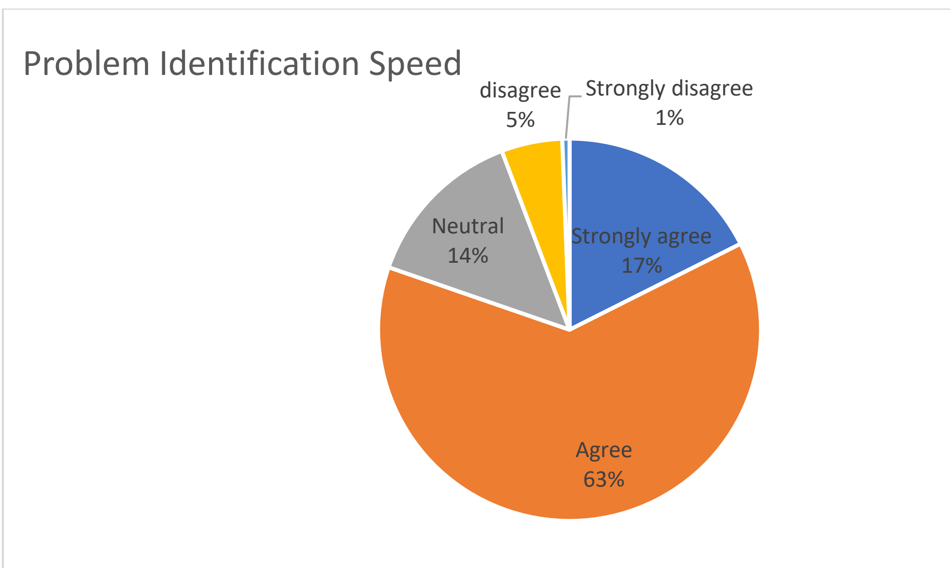


**Figure 4-19: Problem identification speed**

Figure 4-19 shows that many of the responses agreed that their organisation, for BPM and KM, has helped them to determine problems more rapidly and they have noticed potential problems before they have become serious crises. This means that BPM and KM have influenced the speed at which the decision makers sampled were able to identify the problem. Additionally, the faster the problem is identified, the easier it is to solve or to perform appropriate tasks or processes in order to solve it.

#### 4.7.3.2. DM speed

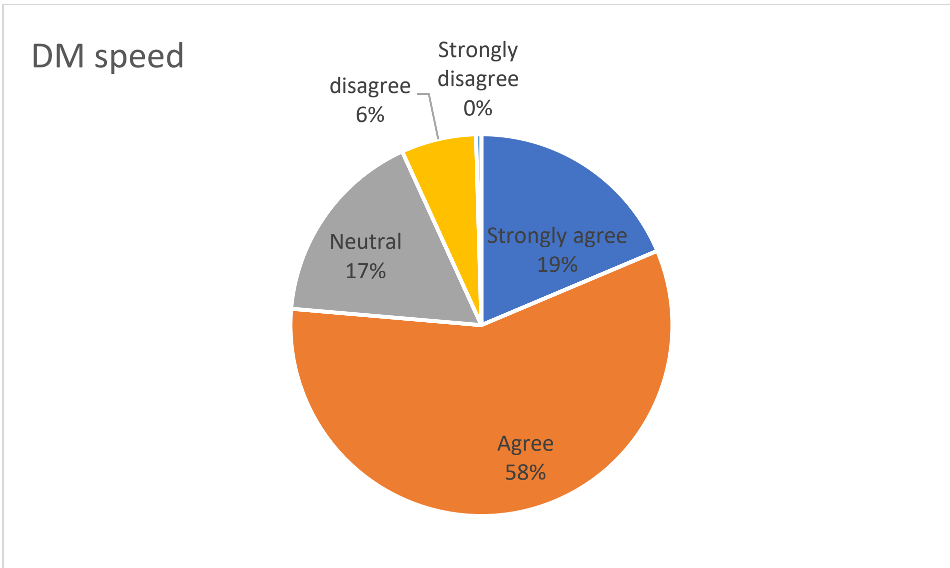


**Figure 4-20: DM speed**

As shown in Figure 4-20, a high proportion of the responses indicated ‘agree’, suggesting that the ‘decision making’ tended to be faster. This might be because participants needed to spend more time on productivity and performing the processes.

#### 4.7.3.3. DMA - The Extent of Analysis in DM

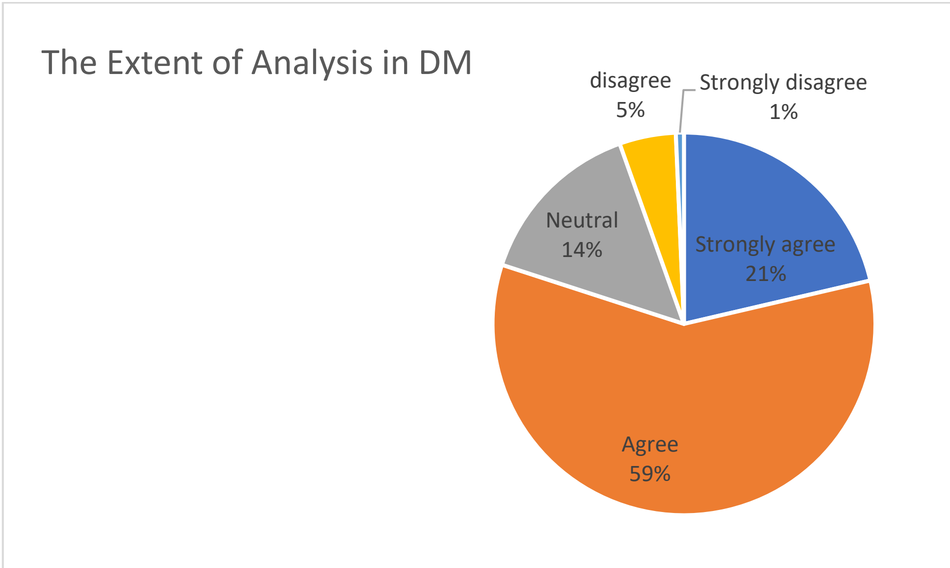


**Figure 4-21: The extent of analysis in DM**

This factor evolves around the analysis in decision making; in Figure 4-21 'agree' was the most selected option. This means that respondents agreed to statements such as 'Spend significantly more time analysing data before making a decision', indicating that the organisation lacks time performing analyses Furthermore, most of the responses suggested that they wanted to examine more alternatives in decision-making and include more in-depth analysis.

With regard to the previous factor (DM speed), respondents indicated that they wanted to spend less time in decision making and meetings, whereas with DMA they wanted to spend more time. Perhaps, spending more time in meetings affects their time spent analysing or searching for alternative methods.

**Table 4-15: Statistics in the Likert scale response for KM, BPM and DMP**

| | Strongly agree | Agree | Neutral | disagree | Strongly disagree |
|---|---|---|---|---|---|
| KM | 20.81% | 54.55% | 14.37% | 8.06% | 2.21% |
| BPM | 16.66% | 57.07% | 17.10% | 7.95% | 1.23% |
| DMP | 19.49% | 59.80% | 14.85% | 5.25% | 0.61% |

The analysis above (Table 4-15) shows that the majority of the sample population in section KM (54.55%) agreed indicating that they agreed to a certain level of satisfaction. In addition, 20.81% of the participants chose 'strongly agree'. The table also shows that a small proportion of the sample (8,06%) disagreed.

Section BPM is similar to section KM, where the majority of participants agreed; a small number disagreed. However, in this section more people selected the neutral option (17.10%), whereas in section KM the percentage was 2.6% less (14.37%).

Similarly, section DMP also shows that the majority of participants selected the 'agree' option by 59.80%. Furthermore, this percentage of the participants was higher than sections BPM and KM. Additionally, 5.25% of participants in this section disagreed. In contrast, the other two sections have a higher percentage of disapproval than section DMP.

Overall, the total number indicates that most of the participants agreed with 56.1%, followed by 19% who choose to strongly agree. In addition, 15.6% chose neutral in the entire survey. Finally, a total of 9.3% of the participants disapproved.

## 4.8. Research Hypotheses

By contextualising a framework for the integration of KM and BPM to support DMP, the variables were determined from existing theories and the relevant literature and summed up in a theoretical framework containing three central elements. In the first element (KM), three sub-variables have been identified: KM processes, KM technology and the KM team. In the second element (BPM), six sub-variables were recognised: strategic alignment, governance, methods, culture, IT and the skills and attitudes of people. In the third element, the DMP: problem identification, the speed of DM and the extent of analysis were identified.

This research reflects two main hypotheses derived from the research framework illustrated in Chapter 2 (Figure 2-13). Each of these hypotheses is segmented into several hypotheses. Usually, the hypothesis is an essential component of study for scientific research as it is one way to motivate the researcher to concentrate on the main subject. Similarly, it is another assumption made to assess its logical or empirical outcomes (Kenya, 2013). In this research, the focus is on knowledge management and business process management. These two contemporary terms are important for the process of DM and its outcomes. Merriam (2009) and Bogdan and Biklen, (1992) indicated that the hypothesis guides the researcher to find answers to tentatively adopted generalizations (Punch, 2005).

Two hypotheses to be justified are offered in this research. The structure and their relationship with the key variables of this research are shown in Figure 4-22.

### 4.8.1. The First Hypothesis

H.1 There is a significant relationship between KM and BPM. This hypothesis is subdivided into the following hypotheses.

H.1.1 There is a significant relationship between the processes of KM and strategic alignment.

H.1.2 There is a significant relationship between KM processes and governance.

H.1.3 There is a significant relationship between the processes of KM and methods.

H.1.4 There is a significant relationship between KM processes and culture.

H.1.5 There is a significant relationship between KM processes and IT.

H.1.6 There is a significant relationship between KM processes and people (attitude, skills).

H.1.7 There is a significant relationship between the technology of KM and strategic alignment.

H.1.8 There is a significant relationship between the technology of KM and governance.

H.1.9 There is a significant relationship between the technology of KM and methods.

H.1.10 There is a significant relationship between the technology of KM and culture.

H.1.11 There is a significant relationship between the technology of KM and IT.

H.1.12 There is a significant relationship between the technology of KM and people (attitude, skills).

H.1.13 There is a significant relationship between team knowledge and strategic alignment.

H.1.14 There is a significant relationship between the team and governance.

H.1.15 There is a significant relationship between team knowledge and methods.

H.1.16 There is a significant relationship between the team and culture.

H.1.17 There is a significant relationship between the team and IT.

H.1.18 There is a significant relationship between the team and people (attitude, skills).

### 4.8.2. The Second Hypothesis

H.2 There is significant effect in the integration of KM and BPM in DMPP. Subdivided into the following hypotheses:

H.2.1 There is a significant effect in the integration of KM and BPM in problem identification speed (PIS)

H.2.2 There is a significant effect in the integration of KM and BPM in decision-making speed (DMS).

H.2.3 There is a significant effect in the integration of KM and BPM in the extent of analysis in decision making (DMA)

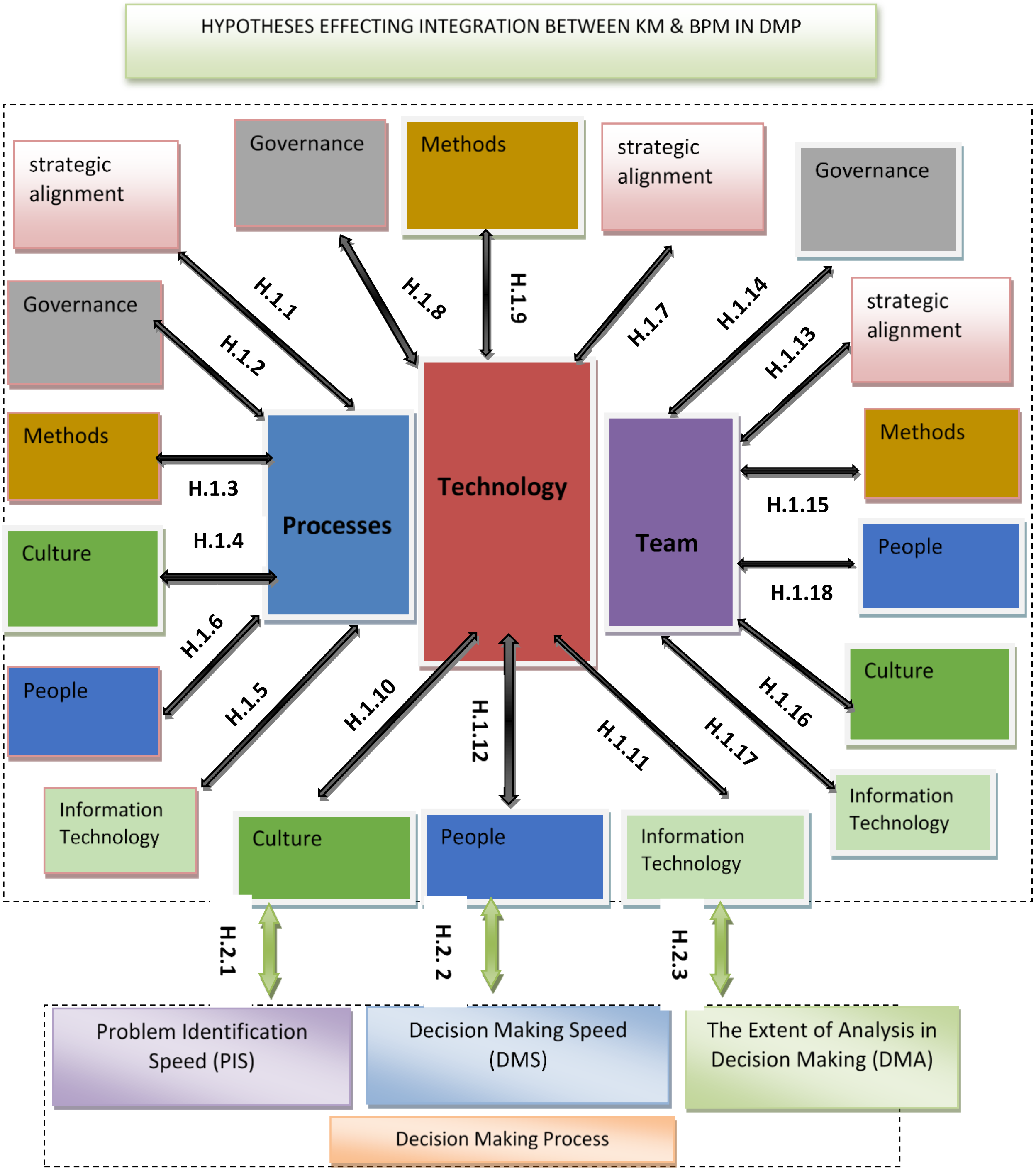


**Figure 4-22: Hypotheses effecting integration between KM and BPM in DM**

## 4.9. Operationalisation of Variables

- *KM & Strategic Alignment (H1.1, H1.7, H1.13)*

Both the strategic direction and the missions within the organisation have a significant relationship within the growth of KM as the organisational strategy helps to find the location of its clients and competitors.

Abou-zeid and Cheng (2004) argued that the type and size of knowledge needed to succeed in the industry is dependent upon the strategic choices that the organisation makes.

A number of studies state that KM strategic alignment benefits the organisation's performance (Kekwaletswe & Mathebula, 2014; Al-Ammary, 2014; Chen & Huang, 2010). The main solution to the inconsistency of KM productivity is KM strategic alignment because KM strategic alignment has an impact on the business values such as innovation (Choe, 2014), and it allows organisations to obtain the necessary knowledge that is associated with their goals, objectives and plans (Asoh, Belardo, & Duchessi, 2008).

The strategy of managing knowledge in an organisation, which can provide guidelines for making decisions and achieving outcomes from knowledge management initiatives, should achieve the organisation's strategic knowledge demands. Through combining knowledge management with business strategies, the strategic knowledge requirements of an organisation can be effectively achieved within the management processes of knowledge assets (Wu and Lin 2009).

- *KM &* Governance *(H1.2, H1.8, H1.14)*

Due to the fact that business processes and KM plays a major role in organisational achievement, including some governance is important to develop and sustain enhancement to the organisational performance (Spanyi, 2010), aid the organisational objectives and reduce the risks related with the utilisation of IT (Bernroider, 2008). Business process governance (BPG) is considered one of the six fundamental basics needed to develop BPM (Rosemann and Brocke, 2010).

Operative BPG needs to strengthen the strategic alignment between process management activities and the business's main concerns (Jesus et al., 2009), so it is recommended that BPM practices be associated and combined with business governance and management systems such as KM (Doebeli et al., 2011).

BPG is organised by creating applicable and clear process roles and responsibilities, process management decision creating and certain other processes to help obtain the required process activities (Doebeli et al., 2011; Scheer and Brabander, 2010).

The governance process should be established effectively in order to guarantee an efficient distribution of services, both Rosemann and Von Brocke (2015) believed that for this to happen there has to be a wide range of knowledge utilised throughout, allocating appropriate roles and responsibilities in the levels of BPM.

- *KM and Methods (H1.3, H1.9, H1.15)*

The definition of methods refers to the approaches which an organisation practises to help its process-based activities and is a major success aspect of BPM (Melenovsky and Sinur, 2006).

One example of the methods that organisations use to allow them to deal with their processing systems is Six Sigma. Both KM and Six Sigma are different from each other, but they sustain each other, helping to build a powerful base used to gain knowledge when is used effectively. Pinjari and Teli (2018) strongly believed that both KM and Six sigma have to be merged to deliver a strong management strategy as the two of them provided the organisation's system with problem-solving and process-enhancement methods. Additionally, KM and Six Sigma aid each other. Six Sigma is an organised and systematic method throughout the project and in addition all the knowledge used is recorded, therefore Six Sigma supports KM. Furthermore, if there is a new Six Sigma project all the data are stored methodically and this is time-conducive and fewer resources will be needed so costs will decrease and money saved. Hence, KM supports Six Sigma and decreases the costs in improving the quality.

Integrating Knowledge management variables with methods such as Six Sigma or using Lean techniques that support the business processes will lead to a decrease in costs due to fault deterrence and an enhanced product and process resulting in an increased profit and market share in addition to achieving high quality, consistency and productivity within the organisational processes.

- *KM & Culture (H1.4, H1.10, H1.16)*

As indicated by Bandara et al., (2009), organisational culture infers the standard direction which individuals carry out within their associations. It is exceptionally difficult to alter an organisation's culture within a brief timeframe; thus, the attributes of culture are viewed as the main features which impact BPM project success (Grugulis and Wilkinson, 2002). Brock and Rosemann (2015) affirm that culture is a significant factor with respect to BPM as well as being critical for associations in recognizing the possible protection from alteration or an absence of process consideration toward the start of establishing BPM.

The success of KM is obtained through creating a helpful culture during the enhancement of the KM systems (Ajmal and Koskinen (2008)). Consequently, the organisation's culture plays a major role in the organisation's capability to produce value by taking advantage of the knowledge asset (Wei, 2005). Therefore, KM and the organisation's culture must work together logically (Ajmal and Koskinen, 2008).

Hence, it is clear that the organisation's culture impacts the organisational KM through influencing staff behaviour. Furthermore, the organisational culture is undoubtably important in enabling knowledge making, storing, transferring and utilization (Schmitz et al., 2014; Prabhakar et al., 2018; Leidner and Kayworth, 2006;).

Choosing the organisation culture's features is vital as it helps develop KM effectively (Lee and Choi, 2003). Moreover, creating a helpful culture during the enhancement of KM systems within an organisation results in the development of KM (Ajmal and Koskinen 2008), and additionally, the organisation's culture plays an important role in creating value within utilised knowledge assets. Overall, the culture of an organisation affects KM, due to the fact that KM involves communication and interaction between employees.

Moreover, a culture that mainly focuses on knowledge has values and norms that promote and explore the development of organisational knowledge and continuous learning as claimed by Cardoso et al., (2012).

KM variables and the organisation's culture work together because they reinforce the establishment of an environment that could easily increase BPM activities in order to combine values and beliefs This results in the creation of behaviours and attitudes that improve the organisational value chain. Furthermore, organisations manage culture to identify any possible protection; for example, if any employee lacks process understanding or if there is a change occurring at the start of the launch of BPM (Rosemann and Von Brocke, 2015 and Rosemann and De Bruin, 2004))

- *KM & IT (H1.5, H1.11, H1.17)*

To develop the KM environment, advanced KM capability must be coupled with a more advanced quality of IT based upon the specific needs of an organisation (Sher and Lee, 2004; Tanriverdi, 2005) and the organisation's KM strategy should create a path identifying how information technology can aid the knowledge activities of the organisation (Chen and Huang, 2010). The use of information technology in the process activities is an important factor in managing business process achievement (Melenovsky and Sinur, 2006) and IT ought to be used in enhancing the efficiency of BP instead of merely automating the processes. Furthermore, IT assumes a vital role in BPM ventures as it helps to control the development of business process modifications and encourages the process design stage.

- *KM & People (H1.6, H1.12, H1.18)*

An organisations' employees play a major role in the provision of the organisation's knowledge base due to their experiences, skills and capabilities gained through work activity (Shamsi, 2017).

Sabokro et al., (2018) highlighted the fact that sharing knowledge is essential within organisations as it plays a role in human resource management and therefore directors should improve their perceptual, human and operational abilities. Furthermore, Shamsi (ibid) considered the relationship between KM and the communication skills of directors stating that improving their communication skills leads to much improved creativity from employees and enhanced growth within the organisation.

For BPM to be portrayed and represented successfully, employees within the organisation are required to alter their behaviours and traditional methods towards their work. They need to organise ways to coordinate their attempts to accomplish the process outcomes with the aim of gaining knowledge throughout the implementation of BPM (Jeston and Nelis, 2014).

While the IT factor secures Information-Technology-based assets, the "people" component contains HR. This aspect is characterized by the individuals as well as the groups that repeatedly improve and implement their expertise and knowledge in business management to enhance the organisational performance. Process aptitudes and skills are focused on the completeness as well as the complexity of the capacities of the included stakeholders within the particular requirements of the BPs. This is a vital aspect for process owners associated with the administration and tasks of a process.

*Integration between KM and BPM with the Decision- Making Process (*H2.1, H2.2, H2.3)

KM is business and process oriented (Zhang, 2013) and the aim is to transfer the right knowledge at the right time to the right people in order to enhance the effectiveness of decision making within the organisation (Chu et al., 2011).

BPM has arisen as a major technological component mainly in the past thirty years to provide process support to organisations along with achieving better decision-making. Nemati et al., (2002) stated that KM initiatives have the ability to simplify the capture, coding and sharing of knowledge within organisations; this is essential for the improvement of the DMP.

KM and BPM have arisen as key technology with the goal of providing process support to organisations and supporting better decision making (Deokar and El-Gayar, 2008; Chu, 2011). Moreover, Zhang and Lu (2007) highlight the importance of the interrelation between KM and an enterprise’s BPs in order to support decision making efficiently and effectively.

## 4.10. An Analysis of the Integration Between KM and BPM

Hypothesis one: H.1 There is a significant relationship between KM and BPM. This hypothesis is subdivided into the following hypotheses. (the analysis can be found in appendix A)

1. H.1.1 There is a significant relationship between the process of KM and strategic alignment.

Linear regression was carried out to investigate whether the processes of KM could significantly predict strategic alignment. Results of the linear regression indicated that there was a significant effect between the processes of KM and strategic alignment, $F(1, 109) = 101.516$, $p < .001$). The processes of KM explained 48.5% of the variance in strategic alignment. The KM processes predictor was examined further and indicated that the KM processes ($\beta$ =. .696, $t = 10.075$, $p < .001$) were significant predictors in the model. There will be a significant prediction in strategic alignment from the processes of KM.

2. H.1.2 There is a significant relationship between KM processes and the governance .

Linear regression was carried out to investigate whether the processes of KM could significantly predict the governance. Results of the linear regression indicated that there was a significant effect between the processes KM and governance, $F(1, 108) = 128.403$, $p < .001$). The processes of KM explained 54.3% of the variance in the governance. The KM process predictors were examined further and indicated that KM processes ($\beta$ =0. 737, $t = 11.332$, $p < .001$) were significant predictors in the model. There will be significant prediction of the governance by the processes of KM.

3. H.1.3 There is a significant relationship between the processes of KM and methods .

Linear regression was carried out to investigate whether the processes of KM could significantly predict the methods. Results of the linear regression indicated that there was a significant effect between the processes of KM the methods, $F(1, 109) = 71.630$, $p < .001$). The processes of KM explained 39.9% of variance in the methods. The KM processes predictor was examined further and indicated that KM processes ($\beta = 0.631$, $t = 8.463$, $p < .001$) were significant predictors in the model. There will be significant predictions of the methods from the processes of KM.

4. H.1.4 There is a significant relationship between KM processes and culture .

   Linear regression was carried out to investigate whether the processes of KM could significantly predict the culture. Results of the linear regression indicated that there was a significant effect between the processes of KM and culture, $F(1, 109) = 99.476$, $p < .001$). The processes of KM explained 47.9% of the variance in **culture**. The KM processes predictors were examined further and indicated that KM processes ($\beta = 0.692$, $t = 9.974$, $p < .001$) were significant predictors in the model. There will be significant prediction of culture from the processes of KM.

5. H.1.5 There is a significant relationship between KM processes and information technology.

   Linear regression was carried out to investigate whether the processes of KM could significantly predict information technology. Results of the linear regression indicated that there was a significant effect between the processes of KM and information technology, $F(1, 109) = 50.132$, $p < .001$). The processes of KM explained 31.7% of variance in information technology. The KM process predictors were examined further and indicated that KM processes ($\beta = 0.563$, $t = 7.080$, $p < .001$) were significant predictors in the model. There will be significant prediction of information technology from the processes of KM.

6. H.1.6 There is a significant relationship between KM processes and people (atti-tude, skills).

Linear regression was carried out to investigate whether the processes of KM could significantly predict for people. Results of the linear regression indicated that there was a significant effect between the processes of KM and people, $F(1, 109) = 50.737$, $p < .001$). The processes of KM explained 3.2% of variance in people. The KM process predictors were examined further and indicated that KM processes ($\beta = 0.565$, $t = 7.123$, $p < .001$) were significant predictors in the model. There will be significant prediction for people from the processes of KM.

7. H.1.7 There is a significant relationship between the technology of KM and strategic alignment.

Linear regression was carried out to investigate whether the technology of KM could significantly predict for strategic alignment. Results of the linear regression indicated that there was a significant effect between the technology of KM and strategic alignment, $F(1, 109) = 50.737$, $p < .001$). The processes of KM explained 3.2% of variance for strategic alignment. The KM technology predictors were examined further and indicated that KM technology ($\beta = 0.565$, $t = 7.123$, $p < .001$) was significant predictors in the model. There will be significant prediction of the strategic alignment from the technology of KM.

8. H.1.8 There is a significant relationship between the technology of KM and governance.

Linear regression was carried out to investigate whether the technology of KM could significantly predict for governance. Results of the linear regression indicated that there was a significant effect between the technology of KM and governance, $F(1, 109) = 61.558$, $p < .001$). The processes of KM explained 36.3% of variance in governance. The KM technology predictors were examined further and indicated that KM technology ($\beta = 0.603$, $t = 7.846$, $p < .001$) was significant predictors in the model. There will be significant prediction of the governance from the technology of KM.

9. H.1.9 There is a significant relationship between the technology of KM and **methods**.

Linear regression was carried out to investigate whether the technology of KM could significantly predict for methods. Results of the linear regression indicated that there was a significant effect between the technology of KM and methods, $F(1, 109) = 43.093$, $p < .001$). The processes of KM explained 28.5% of variance in methods. The KM technology predictors were examined further and indicated that KM technology ($\beta = 0.534$, $t = 6.565$, $p < .001$) was significant predictors in the model. There will be significant prediction of the methods from the technology of KM.

10. H.1.10 There is a significant relationship between the technology of KM and the culture.

Linear regression was carried out to investigate whether the technology of KM could significantly predict the culture. Results of the linear regression indicated that there was a significant effect between the technology of KM and culture, $F(1, 109) = 58.469$, $p < .001$). The processes of KM explained 35.1% of variance in culture. The KM technology predictors were examined further and indicated that KM technology ($\beta = .593$, $t = 7.647$, $p < .001$) was a significant predictor in the model. There will be significant prediction of culture from technology of KM.

11. H.1.11 There is a significant relationship between the technology of KM and information technology.

    Linear regression was carried out to investigate whether the technology of KM could significantly predict for information technology. Results of the linear regression indicated that there was a significant effect between the technology of KM and information technology, $F(1, 109) = 66.239$, $p < .001$). The processes of KM explained 38% of the variance in information technology. The KM technology predictors were examined further and indicated that KM technology ($\beta = 0.617$, $t = 8.139$, $p < .001$) was a significant predictor in the model. There will be a significant prediction of information technology from the technology of KM.

12. H.1.12 There is a significant relationship between the technology of KM and people (attitudes, skills).

Linear regression was carried out to investigate whether the technology of KM could significantly predict for people. Results of the linear regression indicated that there was a significant effect between the technology of KM and people, $F(1, 109) = 33.384$, $p < .001$). The processes of KM explained 23.6% of variance in people. The KM technology predictors were examined further and indicated that KM technology ($\beta = 0.486$, $t = 5.778$, $p < .001$) was a significant predictor in the model. There will be significant prediction of people from the technology of KM.

13. H.1.13 There is a significant relationship between the knowledge teams and strategic alignment.

Linear regression was carried out to investigate whether the knowledge teams could significantly predict for strategic alignment. Results of the linear regression indicated that there was a significant effect between the knowledge teams and strategic alignment, $F(1, 109) = 63.194$, $p < .001$). The knowledge team explained 36.9% of variance in the strategic alignment. The knowledge team predictor was examined further and indicated that the knowledge team ($\beta = .608$, $t = 7.949$, $p < .001$) was a significant predictor in the model. There will be a significant prediction of strategic alignment by the knowledge team.

14. H.1.14 There is a significant relationship between knowledge team and governance .

Linear regression was carried out to investigate whether the knowledge team could significantly predict for governance. Results of the linear regression indicated that there was a significant effect between the knowledge team an governance, $F(1, 109) = 134.544$, $p < .001$). The knowledge team explained 55.5% of variance in governance. The knowledge team predictor was examined further and indicated that the knowledge team ($\beta = .745$, $t = 11.599$, $p < .001$) was a significant predictor in the model. There will be a significant prediction of governance by the knowledge team.

15. H.1.15 There is a significant relationship between the knowledge team and meth-
o**ds.**

Linear regression was carried out to investigate whether the knowledge team could significantly predict for methods. Results of the linear regression indicated that there was a significant effect between the knowledge team and methods, $F (1, 109) = 100.794$, $p < .001$). The knowledge team explained 48.3% of variance in methods. The knowledge team predictor was examined further and indicated that the knowledge team ($\beta =.695$, $t = 10.040$, $p < .001$) was a significant predictor in the model. There will be significant prediction of the methods by the knowledge team.

16. H.1.16 There is a significant relationship between the knowledge team and cul-
ture **.**

Linear regression was carried out to investigate whether the knowledge team could significantly predict for culture. Results of the linear regression indicated that there was a significant effect between the knowledge team and culture, $F (1, 109) = 98.628$, $p < .001$). Th knowledge team explained 47.7% of variance in culture. The knowledge team predictor was examined further and indicated that the knowledge team ($\beta =.691$, $t = 9.931$, $p < .001$) was a significant predictor in the model. There will be significant prediction of culture by the knowledge team.

17. H.1.17 There is a significant relationship between the knowledge team and Infor-
mation technology.

Linear regression was carried out to investigate whether the knowledge team could significantly predict for information technology. Results of the linear regression indicated that there was a significant effect between the knowledge team and the information technology, $F (1, 109) = 86.575$, $p < .001$). The knowledge team explained 44.5% of variance in Information technology. The knowledge team predictor was examined further and indicated that the knowledge team (β =.667, t = 9.305, $p < .001$) was a significant predictor in the model. There will be significant prediction of information technology by the knowledge team.

18. H.1.18 There is a significant relationship between the knowledge team and people (attitudes ,skills).

Linear regression was carried out to investigate whether the knowledge team could significantly predict for people. Results of the linear regression indicated that there was a significant effect between the knowledge team and the people, $F(1, 109) = 78.511$, $p < .001$). The knowledge team explained 42.1% of variance in people. The knowledge team predictor was examined further and indicated that the knowledge team (β =.649, t = 8.861, $p < .001$) was a significant predictor in the model. There will be a significant prediction for people by the knowledge team.

## 4.11. The Effect of the Integration of KM and BPM on DMP

The second hypothesis: H.2 There is a significant effect of the integration of KM and BPM on DMP (the analysis can be found in appendix A). Subdivided into the following hypotheses:

19. H2.1 There is a significant effect of the integration of KM and BPM in problem identification speed (PIS).

Linear regression was carried out to investigate whether the effect of integration of KM and BPM (KMBPM) could significantly predict the problem identification speed (PIS). Results of the linear regression indicated that there was a significant effect between the integration of KM and BPM and PIS, $F(1, 109) = 120.575$, $p < .001$). The integration of KM and BPM explained 52.8% of the variance in the PIS. KMBPM was examined further and indicated that KMBPM (β =.726, t = 10.981, p < .001) was a significant predictor in the model. There will be significant prediction of PIS by KMBPM.

20. H2.2 There is a significant effect from the integration of KM and BPM in the decision-making speed (DMS).

Linear regression was carried out to investigate whether the effect of the integration of KM and BPM (KMBPM) could significantly predict the decision-making speed (DMS). Results of the linear regression indicated that there was a significant effect between the integration of KM and BPM and DMS, $F(1, 109) = 53.162$, $p < .001$). The integration of KM and BPM explained 33% of variance in the DMS. KMBPM was examined further and indicated that KMBPM ($\beta = .574$, $t = 7.291$, $p < .001$) was a significant predictor in the model. There will be a significant prediction of DMS by KMBPM.

21. H2.3 There is significant effect from the integration of KM and BPM in the extent of analysis in decision making (DMA)

Linear regression was carried out to investigate whether the effect of the integration of KM and BPM (KMBPM) could significantly predict the extent of analysis in decision making (DMA). Results of the linear regression indicated that there was a significant effect between the integration of KM and BPM and DMS, $F(1, 109) = 90.348$, $p < .001$). The integration of KM and BPM explained 45.6% of the variance in the DMA. The integration between KM and BPM (KMBPM) was examined further and indicated that KMBPM ($\beta = .675$, $t = 9.505$, $p < .001$) was a significant predictor in the model. There will be significant prediction of DMA by KMBPM.

## 4.12. Description of questionnaire analysis

*Knowledge Management*

With regards to knowledge management processes the questionnaire's results indicated that knowledge was being created and acquired from different sources such as clients, donors or competitors within different organisations. Converting staff's knowledge into written documents or recording data created during a project are evidence that knowledge is being created within an organisation. Moreover, in Jordan, organisations have access to digital information media storage or to a database of skills and expertise, these are used to store knowledge. They also utilize a standard process for storing reference material such as guidelines and lists of expertise. Furthermore, the results indicate that the organisation's members of staff (decision makers) are encouraged to apply their tacit knowledge and experience to subsequent projects, and are able to solve problems and be able to improve these projects. For example, improving new projects based on the feedback from previous projects. In addition, the staff are able to convert knowledge into action and remove barriers that prevent individuals, experts and administrators from acquiring knowledge. Additionally, the results indicated that organisations in Jordan use documents, publication, and internal information networks in order to distribute knowledge. In addition, it shows there are regular symposiums, lectures, conferences and training being provided to employees which makes knowledge easily accessible throughout these sessions.

Moreover, with regards to the knowledge management technology the questionnaire signalled that technology is up to date within organisations in Jordan, for example, IT is frequently used by employees within organisations for communicating with other employees. Also, the fact that this type of technology is likely to be used may suggest that IT supports collaborative work and interorganisational communication which helps to spread knowledge. In addition to this the presence of Knowledge teams within organisations is useful, as the results show that within teams there are qualified knowledge makers that the organisation relies upon to help motivate and aid employees, these could be managers or employees or anyone that makes a decision within the organisation. The results also suggest that knowledge makers maintain modernity of knowledge and communication with external organisation.

*Business Process Management*

Regarding strategic alignment, the results from the questionnaire show that decision makers are aware that improvements are being made, this helps them link the organisation's needs and enterprise processes in order to accomplish their business targets. Additionally, organisations are likely to consider new plans that enhance the process used, since the processes created are aligned to the company's strategic goals. Also, the organisational culture was also addressed in the results since most respondents agreed that everybody within their organisation clearly knows the meaning of managing business processes and knows exactly how to utilize process management for the benefit of the organisation, since they are likely to perform processes that fit the organisation's purpose and values. Furthermore, more than half of the respondents agreed that the top management has a plan to alter the organisation's culture to make it more process-oriented, this reinforces the idea that culture is still an important aspect of BPM. Additionally, the respondents approve and accept BPM to allow top management to pursue the continuous improvement process, this benefits the organisation as it allows the process to occur without any conflict between decision makers.

With regards to the people within the organisation, the results emphasized that the manner in which employees carry out their everyday duties is important and that if they do not alter their practices it will be difficult to adopt a new strategy. In addition, the fact that rarely any respondent strongly disagreed encourages the idea that decision makers have a full understanding of multiple areas such as the process's goals and understanding cross-functional departmental cooperation, this could be because decision makers might have received education on measurement, control and improvement in order to be aware of what must be done to achieve the process's aims. Moreover, concerning governance the results highlighted that staff members are able to engage in decision-making, define process roles, and are capable of dealing with differences and contradictions between processes and polices. Also, within their organisation process requirements and responsibilities are taken into consideration, this suggests that the organisation's processes are running smoothly and once again highlights the idea that governance is important to control roles.

Concerning the organisational methods, the results from questionnaire highlight the idea that methods identify and conceptualise current business processes and future processes within an organisation in order to develop process management. Also, the results indicate the one of the lest used teams within organisations in the construction sector in Jordan is the team in charge of BPM. In addition to this the results that concern information technology (IT) imply that IT is an important factor because it improves the process activities as IT provides a plan that works effectively for the process. Also, the findings of this questionnaire (Figure 4-18) shows that there is no lack in providing a system that works within the company's management structure, this means that the company's management is running effectively without any problems. Another finding related to IT is that decision makers agree that the responsibility of the IT department with regard to the BPM is clear and that there is a plan to enhance the IT department to make it more effective for process management.

*Decision Making Process*

With regards to DMP, the questionnaire results showed that to accelerate the DMP any issues faced must be identified quickly, this makes problem identification a very important variable in the DMP. Also, a lot of time is spent in meetings, but the time taken to make a decision is not that long because BPM and KM help shorten the time, this means that the speed plays a big part in the DMP. Moreover, the results demonstrate that both KM and BPM aid to provide in-depth analysis. And regarding the problem identification speed (PIS) the questionnaire indicates that many of the responses agreed that their organisation's use of BPM and KM has helped them to determine problems more rapidly and they have noticed potential problems before they have become serious crises. This means that BPM and KM have influenced the speed at which decision makers were able to identify the problem. Furthermore, the results that concern the DM speed in the study showed that the participants thought that 'decision making' tended to be faster within their organisation. This might be because they use the time left to spend more time on productivity and performing the processes, it is clear that the DM speed should be fast so that they utilize the rest of the time on carrying out the decision. Finally, with regards to the Extent of Analysis in DM the questionnaire implies that the organisation needs more time when doing analyses, and that it was important to examine more alternatives in decision-making and include more in-depth analysis. Perhaps, spending more time in meetings affects their time spent analysing or searching for alternative methods.

*Integration between KM and BPM*

With regards to KM and strategic alignment, the questionnaire's results indicate that when changing the organisation's strategic goals, business processes will be modified accordingly. Also,

the knowledge used is highly dependable on the strategic choices that an organisation makes, this is because the strategic choices provide guidelines for making decisions and achieving outcomes from knowledge management initiatives. Furthermore, through combining knowledge management with business strategies, the strategic knowledge requirements of an organisation can be effectively achieved within the management processes of knowledge assets. Moreover, the results of the section that concerns KM and governance in the study indicate that business process governance is organised by allocating roles and responsibilities, and the use of KM helps the organisation to allocate these roles to the most suitable employees, also KM makes sure that all employees understand their roles and responsibilities. Likewise, KM helps to explain the standards and policies regarding the roles being allocated to the employees. This suggests that governance (roles and responsibilities) needs KM to function effectively, as once governance starts to function effectively an efficient distribution of services is guaranteed because there will be a wide range knowledge used all throughout.

Additionally, the questionnaire's findings that concern KM and methods suggest that knowledge management allows organisations to introduce new methods and approaches to support and improve the business processes. For example, when integrating Knowledge management variables with methods such as Six Sigma it will lead an enhanced process since high quality, consistency and productivity within the organisational processes will be achieved. Also, regarding the organisational culture and KM, the questionnaire's results suggest that having a culture that promotes sharing knowledge and exchanging experience guarantees the success of the KM systems. This happens because the organisation's culture impacts the organisational KM through making sure that staff behaviours and attitudes help improve the organisation's value chain. Also, the culture enables knowledge making, storing, transferring and utilization.

The results from questionnaire that concerns KM and IT support the idea that the use of information technology in the process activities is an important factor in managing the business process. As the results indicated that selecting the right IT tool helps develop the KM environment which also improves the business processes. Furthermore, with regards to KM and people the questionnaire indicated that people gain knowledge through their work activities, and KM helps people know exactly what their roles and responsibilities are in the workplace, this helps them accomplish the business processes goals. Moreover, it is shown that when staff communicate with each other they share knowledge with each other which directly impact their creativity and many other skills. Also, KM helps the organisation select the appropriate people for a specific position that requires and certain skill, for example for design roles the organisation looks for creative skills.

*Integration between KM and BPM with the Decision- Making Process*

The results showed that in order to enhance and effectiveness of decision making within the organisation, the right knowledge must be delivered to the right people at the most appropriate time. Moreover, KM initiatives help to promote the sharing of knowledge which helps to improve the DMP. This means that KM contributes to the succession of the DMP. Also, BPM provides support to organisations by helping to achieve a better DMP.

## 4.13. Conclusion

This chapter began with the sample population, response rate and the respondent's demographic characteristics along with their profiles. This chapter then focused on the statistical analysis of data found in the survey (Appendix A). Outcomes revealed that the average opinions of Jordanian construction organisation participants regarding various issues related to managing knowledge and BPM were mainly around the 'agree' option on the Likert rating scale. This signifies that participants stated that they approved the majority of the statements in the questionnaire. This chapter then examined the first and second research hypotheses. Additionally, all hypotheses were accepted following their testing and the research model estimations showed that every hypothesis is statistically significant. These findings suggested the presence of a major impact on the integration of knowledge management and BPM within the process of decision making in Jordanian construction organisations.

# 5. Chapter 5: Discussion

## 5.1. Introduction

This chapter is a summary and a discussion based upon the findings in chapter four and are related to the research question, literature and research objectives along with the hypotheses stated in chapter 4. This chapter focuses on two main hypotheses related to the link between the variables within the research model (see section 4-9).

## 5.2. The Hypothesised Model

A questionnaire was administered to gather the data regarding the integration of KM and BPM to support the process of decision making in the Jordanian construction sector. A survey tool was adopted by adapting measures utilized in previous studies that evaluated KM variables (processes, team, technology), BPM (strategic alignment, culture, governance, people, methods, IT) and decision-making processes. In the present study, the population size was 400 individuals with a response rate of 30%. This questionnaire is aimed at decision-makers (senior management, managers, department heads and supervisors) in the Jordanian construction sector for small and medium sized organisations. The selection of the sample in this study will be chosen from all the engineering companies and architectural offices officially registered with the Jordanian Engineers Association (JEA). It is known that the majority are small and medium sized organisations. The Statistical Programme for Social Sciences (SPSS) has been utilised to analyse the viewpoints of 110 participants, test the two main hypotheses within the hypothesised model and evaluate the relations amongst the variables. The findings showed that the standardised estimates for all hypotheses are statistically significant and show support for the hypotheses. The following sections will discuss the hypothesis testing along with the key findings of this study.

### 5.2.1. Knowledge Management and Strategic Alignment.

In this research, the proposed framework hypothesised a positive relationship and significant correlation between knowledge management variables and strategic alignment within construction organisations in Jordan (H1.1, H1.7, H1.13). The hypothesis (H1.1) testing for the KM processes with strategic alignment resulted in the following findings ($\beta = 0.696$, $t = 10.075$, $p < .001$). Similarly, a second hypothesis (H1.7) was also used to test the effect of KM technology on strategic alignment and the findings were ($\beta = 0.565$, $t = 7.123$, $p < .001$). Furthermore, the final hypothesis (H1.13) tested the impact of the knowledge team on strategic alignment and resulted in $\beta = .608$, $t = 7.949$, $p < .001$. This shows that all three hypotheses reveal a positive relationship between KM and strategic alignment. This further indicates that an increase in KM will positively impact the strategic alignment within the construction organisations in Jordan. This finding is consistent with other research which provided empirical evidence of the effect of KM on strategic alignment (Choe, 2014; Chen and Huang, 2010; Abou-zeid and Cheng; 2004; Bandara et al., 2009).

There is a strong correlation between the KM in an organisation with the strategic direction or with the organisation's mission and goals. The business strategy determines the organisation's location with regard to its customers and competitors. Intellectual resources in institutions are important for understanding an organisation's strategic position (Zack, 1999). The strategic choices made by organisations have an impact and reflect on the types and volume of knowledge required to sustain as well as move beyond industry requirements (Abu Zaid and Cheng 2004). A company's knowledge management strategy, which helps locate an appropriate mechanism for making effective decisions and achieving results from knowledge management initiatives, must fulfil the organisation's strategic knowledge requirements. By aligning KM with business strategies, the strategic knowledge requirements of an organisation can be effectively fulfilled in knowledge asset management processes (Wu and Lin 2009).

Regarding the alignment patterns of business and knowledge management strategies, KM activities will, possibly, be operated differently. In addition, various sorts of innovation could be influenced (Choe, 2014). There is a possibility that along with aligning business strategies and knowledge management strategies, an organisation that operates several features of knowledge management activities can achieve specific types of innovation (Choe, 2014).

As indicated by De Bruin and Rosemann (2006), the strategic alignment of business process management is facilitated to improve connections, organisational needs and enterprise processes including the prime aim of achieving the organisation's targets. O`Neill and Sohal (1998) contend that BPM objectives build up dependency on the strategic course and will assist the organisation to achieve considerable advantages. It is also true that organisations that have an absence of connections and BPM in their strategy will meet with disappointment (Chong and Sadiq, 2007). Strategic alignment has a significant role among organisational targets as well as the objectives of BPM. In other words, it is a very important component for the accomplishment of tasks (Bandara et al., 2009).

It is clear that there is a strong relationship between KM and BPM and strategic alignment; this can enhance the competitive strategy and performance of an organisation.

### 5.2.2. Knowledge Management and Information Technology.

In this research, the proposed framework hypothesised a positive relationship and significant correlation between knowledge management variables and information technology (IT) within construction organisations in Jordan (H1.5, H1.11, H1.17). The hypothesis (H1.5) testing for the KM processes with IT resulted in the following findings ($\beta$ =0.563, t = 7.080, $p < .001$). similarly, a second hypothesis (H1.11) was also used to test the effect of KM technology on IT. The findings were $\beta$ =0.617, t = 8.139, $p < .001$. Furthermore, the final hypothesis (H1.17) tested the impact of the knowledge team on IT which resulted in $\beta$ =.667, t = 9.305, $p < .001$. This shows that all three hypotheses reveal a positive relationship between KM and IT. This further indicates that an increase in KM will positively impact IT within construction organisations in Jordan. This finding is consistent with research that found a positive relationship between KM and IT (Chen and Huang, 2010; Asoh, 2004; Akhavan et al., 2006).

Consistent with the emerging body of literature on managing knowledge there is a similarity between properties of managing knowledge, units, relations, alongside with the environment. This improves organisational performance and more improved knowledge management and information technology results than if there is a misfit with alignments (Chen & Huang, 2010; Asoh, 2004; Alavi & Leidner, 2001).

Consequently, strategic IT management promotes business performance, when it works alongside features of the KM context, serving organisations to endure in a highly competitive business environment (Alavi & Leidner, 2001).

Hence, the relationship between KM and IT is exceedingly relevant. In the meantime, as observed by Asoh (2004), as it supports the management of knowledge and information systems, the strategy of information technology also assists with the delivery-oriented factor which should be combined with knowledge management to enhance organisational performance.

Based on the knowledge management environment, advanced KM capability needs a more advanced quality of IT association, based on how well their associations have been presented (Tanriverdi, 2005). That is to say, an organisation's knowledge management strategy should offer direction in identifying how information technology can aid knowledge activities within the organisation (Chen & Huang, 2010).

IT helps the process activities and it is a vital factor in managing business process achievement (Melenovsky and Sinur, 2006). It is contended that IT ought to be used in enhancing the efficiency of BP, instead of automating the processes ( Akhavan et al., 2006). Furthermore, IT assumes a vital role in BPM ventures, as, for instance, it helps control the alteration of BPs, encourages the process design stage and supports its completion (Attaran 2004).

The relationship between KM variables and information technology is extremely relevant and can improve business process performance and enhance the efficiency of the BPM life cycle.

### 5.2.3. Knowledge Management and Governance.

In this research, the proposed framework hypothesised a positive relationship and significant correlation between knowledge management variables and governance within construction organisations in Jordan (H1.2, H1.8, H1.14). The hypothesis (H1.2) testing for the KM processes with governance resulted in the following findings $\beta = 0.737$, $t = 11.332$, $p < .001$. Similarly, a second hypothesis (H1.8) was also used to test the effect of KM technology on governance and the findings were $\beta = 0.603$, $t = 7.846$, $p < .001$. Furthermore, the final hypothesis (H1.14) tested the impact of the knowledge team on governance which resulted in $\beta = .745$, $t = 11.599$, $p < .001$. This shows that all three hypotheses reveal a positive relationship between KM and governance. This further indicates that an increase in KM will positively impact the governance within construction organisations in Jordan. The result is consistent with other research that shows a significant relationship between KM and governance (Hossain, 2017; Zyngier, 2008; Rosemann and Brocke, 2015).

Hossain (2017) states that KM is an essential element of the governance structure in an organisation. However, knowledge has constantly remained as the most significant resource at both individual and collective levels. Recently, organisational practitioners have highlighted the role of knowledge in management and governance, and included the management of knowledge. Therefore, KM is currently an essential factor of governance (Hossain, 2017).

In addition, such comprehensive knowledge can contribute to the effective functioning of governance processes such as establishing suitable responsibilities and roles regarding distinctive levels of BPM (portfolio, program, task and activities (Rosemann and Brocke, 2015).

In such circumstances, the process of governance must be fulfilled more productively to guarantee smooth service delivery. Therefore, governance systems need to apply new strategies together with more sufficient KM processes and operations.

However, to guarantee more improved operating with regard to governance, employees ought to be naturally motivated to be more collaborative regarding governance processes. Appropriate

KM having technical as well as human features can produce a friendly environment for the development of governance.

There is a significant relationship between KM variables and governance which affect process roles and responsibilities in addition to covering regular review cycles to maintain superiority and process administration values.

### 5.2.4. Knowledge Management and Culture.

In this research, the proposed framework hypothesised a positive relationship and significant correlation between knowledge management variables and culture within the construction organisations in Jordan (H1.4, H1.10, H1.16). The hypothesis (H1.4) testing for the KM processes with culture resulted in the following findings, $\beta = 0.692$, $t = 9.974$, $p < .001$. Similarly, a second hypothesis (H1.10) was also used to test the effect of KM technology on culture and the findings were $\beta = .593$, $t = 7.647$, $p < .001$. Furthermore, the final hypothesis (H1.16) tested the impact of the knowledge team on culture which resulted in $\beta = .691$, $t = 9.931$, $p < .001$. This shows that all three hypotheses reveal a positive relationship between KM and culture. This further indicates that an increase in KM will positively impact the culture within construction organisations in Jordan. This result is consistent with research that has found a positive relationship between KM and culture (Rosemann and Brocke, 2015; Cardoso et al., 2012; Ajmal and Koskinen, 2008; Zheng et al., 2010)

Regarding the significant correlation of organisational culture with the knowledge capturing process, determining an organisational cultural feature is crucial to an organisation's ability to improve KM efficiently (Lee and Choi, 2003; Wei, 2005; Ajmal and Koskinen, 2008). Nevertheless, managing knowledge necessitates a significant change within the organisational culture and a commitment at all levels of a company to accomplish it (Gupta et al., 2000; Ajmal and Koskinen, 2008). Furthermore, Ajmal and Koskinen (2008) claim that the achievement of managing knowledge is attained through constructing a helpful culture while developing the systems of managing knowledge. Consequently, organisational culture is an important component of an organisation’s ability to generate value within used knowledge assets (Wei, 2005; Ajmal and Koskinen, 2008).

Clearly organisational culture impacts KM activities since KM includes human interaction. Knowledge-based culture is understood through values as well as norms that cultivate and discover organisational knowledge and continuous learning (Cardoso et al., 2012). Moreover, KM could operate as a mediator between organisational culture and organisational effectiveness as organisational culture can indirectly encourage organisational effectiveness through its direct effect on KM (Zheng et al., 2010). Mueller (2012) discusses the interactive relationship between the company’s culture and KM. On the other hand, KM could change the organisational culture. In consideration of this, organisational culture and knowledge management need to be operated coherently (Ajmal and Koskinen, 2008).

McDermott and O'Dell (2001) stated that cultural matters remained as the key explanation for the collapse of primary KM innovations. However, Jones (2009) proposed that organisations desired proper programmes of KM to achieve essential productivity and desired coordination with the organisational culture so that these programmes might be effective. In addition, Balthazar and Cook (2004) believed that understanding organisational culture has remained essential for people offering KM strategies since it influences the critical knowledge process in its promotion of KM;  complete cooperation and responsibility of members toward KM is required.

Rosemann and Brocke (2015) state that culture is an important factor with respect to managing the business process and is critical for organisations recognizing the potential protection needed from change or an absence of process understanding at the launching of BPM.

It can be shown that KM variables and organisational culture require collaboration to create a facilitating environment that supplements the different BPM activities in order to share values and beliefs which form process-based attitudes as well as behaviour which will advance the organisation’s value chain.

### 5.2.5. Knowledge Management and People.

The proposed framework hypothesised a positive relationship and significant correlation between knowledge management variables and people (attitudes, skills) within construction organisations in Jordan (H1.6, H1.12, H1.18). Hypothesis (H1.6) testing for the KM processes for skills and attitudes of people resulted in the following findings: $\beta = 0.565$, $t = 7.123$, $p < .001$). Similarly, a second hypothesis (H1.12) was also used to test the effect of KM technology on the skills and attitudes of people and the findings were: $\beta = 0.486$, $t = 5.778$, $p < .001$. Furthermore, the final hypothesis (H1.18) tested the impact of the knowledge team on skills and attitudes of people with the following results: $\beta = .649$, $t = 8.861$, $p < .001$. This shows that all three hypotheses reveal a positive relationship between KM and the skills and attitudes of people. This further indicates that an increase in KM will positively impact the skills and attitudes of people within construction organisations in Jordan. This result is consistent with the research (Shamsi, 2017; Taleghani et al., 2015; Sabokro et al., 2018; Langouri , 2013; Arzeh , 2012)

Organisational knowledge is shown and represented in its employees; this knowledge is gained through their work activities (Shamsi, 2017), and comprises their capabilities, practical experiences and skills. Moreover, Taleghani et al., (2015) mention that there is a strong relationship between KM and skills, attitudes and staff knowledge.

Taleghani et al., (2015) confirmed that human factors play a major and exceptional role. One way to develop an employees' skill is to generate knowledge which will enhance their qualifications. Other factors include self-confidence, understanding the importance of their role, participation in decision making, being productive in their work and having the confidence and willingness to share and gain knowledge from other employees.

Sabokro et al., (2018) state that directors ought to enhance their managerial skills (perceptual, human and operational) since knowledge sharing is a recognized need in an organisation and is observed as a factor in human resource management. Self- confidence and courage to make decisions can develop directing skills.

KM can enhance the operational skill of administrators and is in agreement with Cohen and Olsen (2015) who inspected the KM dimensions and business strategy results on performance.

Ameri and Areze (2014) considered the relationship between KM and the communication skills of directors. The outcomes of this study showed that there is a significant relationship between communication skills and KM variables; consequently, directors need to enhance their communication skills until this leads to improved creativity in employees and enhanced growthi in the organisation, in addition to more effective KM skills.

Employees need to coordinate their attempts to accomplish the process results (Jeston and Nelis 2006), knowing that it is imperative for the association to organize proficiency training through the execution of BPM (Pritchard and Armistead, 1999).

There is strong correlation between KM variables and people who are characterized as the individuals and groups who repeatedly improve and apply their process management skills and knowledge to enhance the execution of the business process.

### 5.2.6. Knowledge Management and Methods.

The proposed framework hypothesised a positive relationship and significant correlation between knowledge management variables and methods within the construction industry in Jordan (H1.3, H1.9, H1.15). The hypothesis (H1.3) testing for the KM processes with methods resulted in the following findings: $\beta = 0.631$, $t = 8.463$, $p < .001$. Similarly, a second hypothesis (H1.9) was also used to test the effect of KM technology on methods and the findings were as follows: $\beta = 0.534$, $t = 6.565$, $p < .001$. Furthermore, the final hypothesis (H1.18) tested the impact of the knowledge team on methods which resulted in $\beta = .695$, $t = 10.040$, $p < .001$. This shows that all three hypotheses reveal a positive relationship between KM and methods. This further indicates that an increase in KM will positively impact the methods within construction organisations in Jordan. This finding is consistent with the research (Pinjari, and Teli, 2018; Dominic and Godwin, 2018; Rosemann and Brocke, 2015).

Pinjari and Teli, (2018) state that KM can achieve more by integrating it into Six Sigma process. Therefore, Six Sigma and KM need to be combined thus creating a very powerful management strategy. Furthermore, both knowledge management along with Six Sigma are rapidly infiltrating the BP system with problem-solving and process-optimization methodologies (Pinjari and Teli, 2018).

Six Sigma and KM need to be combined to provide a powerful management strategy. Although Dominic and Godwin (2018) point out that Six Sigma and KM are different from each other, both Six Sigma experts and the knowledge management teams can benefit from each other. For example, Six Sigma experts can use KM to learn to adapt and maintain changes (Leavitt, 2002), whereas Six Sigma teaches KM how to utilise analytic and quality tools along with gaining the ability to encourage full-time employees to participate in major projects. Moreover, when they work together, they build an environment that simplifies learning within an organisation (Dominic and Godwin, 2018). Considering that they have different objectives, as Six Sigma focuses on improving processes and KM aims to deliver the right information and knowledge, when both are utilised together, they improve the process's performance.

In order to help an organisation, to decrease costs, effort and the time taken to complete processes along with gaining high quality and consistent process KM variables it needs to be integrated with methods that support business processes.

### 5.2.7. The Integration Between KM and BPM with the Decision Making Process

The proposed framework hypothesised a positive and significant relationship between the integration of KM and BPM and the process of decision making within construction organisations in Jordan (H2.1, H2.2, H2.3). The hypothesis (H2.1) testing for the integration of KM and BPM with the problem identification speed (PIS) resulted in the following findings: $\beta = .726$, $t = 10.981$, $p < .001$.. Similarly, a second hypothesis (H2.2) was also used to test the effect of the integration of KM and BPM on the decision-making speed (DMS) and the findings were as follows: $\beta = .574$, $t = 7.291$, $p < .001$. Furthermore, the final hypothesis (H2.3) tested the impact of the integration of KM and BPM on the extent of analysis in decision making (DMA) which resulted in $\beta = .675$, $t = 9.505$, $p < .001$. This shows that all three hypotheses reveal a positive relationship between the integration of KM and BPM and the process of decision making within construction organisations in Jordan. This result is consistent with research that has found a positive relationship between KM and BPM with the process of decision making (Chu, 2011; Zhang and Lu, 2007; Deokar and El-Gayar, 2008).

BPM has shown itself to be key technology mainly in the past three decades with a goal of providing process support to organisations and supporting better DM (Deokar and El-Gayar, 2008). Similarly, Nemati et al., (2002) stated that KM has the ability to simplify, to capture, code and share knowledge within organisations and, has improved the decision-making process.

In addition, the interrelationship between KM and BPM has the ability to help the operation of BPs through merging KM techniques with day-to-day operations, along with the knowledge field that can be applied and the KM components interconnected with precise BPs (Mertins et al., 2001).

KM is business and process oriented (Zhang, 2013). The aim is to transfer the right knowledge at the right time to the right people which can also enhance the effectiveness of decision making within the company.

KM and BPM have arisen as key technology with an aim of giving process support to organisations along with improving the process of decision making (Deokar and El-Gayar, 2008; Chu, 2011). Moreover, Zhang and Lu (2007) highlight the importance of the integration between KM and an enterprise’s BPs in order to support decision-making efficiently and effectively.

It can be shown that the integration of KM variables and BPM variables can enhance the decision-making process by enhancing the speed of problem identification, the decision-making speed and the extent of analysis in decision making.

## 5.3. Conclusion

This chapter explained the major outcomes of this research relating to the variables that impact KM and BPM to improve the decision making process in the Jordanian construction sector, along with the hypothesised model which assesses the relations between the constructs within the research model. This questionnaire is aimed at decision-makers (senior management, managers, department heads, supervisors) in the organisation in the Jordanian construction sector for small and medium sized organisations. The proposed framework intended to clarify the relationships between these variables and the key framework estimations suggested that every hypothesis in this study is statistically significant. The next chapter will present the validation of this framework.

# 6. Chapter 6: Qualitative Analysis

## 6.1. Introduction

The questionnaire outcomes stated in Chapter 4 reflect the essential factors and capabilities of the integration of KM and BPM within the Jordanian construction industry. Furthermore, it improves the process of decision making more effectively. According to the research process (Relevant to Chapter 3), 12 semi-structured interviews were conducted with chosen industry practitioners along with robust knowledge and experience regarding KM and BPM in the construction sector in order to:

- elicit any crucial matters that need to be referred to within the framework as well as those that were discovered within the literature review and synthesis.
- discover if the participants (domain experts) supported the outcomes from the questionnaire survey;
- to verify and compare some of the findings from the questionnaire analysis.

Validation is considered to be the final stage of a research study, validation is a process that determines whether the framework is accurate and is practical so that the framework works well when implemented (Thacker, et al., 2004). Also, validation verifies the quality standards of the proposed framework (Sarhan, 2018). According to Varshney et al (2013), validation is very important because it identifies whether the concepts and ideas in the proposed framework are consistent and ensures that the framework is applicable and appropriate in the construction industry. This means that it is important for experts to accept the framework, as Alsulamy (2015) argues that the validated framework should be achieving an acceptance rate of 50%. Achieving 50% is important because it means that the framework is likely to succeed when it is applied in the construction projects.

This chapter presents the outcomes of the interviews. Initially, it also presents the background of the participants in addition to their selection criteria. The following sections correspond with the qualitative analysis of the interviews. Ultimately, the final section presents the main findings from the qualitative investigation. The interview results are summed up at the end.

## 6.2. Participants' Selection and Their Background

The interviewees who expressed eagerness and had good relevant experience and expertise were requested for interview. These interviewees also suggested other very knowledgeable and qualified employees who could also act as interviewees.

The choice of suitable respondents was an essential aspect of this research. The interviews were conducted with 12 experts to elicit their opinions on the proposed frameworks in the Jordanian construction sector. They were chosen according to four criteria:

1. They had experience of significant practices in KM along with BPs, and/or participated in numerous phases of KM.
2. They were still employed in business.
3. They needed to be a decision maker (senior management, managers, department heads, supervisors and decision makers in the organisation) in the Jordanian construction sector for small and medium sized organisations.
4. They gave their consent to participate in both the semi-structured interview and the survey questionnaire. (they were interested in validating the mode).

**Table 6-1: The experts involved in the validation process of the framework**

| Sex | Age | Work experience | Organisation Type | Position | Department |
|---|---|---|---|---|---|
| Male | 41-50 | 21-30 | Medium | Manager | Planning Department |
| Male | 41-50 | 16-20 | Small | General Manager (GM) | H.R |
| Male | 31-40 | 6-10 | Medium | Processing manager | Construction |
| Male | 51-60 | more than 30 | Small | Director | Architectural Design |
| Male | 41-50 | 21-30 | Small | CEO | Electromechanical and civil |
| Male | 41-50 | more than 30 | Medium | Chief of Maintenance | Maintenance |
| Male | 41-50 | 16-20 | Medium | Project Manager | IT |
| Male | 41-50 | 21-30 | Medium | Head of department | Planning Section |
| Female | 41-50 | 21-30 | Medium | Manager | H.R |
| Female | 41-50 | 11-15 | Small | Director | ARCHITECTURE |
| Male | 51-60 | more than 30 | Medium | General Manager (GM) | Decoration |
| Female | 31-40 | 6-10 | Medium | Manager | Design Department |

Before conducting the interviews, an invitation was emailed to prospective experts along with an information sheet that displayed the aim, objectives of the research and the advantages to contributors; they provided their contact details for the researcher for any further information concerning the research (see appendix B).

This interview resulted in the participation of 12 experts from both small and medium sized organisations; their ages varied between 31-60. However, the majority were aged between 41-50. Of the 12 interviewees, three were females (see Table 6-1). The average number of total years of field experience in the construction industry is around 20 years, but there were interviewees who have had more than 30 years of experience and on the opposite side they were some interviewees who have had less than 20 years of experience. Furthermore, all interviewees were in charge of nine different positions within their organisations such as a project manager, GM and CEO. To make generalisations easier the interviewees worked in different departments within their organisation; some worked in HR, others in IT and in decorations.

The combination of the experience and positions of these people offered abundant data for validation. Fox et al. (2003), stated that validation will be efficient if it consists of a proper balance of all the essential expert knowledge, provided that the participants had an average of around 20 years of construction work experience in Jordan and were considered as ‘experts’. The feedback from the interviews could be considered as the viewpoints of suitable ‘experts’ and the knowledge offered is regarded as effective for analysing evaluation and suggestions.

## 6.3. Qualitative Analysis of the Interviews

In this section, the benefits and challenges of KM techniques are discussed as well as the benefits and challenges of BPM techniques, the integration of KM and BPM in the construction sector, the effect of KM and BPM on DMP. The validation of the proposed framework is also discussed in the context of the qualitative analysis of the interviews. (The interview questions can be found in Appendix C)

### 6.3.1. Benefits and challenges of KM techniques

According to 9 out of 12 interviewees, a number of techniques are used within their organisation. There was a variety of answers, as some said that they used recruitment while others had chosen brainstorming. However, the most common ones were face-to-face, meetings, training and seminars.

KM techniques has many benefits; 60% of the interviewees argued that KM techniques are cheap, because they do not require any equipment to set-up. For example, no materials are required during face-to-face interaction. 70% of the interviewees thought that an important benefit for using KM techniques was that it was easy to maintain and uncomplicated to use within an organisation. However, 50% of the interviewees claimed that KM techniques were important because they helped maintain a key asset in their organisation.

Nevertheless, there are challenges that exist in using KM techniques that may be difficult to overcome. One of the most common challenges that was mentioned by the interviewees was security as interviewees explained that this was because KM techniques provided sustainable access to some private information that should not be shared with some employees within the organisation. Many have said that one difficulty in using KM techniques was motivating, employees as the organisation's culture may not sufficiently encourage employees to adapt easily to any changes such as encouraging employees to interact and share knowledge with others. Another challenge that half of the interviewees included in their answers was adapting to the constantly changing technology because they needed to be agile to respond to this change to increase productivity. Some added another challenge to do with leadership. They explained that as everyone in the organisation would like to have a say in making decisions and KM techniques allows them to, this may lead to many disagreements which created conflicts between employees. An advanced interviewee in the field added that a challenge for many organisations was finding the right way to measure knowledge.

### 6.3.2. Benefits and Challenges of BPM Techniques

One common benefit that was mentioned by 60% of the interviewees was the ability of BPM to improve the organisation's agility. As changes are constantly occurring within an organisation, the organisation must be able to adapt and respond rapidly to these changes in BPs to meet an organisation's needs. One feature of using BPM techniques was that they included flexible tools and designs that allowed the organisation to adapt quickly. Three interviewees highlighted the importance of using BPM techniques as they were efficient as BPM has tools that are designed in a way to delete the irrelevant and inefficient parts of the process. A s a result, productivity is increased.

Interviewees emphasised the importance of BPM techniques within their organisations as BPM made the organisation's processes more visible meaning that BPM studies every stage and performance of each process which enabled the employees to understand more about the process This allowed them to adapt easily with the process enabling management to alter the flow of each BP.

10 out of 12 interviewees added that BPM techniques provided the ability for the organisation to protect their data from any threats such as fraud or theft. Moreover, more experienced interviewees suggested that BPM techniques made the organisation's knowledge more easily transferable between employees as BPM techniques encouraged employees to share knowledge constantly by creating process charts and recording them. Additionally, as 5 out of 12 said, BPM techniques provided the opportunity to keep improving the organisation. This was because BPM provided data regarding the organisation's processes which would further inspire improvement in processes to and make a change for the better. As a result, the processes would have a higher chance of success.

One common challenge when using BPM, according to the interviewees was lack of management commitment among the leaders as they may start losing focus and therefore teams may not be encouraged to reach their targets. In addition, chaos might occur which would reduce communication between peers. Moreover, some interviewees stated that it could be a challenge to enable all employees to agree on a project because some employees have different opinions and thoughts on the project. This would lead to a proportion of the employees disengaging, and sometimes may cause these employees to resign.

Another common challenge stated by interviewees when using BPM within their organisation was having a framework for improving their process, Interviewees explained that organisations that had been newly introduced to BPM did not have a framework to improve their process. As a result, the employees would struggle in many areas. For example, would the process will be approved or not? Few interviewees believed that a common struggle that many organisations undergo is having weak agility because improving agility is time consuming. Therefore, the organisation would have a reduced productivity compared to other organisations.

### 6.3.3. The Integration of KM and BPM in The Construction Sector.

70% of the interviewees stated that the integration between KM and BPM helped their organisation by just focusing on the important information necessary for the company's activities. In addition, it provided the knowledge needed from the beginning of the organisation's process and made the process more efficient with the organisation having more control over the process.

7 out of 12 interviewees mentioned that the integration between KM and BPM helps to increase the efficiency of utilising knowledge in the organisation by improving the abilities in the way knowledge is used. Highly advanced interviewees in the field stated that the integration between KM and BPM would help in the transference of knowledge to the right employees at the right time reducing the time and effort needed to increase the rate of productivity because it gave employees time to focus on other work. As a respondent agreed that combing KM and BPM help enhance their organisation since this integration helps them to "*provide a list of people with their information (such as experience) which helps us to make a decision on the most appropriate employee to be involved in a specific project.*"

A common advantage that a few of the interviewees' stated was that it provided easy access to knowledge on a daily basis. The BP process also enabled the combination of KM tools with the daily work operations as BPs were an outstanding source of knowledge. Additionally, the data resulting from BPs can be collected and used to develop the performance of BPs within the workplace.

### 6.3.4. The Effect of KM and BPM on DMP

As shown in Table 6-2, over half (56%) of the interviewees have agreed that both BPM and KM has helped them understand problems faster and observe potential problems before they become serious crises. This implies that BPM and KM has influenced the speed at which the interviewees were able to identify problems, as respondents believed that KM and BPM work well together, since it helps employees to identify potential upcoming issues faster, one respondent stated that "*it is good to combine both KM and BPM because it supported my organisation by giving every employee their needed knowledge such as documents at the appropriate time. This allows me to be aware of an upcoming issue that could impact the work I do."* This also suggests that 56% of the interviewees' organisations are able to identify problems quickly to enable them to perform appropriate tasks or processes in order to solve them, as according to a respondent Knowledge management can be utilized in any "*business process in order to help me use the knowledge and data provided by it to solve an issue.".*

Furthermore, many interviewees agreed with statements that measured the DM speed within their organisation. This is evident in Table 6-2 as 54% of the interviewees had agreed that they 'spend less time in meetings' and they want to 'shorten the time frame for making decisions', indicating that the DM speed is fast. The interviewees believed that Knowledge Management and Business Processes function well together because it *"results in allowing decisions to be made quickly by spending less time in group meetings especially the urgent decisions regarding critical issues, and successfully by using a variety of sources to research about the decision."* as an interviewee highlighted. This also suggests that they desired a reduction in the decision-making speed because interviewees wanted to spend more time on other tasks and performing processes. In addition, 21% strongly agreed that this emphasises the fact that the DM speed within their organisation is incredibly fast.

A large number of interviewees (54%) agreed that they spend more time analysing data before making a decision, highlighting that the organisation was spending time on analysing data and assessing other replacements in DM. This indicates that Knowledge management and business process management can be a great benefit to construction organisations, as an interviewee argued that *"KM and BPM work together to deliver to our workers knowledge-based roles in the business process. Allowing us to ……. analyse any decision about to be made thoroughly.".* This may also suggest, further, that their organisation is producing detailed analyses which would mean they were likely to obtain reliable results. In the previous factor (DM speed), interviewees emphasized that they spend less time in decision making and meetings, whereas in this factor (DMA) they spend more time. Perhaps, spending more time in meetings affects the time taken to analyse or look for alternative methods, one of the interviewees mentioned that spending less time in meetings allows them to *"examine a number of other alternatives in case the decision did not work."*

Overall, the majority of construction experts agreed that the integration between BPM and KM would enhance the process of DM through determining problems more rapidly and increasing the speed of decision making and analysing decision making effectively.

**Table 6-2: The effect of KM & BPM on DMP**

| Decision Making Process | Strongly agree | Agree | Neutral | disagree | Strongly disagree |
|---|---|---|---|---|---|
| Problem Identification Speed | 19% | 56% | 17% | 8% | 3% |
| DM speed | 21% | 54% | 13% | 8% | 4% |
| The Extent of Analysis in DM | 19% | 54% | 17% | 6% | 4% |

### 6.3.5. The Validation of the Proposed Framework

Most of the interviewees (7 out of 12) mentioned that all the variables gathered within this framework do not have a similar impact on the successful execution of this framework in every organisation site. The relative importance of each of these variables is affected through the mission and goals of the organisation, including its structure, BPs and policies. The interaction between the variables of KM and BPM would enhance the process of decision making regardless of the circumstances in the organisation. For example, one of the interviewees argued that combining KM and strategic alignment (a variable of KM) has a great benefit to the performance of their organisation by helping to meet their organisation's goals and targets of a BP. Their comment was as follows *"The combination between KM and the strategic alignment of business processes enhances my organisation's performance because it helps us make the decisions that will lead us to meet my organisation's business processes' goals and targets. One example of this is that the strategic alignment of KM allows my organisation to take the market demands and resources limits into consideration when starting a new project, but at the start of a new project one of the issues that my organisation faces is the pressure from the market to complete the project early, to release our product to the market to gain a competitive advantage."*

Furthermore, the interviewees believed that the KM variables aided the decision making process, for example, a respondent believed that the combination of KM and strategic alignment *"influences my business's values such as innovation and efficiency. Also, the strategic alignment of KM effects my business on the selections made for the right construction project, this includes the right project size, budget, choosing my team depending on their skills, correct machinery, right technology and selecting contractors…….the business I work in gains many advantages through creating business processes aims that rely on the strategic direction. The project managers in my organisation play a critical role in aligning both the objectives and strategies of my organisation to try and meet the project's goals, for example, project owners could decide whether the idea of the construction project is new to the market or not, therefore the project owner tries to complete the construction in a short amount of time to be launched quickly to market in order to gain a competitive advantage over other construction organisations. Moreover, contracting organisations could perhaps see a benefit in a new technology and use it to gain profit."*. Another interviewee spoke about IT, the interviewee thought utilizing IT within an organisation has many benefits some include *"IT allowed me and other workers to improve our business process projects, because it eased the process design phase and allowed any changes that needed to be made to happen quickly and easily. However, utilizing IT in our business process projects created a barrier to attain business process management…. In my organisation we use different IT skills for interacting with other employees and information processing. Also, KM helps my organisation select the most appropriate application for the project, for example my organisation uses a variety of IT applications such as, traditional applications that include AutoCAD which is 2D, or BIM applications e.g. 3D Revit, and Tekla (is also 3D) that is used for bigger projects such as an airport or a stadium."*.

Other interviewees mentioned different KM variables regarding:

- governance, as one of the interviewees thought *that "governance is vital, and it helps support any organisation's performance. Since, it has helped my organisation to grow, assist me and my colleagues to work towards my organisation's goals, and supported me to use IT without being liable to any risks. Also, governance makes sure that the project team follows the specific criteria set by the government regarding construction industry, for example in Jordan the government and Jordanian Engineers Association (JEA) set* *standards regarding building houses, there are 4 zones a,b,c and d. each zone differs depending on a number of factors such as, number of people living in the residence and number of floor…..governance helps me and my project team mates to stick with our individual roles and responsibilities that match the standards given by the government."*

- People, KM is clearly very important since it helps to allocate the right people to the most appropriate role, this is evident when one of the interviewees believed that *"linking KM with business process governance play a major role in determining the most appropriate roles and responsibilities for each individual in my team based on certain characteristics of the business process that were provided by previous projects, which allowed us to get the right team, for example an architect is given the responsibility to develop the construction designs and drawings, as well as bringing both the plan application and building warrens. Whereas structural engineer is normally given the role to design the construction structure and gives advice to both the client and the quantity surveyor regarding cost. Also a project manager mentors and is in charge of the entire project, and makes sure that the project delivers the best outcome, quality and the least possible cost, …..governance helps my organisation focus on the design of the decision making process allowing it to control its activities. "*
- The importance of the employees within organisations, as one of the respondents explained that *"people play a major role within my organisation, since they represent human resource, those who work in team or individually constantly enhance and utilize their skills and knowledge within my organisation, in which we link it with knowledge-based systems to gain all the possible needed information about our staff. Human resource in my organisation aids me and my colleagues specially process owners to select the right people for the right project such as experience, attitude, and commitment. Also, there is a number of other skills that we look for, for example, multiskilling which allows the organisation to allocate that multi-skilled employee to work in a number of roles if there is a shortage, an organisation would normally look for employees with generic skills or technical skills (such as the ability to use specific technology, and knows how to deal with Enterprise Resource Planning(ERP) and finance)……communication skills that my organisation advises*

*employees to have are team building, self and time management, self-learning, creativity (innovation)."*

- The culture, It has been shown that the culture of an organisation works well with knowledge management *"to allow my organisation gain knowledge, therefore my organisation's culture impacts Knowledge Management, as my colleagues interact with each other…… my colleagues and I begin to share knowledge when we feel motivated to interact with different teams in my organisation which gives us a chance to exchange skills and experience, as well as come up with solutions to solve a problem that we would be facing. Due to the increased competition between the teams in my organisation, we used this competition positively to start interacting with each other more and gained loyalties amongst each other. However, there are a number of culture-related factors that negatively affect knowledge sharing in my organisation, one factor is lack of trust, which makes the employee hesitant to share information with people that they have very little trust for. Also, the lack of efficiency of communication technology slows down knowledge sharing, for example, if an electrical engineer is not up-to-date with the latest technology in electrical equipment, then a mistake could occur which disturbs the completion of the project and results in a high cost damage."* as justified by one of the interviewees.

However, the framework presented here enables the variables to be largely interconnected and if each variable of KM and BPM has a strong effect on DMP, together they would produce excellent decision-making opportunities for the organisation. An example of this is that Knowledge management can give employees information about past projects, as a respondent claimed that *"Prior to making any decision we use the feedback from our previous projects to avoid any issues that were made in the past regarding the application of KM…. KM provides us with past experiences that helps us know what we should or should not do in a new construction project to avoid making any inappropriate decision".*

For 11 out of 12 interviewees, the framework was recommended for use in SME construction organisations and at several stages of management. Furthermore, there is a necessity to implement the framework in a real organisation in order to monitor its usefulness and performance. This will be proposed in further research associated to the integration between KM and BPM in Jordanian construction organisations.

Based on this research, the integration between KM and BPM will continuously improve the process of decision making. A variety of benefits were discovered for connecting KM with BPM to enhance DMP, one benefit according to one of the interviewees "*Most people in my organisation use KM because we can find experts and documents easily and complete any work in a short amount of time.".* Further attempts have to be prepared, and an understanding should be established to guarantee that individuals recognise the advantages of KM and BPM.

Undoubtedly, the feedback collected from the experts indicates their support for the framework to enhance DMP in terms of KM and BPM in Jordanian construction enterprises, as one of them indicated that *"the framework is easy to understand and utilize, also the framework is applicable among construction organisations. Carrying out a developed framework within the Jordanian construction organisations aids BPs because the developed framework combines KM with the daily tasks, this will help strengthen the DMPs within the organisation. Overall, this developed framework is useful for providing DMP, also I reckon that this framework's concept will be highly accepted within the Jordanian construction organisation.".* The framework established through this study ought to produce numerous strategic outcomes, creating a clearer awareness of, and solutions for, the main vital variables. It was intended to provide a holistic perception into understanding the main variables to develop the process of decision making depending on the integration of KM and BPM in Jordanian construction enterprises. An example of a positive feedback was *"Yet there is no denying that the developed framework is a result from a thorough literature review, which makes the developed framework easy to use as the framework is valid and is consistent with the actual projects implemented in the Jordanian construction organisations".*

It is anticipated that additional adjustments to the framework will be necessary because of the adjustment in the requirements of the Jordanian construction industry Therefore, it provides flexibility for any later developments. From the above observations and feedback, further work and attempts are essential to include construction organisations collectively as one to aid the upcoming implementation of this framework. Additional initiatives that lead to the implementation of this framework would lead to its continuous improvement.

The interviews reveal that most of the respondents (10 out of 12) noted that the presented variables in the framework are explicit, as one of them observed that "*the framework is beneficial, the framework has clearly been built upon detailed and useful findings. Most of the variables that form the framework are clear and straightforward also they can be easily implemented within organisational project, these variables within the framework do help guide the construction organisations to identify and decide on decisions (helps with the DMP). Also, I think that the framework reflects the real-life situations within organisations. In general, I find this framework a good piece of work, and it allows many experts and professionals to consider researching into important issues within the Jordanian construction sector."* Moreover, it was suggested by all of the participants that the variables in the framework are expected to influence the process of decision making in Jordanian construction organisations. In terms of KM and BPM, 8 out of 12 respondents agreed that the framework contained almost all the variables of KM and BPM that they expected. However others thought that the framework missed some variables, and one of them stated the following *"I agree with most of the variables provided by the developed framework for improving the process of decision making, however I think that the developed framework is lacking some additional variables that can make the framework function even better, such as dynamic capabilities ", likewise another interviewee observed that although the framework "covers these major elements there are some variables that were missed for example, leadership, organisational structures, business repositories and knowledge context. I personally recommend that the proposed framework is implemented within the Jordanian construction organisations because they will benefit from the proposed framework.".* Regarding the process of decision making, the participants noted that the integration of KM and BPM will improve DMP efficiently. In terms of suggestions, all the respondents (12) engaged in the research suggested that the framework would work in their organisation, *as an interviewee mentioned that "I do think that the proposed framework is applicable, as it can be easily used within projects. Also based on my observations the framework is practical."*

As mentioned above by some of the interviewees, they suggested a few changes to the framework to increase the efficiency of this research. These include:

- Firstly, to add tools and techniques to assist the integration of knowledge management and business process management; an example of this would be a data warehouse, in addition to utilizing methods to analyse the data such as data mining.
- Secondly, to include extra elements or variables from the conceptual framework, such as dynamic capabilities with exploration and exploitation processes to exchange knowledge between variables and external environmental factors.
- Thirdly, to add knowledge management enablers in addition to people and technology such as leadership, organisational structures, business repositories and knowledge context.

Although the suggestions above are useful for the improvement of the framework this research needed to exclude them because of restrictions on the time required to complete this research. Hopefully, these suggestions may perhaps be incorporated in future research.

## 6.4. Main Findings from the Qualitative Investigation

As a result of the aforementioned analysis, the following points are concluded:

- The techniques, benefits and challenges were determined according to the feedback from the interviewees. The most common techniques claimed to be used in regard to KM are face-to-face interviews, meetings training, and seminars. The benefits were that it is cheap, easy to maintain and uncomplicated to use within an organisation. In addition, it helped maintain a key asset in their organisation and focuses on recalling and building up the organisation's employees' knowledge. The challenges included were security, motivating employees, adapting to the constantly changing technology, leadership problems, and finding the right way to measure knowledge.
- BPM techniques have many different advantages and disadvantages according to the interviewees. The benefits included the ability to improve the organisation's agility and

secure its data from any threats (such as fraud, theft), as well including flexible tools and designs to adapt quickly It is efficient, makes the organisation's process more visible and its knowledge is easily transferred amongst employees providing an opportunity to keep improving the organisation. The challenges of BPM included the lack of management commitment among leaders, ensuring all employees agreed on a project, having a framework for improving their process, and the potential for weak agility.

- The findings obtained through the interviews established that the integration between KM and BPM will facilitate understanding and the sharing of the workflow of the organisation. It will also contribute to answering how BPM elements, activities and resources are created and who has knowledge about them. This understanding and sharing of knowledge can support a resource-based strategy in the organisation which adds a sustainable competitive advantage to our organisation.
- The integration between KM and BPM will support creating a firm base or cornerstone to make the correct as well as rapid decision making. The integration of KM and BPM will provide a dynamic view for the decision makers regarding the problems, defects and achievements of activities and processes inside the organisation. Accordingly, the decision makers can respond to this feedback with quick and more realistic decisions.
- Most interviewees indicated that the framework variables are interconnected and explicit as they impact the organisation in various ways. Moreover, most interviewees advised the use of the framework in SMEs construction organisations and at several management stages. Similarly, the integration of KM and BPM will improve the efficiency of DMP; interviewees suggested utilising the framework in their organisation. The framework should be applied in a real organisation to monitor its efficiency and performance as it ought to produce numerous strategic outcomes and enable awareness and solve key variables. It ensures an understanding of the main variables to develop DMP that are dependent on KM and BPM integration in Jordanian construction enterprises. However, framework adjustments will be necessary due to the adjustments in the requirements of the Jordanian construction industry. From the feedback above, the respondents agreed that the framework covered most of the variables of KM and BPM that they expected.

They also agreed that the framework is easy to use, straightforward and is applicable to the Jordanian construction organisations.

- The combination of KM and strategic alignment influences the organisation's attitudes on innovation and efficiency. The strategic alignment of KM affects the selections made for the construction projects. This includes choosing the right project size and budget, and choice of the project team depending on their skills, correct machinery, appropriate technology and selecting contractors. Project managers in an organisation align both the objectives and strategies of the organisation to try and meet the project's goals. Also, project owners decide whether the idea of the construction project is new to the market or not. If so, the project owner tries to complete the construction project in a short amount of time so that it can be launched quickly to market in order to gain a competitive advantage over other construction organisations.
- The organisation's culture works well with KM as it allows the organisation to gain knowledge. Both the culture and KM are linked as, if the culture is does not build motivated employees the sharing of knowledge would be very weak. If the employees lack trust, it makes them hesitant to share information with people that they have very little trust in. Another example is if an electrical engineer is not up-to-date with the latest technology in electrical equipment due to the lack of the efficiency of communication technology within their organisation's culture, then a mistake could occur which disturbs the completion of the project and results in a high cost damage.
- Utilizing appropriate method and IT tools allows for improvement in BP projects, as it eases the process design phase and allows any changes that are needed to happen quickly and easily and KM helps to select the most appropriate IT tools for the project. If an organisation could use a variety of IT applications such as, traditional applications that include AutoCAD which is 2D, or BIM applications e.g. 3D Revit, and Tekla that is used for bigger projects such as an airport or a stadium.
- The link between KM and business process governance helps to determine the most appropriate roles and responsibilities for each individual in a project team. For example, an architect is given the responsibility to develop the construction designs and drawings,

as well as bringing both the plan application and building warrants. Whereas a structural engineer is normally given the role to design the construction structure and gives advice to both the client and the quantity surveyor regarding costs.

- In order to improve the framework, there were some suggestions by some interviewees, for example, the addition of some variables like new KM enablers such as leadership, organisational structures, business repositories and knowledge context. And to add tools such as datamining to enhance the integration of KM and BPM in order to increase the efficiency of the framework. Other interviewees suggested to add exploration and exploitation processes so that the exchange of knowledge between variables and external environmental factors is easy. But because of the limited time to complete this research the researcher suggested that this could be incorporated in future work.

## 6.5. Conclusions

This chapter presents the stages involved in the validation of the suggested theoretical framework that captures the main variables which impact DMP in terms of KM and BPM in construction organisations. Twenty invitations were sent to the construction experts, but only twelve responses were confirmed for interview attendance. These experts were professionals who were regarded as capable of forming an acceptable scientific opinion on the proposed framework. The assessments made by knowledgeable managers resulted in improving and enhancing the credibility of the suggested framework. The validation feedback could be recognized as the judgement of suitable professionals and is thought to be appropriate for the analysis along with the proposals. To sum up, “to refine and validate the proposed conceptual framework” was referred to as the final objective of this research.

# 7. Chapter 7: Conclusion

## 7.1. Introduction

The aim of this study, as mentioned in chapter 1, was to investigate and explain how organisations in the construction sector can enhance the decision- making process (DMP) by practicing knowledge management (KM) and business process management (BPM) activities. Moreover, the main research outcomes were shown in this chapter along with a summary of the research aim and objectives. Additionally, the theoretical and managerial implications, and the main conclusions obtained from the analysis of the outcomes of the semi-structured interview and the questionnaire are all presented in this chapter. The research contributions and the limitations of this research are discussed. At the end of this chapter ideas for further research was presented.

## 7.2. Summary of the Study and Research Findings

The research aim of this study is to explore and explain how organisations in the construction sector can enhance the decision-making process (DMP) by practicing knowledge management (KM) and business process management (BPM) activities. It has focused on KM processes, KM teams and KM technology, BPM variables which contain strategic alignment, culture and skills. Additionally, other areas that this research paid attention to include the attitudes of people, and governance, methods and IT to investigate their impact on the decision-making processes in the Jordanian construction industry. This section reviews the critical outcomes of the research in line with the study objectives.

Concerning the first objective “Present an appropriate literature review on the concepts of KM and BPM in regard to their significance for construction organisations in addition to assisting in the theoretical framing of them”, concepts, appropriate literature, and previous studies were reviewed which sum up the key areas of the research concerning KM, BPM and DMP. As discussed by Omotayo, 2015; Takhtravanchi and Pathirage, 2016; Serpell et al., 2018; Anumba et al., 2008; Bani Ismail, 2012; Al-Werikat, 2017; and Dave and Dave, 2017 in Ch2. Taken together, these reviews indicate the necessity for further focused emphasis on the usage of KM in DMP as well as, explicitly incorporated consideration of the issues influencing KM and BPM to support DMP in Jordanian construction organisations. The majority of literature associated with KM and BPM was established in or mentioned in Western countries. In addition, no more than a couple of studies were reported from emerging economies, and even fewer have been undertaken in the Middle East, which has a similar culture to Jordan (the research context).

Attaining the first objective of the research assisted in accomplishing research objectives and responding to the research question by underlining research potentials that have been ignored implicitly in recent studies. Moreover, the first objective helped in observing clear recommendations for additional research and trying to avoid similar work that has been completed previously. This is in addition to offering an understanding into research methodologies, methods, and strategies which are suitable to the research question and objectives. The mixed methods approach was utilized in this research to solve the research question in addition to achieving the research objectives. Triangulation with quantitative and qualitative methods was used in this study, uniting all questionnaire and semi-structured interviews.

Addressing the second objective “Contextualise a framework for the integration of KM and BPM to support DMP”, the variables of KM, BPM, and DMP were determined from theories, models, relevant literature and prior studies and summed up in a theoretical framework (see Figure 2-13) showing three central terms. In the first term knowledge management (KM), three variables have been recognized: KM processes, the KM team, and technology. In the second term, business process management (BPM), six variables were noted: strategic alignment, culture, skills and attitudes of people, governance, methods, and IT. In the third term, the process of DM: extent of analysis and speed of DM were pinpointed. The interactions amongst the twelve variables were posited in two main hypotheses established from the outcomes of the literature review and the study aim and objectives.

This research went a stage beyond purely determining the variables that influence DMP in terms of KM and BPM. Specifically, the study explored which factors influence the interrelationship between knowledge management and BPM along with its effect on the process of decision making, to achieve the third objective "Investigate the integration between KM and BPM in the construction organisations". This is apart from the fourth objective "Investigate the effect of the integration of KM and BPM in the DMP of Jordanian construction organisations". A survey method was applied to assess the research model. The questionnaire design was completed on earlier studies validated through a pilot study, reliable measurements, and survey instruments also applied in prior research. In the present study, 400 questionnaires were sent by mail to the target population, with a response rate of 30%. The questionnaire was aimed at decision-makers (senior management, managers, department heads, supervisors, and decision makers in the organisation) in the Jordanian construction sector for small and medium-sized organisations. The selection of the sample in this study was chosen from all the engineering companies and architectural offices officially registered by the Jordanian Engineers Association (JEA).–The Statistical Programme for Social Sciences (SPSS) was applied to analyse the viewpoints of 110 participants, seeking to achieve the research objectives. The quantitative analysis was accomplished by the triangulation of two types of analysis: descriptive and explanatory.

All hypotheses were accepted after being tested and the research model estimations showed that all hypotheses are statistically significant and supported (see Chapter 4, section 4-10). These findings suggested the presence of a significant impact from the integration of KM and BPM in the process of decision making in Jordanian construction organisations (see Chapter 4, section 4-11).

The last objective was "validate the proposed framework". According to the research process (Relevant to Chapter 3), semi-structured interviews were conducted with chosen industry practitioners along with robust knowledge as well as experience regarding KM and BPM in the construction sector in order to:

- elicit any crucial matters that need to be referred to within the framework as well as to those that were discovered within the literature review and synthesis.

- discover if the participants (domain experts) supported the outcomes from the questionnaire survey in order to verify and compare some of the findings achieved from the questionnaire analysis.

Twenty invitations were sent to the construction experts but only twelve responses agreed to attend the interview. All 12 interviews were completed over three months. The validation process was conducted over two stages. In the first stage, the interview questions were evaluated by three academics each employed at different universities, with experience in KM, BPM, as well as DMP. Recommendations were added to the initial edition which was guided by two directors from Jordanian construction organisations. In the second stage, the process was carried out through the validation interviews with the experts in the construction sector in Jordan to refine and examine the proposed framework for the construction sector in Jordan.

It was found that the proposed framework was useful and that it was a good stepping stone towards integrating KM with BPM in order to be able to improve the process of decision making in Jordan (see chapter 6). Furthermore, the framework will support the creation of a firm base or cornerstone to make correct and rapid decision making. The integration of KM and BPM will provide a dynamic view for decision makers regarding problems, defects and achievement regarding activities and processes inside the organisation. Accordingly, the decision makers can respond to this feedback with fast and more realistic decisions.

Regarding the framework, the respondents agreed that the framework covered most of the variables of KM and BPM that they expected. In addition, they noted that the integration of KM and BPM will enable DMP to be more efficient.

## 7.3. Benefits for The Construction Industry

In terms of time, sharing new knowledge and applying it can be time-consuming, especially for less experienced employees as it takes them more time to improve their performance from the new knowledge and skills gained, in comparison to very experienced employees who improve their performance more quickly. Also, it is difficult to gain knowledge and skills instantly, because knowledge sharing is a process that takes place gradually over time. This means that employees develop their skills and knowledge progressively over time so that they can help enhance their organisation's performance. One way that helps speed up the process of learning new knowledge is to give knowledge to employees immediately when they need it. For example, consulting firms could provide just in time knowledge to meet their proposal writer's needs. But one problem with this is that it would only benefit more experienced workers; this is because they have the ability to apply and understand new knowledge a lot more quickly than less experienced workers. Another way that organisations could use to help their less experienced employees learn new skills and knowledge at a quicker rate is to ask more experienced employees to lead workshops and seminars. The use of workshops is a platform that eases knowledge sharing as it provides an opportunity for employees with less experience to learn knowledge from their more experienced colleagues is a short amount of time. Although carrying out seminars and workshops can be costly for an organisation, since they would have to give the experienced employees rewards (such as a bonus) in order to encourage them to carry out workshops, it would act as a good investment for the organisation as the organisation's performance increases. Therefore, cost should not be a big problem because when comparing the benefits from knowledge sharing and amount of money spent, organisations would find out that the benefits outweigh the disadvantage of this spending.

The proposed framework was suggested to help the organisations to efficiently (quickly and correctly) analyse the decisions by interrelating the knowledge management techniques into the enterprise's BPs. This was completed by integrating the knowledge management process with several BP variables. These variables are: strategic alignment, governance, business processes; supporting methods, the organisation's culture, the people in the organisations, and information technologies.

Firstly, by combining KM with the strategic alignment of BP in construction organisations helps make decisions, e.g. decisions regarding budgets and the most suitable employees to join the project team. Secondly, in order to govern the roles in the organisations and to assure that the standards are followed in these roles, deploying knowledge is a major key to choosing the most appropriate roles and responsibilities given to the employees in a business process and every individual's role in the organisations. Thirdly, in order to assure the continuous learning of employees and improve knowledge sharing between them, as well as gaining knowledge and sharing it while conducting BPM activities there needs to be a supporting culture within an organisation. This will improve knowledge sharing between employees and different managers and positively affect DMP, e.g. reaching correct decisions quickly. Fourthly, one way to ease communication amongst employees is by using IT technologies, e.g. using networks, computers and applications. Fifthly, it is important to integrate Knowledge Management variables with BP methods, e.g. Six Stigma methods will lead to an increase in consistency and productivity within the organisational processes which will enhance DMP. Lastly, KMS provides a list of people with some background information (such as experience and skills) which helps to make a decision on the most appropriate employees to be involved in a specific project.

## 7.4. Theoretical and Managerial Implications

### 7.4.1. Theoretical Implications

The outcomes of this survey created a number of significant theoretical contributions. Initially, this study combined knowledge management with business process management in a new context to support decision making in construction organisations. The success of the amalgamation of a variety of elements that influence KM and BPM to improve the DMP in one framework (i.e. i.e. KM processes, KM team, BPM variables which contain strategic alignment, culture, skills as well as attitudes of people, governance, methods, IT and the process of DM variables) is distinct from the findings. Furthermore, the findings indicate that the developed framework can clarify the effect of various variables of KM and BPM on DMP in the Jordanian construction industry.

To ensure the effective utilization and improvement of the role of knowledge throughout the business life cycle, the process of KM is an essential driver for any BP development and evolution as it engages with planning, implementation, and controlling, monitoring and improving processes and systems in an organisation. The combination of KM and BP is indispensable. The aim is to transmit suitable knowledge at the appropriate time to the right people and enhance the effectiveness of DM within the company.

This research improves our understanding of KM in various areas by evaluating, in addition to incorporating, the literature from various disciplines. Commonly, centred on the literature review, it was assumed that there is a considerable body of literature stating how KM could be applied to accelerate DM independently. Thus, there is a gap in the literature concerning the usage of KM with BPM in assisting the DMP, particularly in the construction industry.

Consequently, even though much research concerning KM has been written on business processes and decision making, none of these studies has utilised all the variables applied in this research.

Third, this research presents a different theoretical framework that determines the elements that impact the integration of KM and BPM to support DM in the construction industry. The framework will make an essential contribution to the literature in BPM combined with KM, and this will help small and medium construction organisations detect innovative methods of leveraging in addition to revealing appropriate knowledge to enhance the DMP.

Fourth, the framework proposed explored the relationship between KM and BPM and its influence on the process of decision making in the Jordanian construction industry. This differentiates the research from the current empirical work on KM in addition to BPs, by assessing a variety of variables that influence KM and BPM to support the DMP. Additionally, the assumptions and discoveries produced in this analysis will make a unique impact on the knowledge centre in the areas of BPM and KM.

Consequently, this research makes a contribution by utilizing a mixed methods approach with valuable data for empirical research from contributors from Jordanian small and medium construction organisations Furthermore, SPSS was applied to engage in measurement and research hypotheses.

### 7.4.2. Managerial Implications

The outcomes of this research have many implications for decision makers in Jordanian construction organisations, as reviewed below.

Considerable growth in the usage of KM and BPM in addition to their integration helps to provide the employees with the required knowledge needed for performing the organisation's operational business processes, enhance process performance, develop core competencies (Zhang et al., 2008), and optimize business performance (Han et al., 2008). This encourages construction organisations to improve KM and BP methods and techniques and share suitable knowledge at the appropriate time with the correct people and enhance the effectiveness of DM within the company. Given the noticeable trend in spending on the development of KMSs, it is helpful to understand the factors that affect knowledge management and its effect on BPs so that construction organisations are encouraged to consider managing knowledge and business processes as a significant concept that positively effects DM.

They are also advised to connect KM activities and business processes with organisational needs including the prime aim of achieving the organisation's targets and enhancing the competitive strategy and performance of an organisation. Furthermore, the findings suggest that IT plays a vital role in KM and BPM ventures and enhances the efficiency of BP as well as improving the efficiency of the BPM life cycle and enabling organisations to survive in the highly competitive business environment.

There is a significant relationship between KM variables and governance which can affect process roles and responsibilities in addition to covering regular review cycles to maintain superiority and process administration values. Moreover, comprehensive knowledge can contribute in the effective functioning of the governance process such as establishing suitable responsibilities and roles regarding the distinctive levels of BPM.

Regarding the relationship between KM and the culture of BPs, it can be shown that KM variables and organisational culture need to work together to create a facilitating environment that supplements the different BPM activities. This encouraging the sharing of values and beliefs which form process-based attitudes as well as the requisite behaviour to advance the organisation's value chain. It is essential to take into consideration the uniqueness of every organisational culture in eliminating difficulties regarding the sharing of knowledge through evaluating possible challenges or issues that might occur in the organisation and the suggestion of appropriate solutions.

Furthermore, the outcomes of this research showed that there is a strong correlation between KM variables and people who characterized as the individuals and groups who repeatedly improve and apply their process management skills and knowledge to enhance business process execution. Additionally, it can be shown that KM variables need to be integrated with methods that support business processes, such as Six Sigma, to allow organisations to reduce the lead time in processes, costs and effort in processes and attain excellence in organisational process quality and consistency.

The combination of KM and strategic alignment influences the organisation's attitudes on innovation and efficiency. The strategic alignment of KM affects the selections made for the construction projects. This includes choosing the right project size and budget, and choice of the project team depending on their skills, correct machinery, appropriate technology and selecting contractors. Project managers in an organisation align both the objectives and strategies of the organisation to try and meet the project's goals. Also, project owners decide whether the idea of the construction project is new to the market or not. If so, the project owner tries to complete the construction project in a short amount of time so that it can be launched quickly to market in order to gain a competitive advantage over other construction organisations.

The organisation's culture works well with KM as it allows the organisation to gain knowledge. Both the culture and KM are linked as, if the culture is does not build motivated employees the sharing of knowledge would be very weak. If the employees lack trust, it makes them hesitant to share information with people that they have very little trust in. Another example is if an electrical engineer is not up-to-date with the latest technology in electrical equipment due to the lack of the efficiency of communication technology within their organisation's culture, then a mistake could occur which disturbs the completion of the project and results in a high cost damage.

Utilizing appropriate method and IT tools allows for improvement in BP projects, as it eases the process design phase and allows any changes that are needed to happen quickly and easily and KM helps to select the most appropriate IT tools for the project. If an organisation could use a variety of IT applications such as, traditional applications that include AutoCAD which is 2D, or BIM applications e.g. 3D Revit, and Tekla that is used for bigger projects such as an airport or a stadium.

The link between KM and business process governance helps to determine the most appropriate roles and responsibilities for each individual in a project team. For example, an architect is given the responsibility to develop the construction designs and drawings, as well as bringing both the plan application and building warrants. Whereas a structural engineer is normally given the role to design the construction structure and gives advice to both the client and the quantity surveyor regarding costs.

The people within an organisation represent human resource and those who work in team or individually that constantly enhance and utilize their skills and knowledge within the organisation, the people are linked with as knowledge-based systems to gain all the possible needed information about employees. For example, human resource aids process owners to select the right people for the right project as HR provides knowledge regarding employees' experience, attitude, and commitment. Also, HR gives an advise on who to invite to be part of a project based on a specific skill, for example, organzations often look for multiskilling as it allows the organisation to allocate that multi-skilled employee to work in a number of roles if there is a shortage.

To summarise, the research offered a framework that can help construction organisations to discover new approaches of leveraging and distributing knowledge and integrating with BPM to improve DM. This framework could deliver various benefits to directors and workforce, such as the following:

- ✓ The framework is differentiated from current empirical work on KM as well as BPM by the introduction of a larger selection of elements.
- ✓ The reliability and validity of the research-based model have been demonstrated.
- ✓ The framework contains three terms with 12 variables. Each variable is obtained and derived from prior studies.
- ✓ The framework is connected to the effectiveness and efficiency of an organisation and concentrates on decision making through using knowledge assets and business processes.
- ✓ The framework focuses on administrative and organisational practices related to KM processes, the KM team, KM technology, strategic alignment, culture, the skills and attitudes of people, governance, methods, information technology and the decision-making process. This makes it simpler for construction organisations to utilize; it can similarly be linked to crucial strategic initiatives and capabilities.
- ✓ The questionnaire framework created was simple to apply, as well as applicable to organisations and to further additional research.
- ✓ The findings provide fruitful insight for managers working in small and medium construction organisations in order to improve DM by using KM and BPM.

## 7.5. Recommendations for CEOs

It is recommended that CEOs:

- Incorporate workshops, seminars and programmes that train and enhance the employees' communication skills, they should also introduce mentoring schemes and work experience, and remove any organisational barriers so that everyone in the organisation is given the opportunity to show their skills.
- Build knowledge management systems (KMS) that incorporates all of the previous knowledge regarding construction organisations (such as key workers and standards provided by the government), critical issues in projects and how it can be solved and

important documents and information that effect on this sector such as the standards, policies, key workers details and financial documents.

- Urge employees to stay up to date with the latest news, knowledge, and new technology that can be obtained through KMS. Because this helps project owners carry out projects with new and creative ideas that attract customers, this means that a new idea will be launched first into the construction market, this gives the organisation a competitive advantage over other construction organisations.
- Keep track of the employees' knowledge on written documents or recording, so that there is evidence that knowledge has/being created in the organisation.
- Encourage employees to apply their tacit knowledge to new projects, this help improve the performance of the project.
- Urge the use of IT amongst employees for communication, as IT tends to support collaborative work and eases interorganisational communication to aid the spread of knowledge.
- assign every employee their roles and responsibilities, and make sure they understand the organisation's process requirements. This makes sure that processes run smoothly and that roles are controlled affectively. Including governance within organisations helps to keep the quality of production and helps to maintain the standards provided by the government.
- Select the most appropriate IT applications that suits the project's requirements, for example 3D Revit and Tekla (is also 3D) is probably the most suitable choice for bigger projects such as an airport or a stadium.

## 7.6. Limitations of The Study

Despite this research reaching a number of useful findings, there are some limitations.

1. Even though there is much research regarding the field of KM in the construction industry, there is limited information on empirical studies with solutions to enhance decision making with regard to KM and BPM approaches in Jordanian construction organisations. This study has achieved this empirically.

2. The method of observation is seen as a crucial method for data gathering in the context of monitoring management procedures and performance but due to the time restrictions on this study, the observation method was ignored. Future studies could be conducted applying various methodologies that engage in in-depth research, for example a case study or/and observation.
3. The study was conducted in small and medium-sized construction organisations, but is restricted to one country. Clearly, in order to generalize the findings obtained in the current research, this study needs to be applied to other construction organisations, other countries, and other functional areas or other industries.
4. The proposed framework in this research signifies a reasonable starting point as it was assessed on a sample size (110 responses), which undoubtedly will have various consequences for the generalisability of the discoveries.
5. Utilizing a survey questionnaire regarding KM and DMP limits the possibility of employing a larger population in order to test for ideas and insights.
6. The number of KM and BPM principal experts in the Jordanian construction sector is limited and was consequently a limitation on the validity of this research.
7. This framework is still unique and generic. However, in order to deploy it in different construction projects or other sectors, some customisations need to be implemented. For example, in the banking sector, bank organisations tend to focus on the quality of technologies that have a good level of security and data protection and on being provided with a developed ATM machine system. Also, bank organisations look for a system that has a high level of authentication in online banking websites.

## 7.7. Recommendations for Further Research

During the present research, certain notes along with research suggestions were detected which were not directly linked to the aim of this study but which are deserving of further awareness in any future studies. In particular, further research could validate the generalisability of the findings.

To generalise the obtained outcomes from this research, additional studies need to be performed applying similar surveys with a much larger sample size.

Additionally, assessing the framework established in this research in other countries such as, African, Asian or other Western countries, would be useful in gaining evidence regarding the strength of this research model. It could, likewise, be interesting for forthcoming research to assess as a case study the model generated for this research in companies of a different size to measure the actual impact of the framework and to suggest modifications if any are needed based on a longitudinal study.

Further studies will, possibly, be shown to develop the research model by including additional elements or variables from the conceptual framework, such as dynamic capabilities with exploration and exploitation processes to exchange knowledge between variables and external environmental factors which were excluded in this research because of restrictions on time.

Also, further research will be done to investigate the effect of the integration between KM and BPM and its impact on the organisational performance in the small, medium and large construction organisations.

Other organisational, technical and business challenges for KM and BPM implementation in the Jordanian construction sector were identified by domain experts. However, future studies need to be conducted to investigate these challenges in a thorough and detailed manner.

## 7.8. Conclusion

The results and the conclusion of this research were summarised in this chapter, along with a discussion of the theoretical and managerial implications of the findings. All hypotheses were accepted after being tested and the research model estimations showed that all hypotheses are statistically significant and supported. Moreover, the factors that acted as a limitation to this study were highlighted and suggestions for further research were made.

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# Appendices

## **Appendix A**: Questionnaire Analysis

| Table(1): **Reliability Statistics** | | |
|---|---|---|
| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
| .972 | .973 | 77 |

## 1- All variables (1-77)

Table(1) shows total Cronbach's Alpha, that is 0.972. In table(2), there is no Cronbach's Alpha greater than 0.972 therefore, all variables should be in the questionnaire.

Table(2): **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 |
|---|---|---|---|---|---|
| Q1 | 291.33 | 1394.927 | .592 | . | .972 |
| Q2 | 291.08 | 1405.965 | .471 | . | .972 |
| Q3 | 290.95 | 1413.618 | .337 | . | .972 |
| Q4 | 290.84 | 1411.244 | .374 | . | .972 |
| Q5 | 291.34 | 1388.467 | .583 | . | .972 |
| Q6 | 291.25 | 1398.133 | .494 | . | .972 |
| Q7 | 291.30 | 1401.972 | .435 | . | .972 |

| | | | | | |
|---|---|---|---|---|---|
| Q8 | 291.39 | 1395.998 | .527 | . | .972 |
| Q9 | 291.15 | 1395.163 | .533 | . | .972 |
| Q10 | 291.35 | 1392.266 | .574 | . | .972 |
| Q11 | 291.26 | 1392.674 | .608 | . | .972 |
| Q12 | 291.10 | 1393.277 | .569 | . | .972 |
| Q13 | 291.47 | 1390.566 | .523 | . | .972 |
| Q14 | 291.30 | 1405.287 | .416 | . | .972 |
| Q15 | 291.33 | 1390.371 | .575 | . | .972 |
| Q16 | 291.28 | 1389.220 | .607 | . | .972 |
| Q17 | 291.02 | 1416.703 | .314 | . | .972 |
| Q18 | 291.18 | 1403.873 | .505 | . | .972 |
| Q19 | 290.94 | 1404.635 | .499 | . | .972 |
| Q20 | 291.37 | 1399.160 | .520 | . | .972 |
| Q21 | 291.37 | 1397.753 | .548 | . | .972 |
| Q22 | 291.12 | 1406.902 | .455 | . | .972 |
| Q23 | 291.28 | 1391.812 | .609 | . | .972 |
| Q24 | 291.17 | 1406.090 | .426 | . | .972 |
| Q25 | 292.06 | 1393.793 | .397 | . | .972 |
| Q26 | 291.15 | 1402.145 | .569 | . | .972 |
| Q27 | 291.23 | 1399.808 | .624 | . | .972 |
| Q28 | 291.30 | 1397.695 | .586 | . | .972 |
| Q29 | 291.43 | 1401.988 | .457 | . | .972 |
| Q30 | 291.28 | 1400.317 | .603 | . | .972 |
| Q31 | 291.20 | 1402.089 | .537 | . | .972 |
| Q32 | 291.32 | 1391.239 | .636 | . | .972 |
| Q33 | 291.28 | 1390.442 | .669 | . | .972 |

| | | | | | |
|---|---|---|---|---|---|
| Q34 | 291.52 | 1385.585 | .612 | . | .972 |
| Q35 | 291.44 | 1391.027 | .711 | . | .971 |
| Q36 | 291.50 | 1393.363 | .517 | . | .972 |
| Q37 | 291.28 | 1389.164 | .649 | . | .972 |
| Q38 | 291.19 | 1414.305 | .453 | . | .972 |
| Q39 | 291.15 | 1406.015 | .460 | . | .972 |
| Q40 | 291.28 | 1397.646 | .517 | . | .972 |
| Q41 | 291.12 | 1396.143 | .639 | . | .972 |
| Q42 | 291.28 | 1399.961 | .583 | . | .972 |
| Q43 | 291.17 | 1399.867 | .560 | . | .972 |
| Q44 | 291.42 | 1396.339 | .554 | . | .972 |
| Q45 | 291.32 | 1391.516 | .639 | . | .972 |
| Q46 | 291.25 | 1398.725 | .539 | . | .972 |
| Q47 | 291.24 | 1397.998 | .631 | . | .972 |
| Q48 | 291.35 | 1394.766 | .631 | . | .972 |
| Q49 | 291.28 | 1400.057 | .552 | . | .972 |
| Q50 | 291.34 | 1401.523 | .495 | . | .972 |
| Q51 | 291.19 | 1403.787 | .511 | . | .972 |
| Q52 | 291.12 | 1397.587 | .624 | . | .972 |
| Q53 | 291.39 | 1393.297 | .553 | . | .972 |
| Q54 | 291.27 | 1398.679 | .590 | . | .972 |
| Q55 | 291.39 | 1386.278 | .645 | . | .972 |
| Q56 | 291.29 | 1407.413 | .417 | . | .972 |
| Q57 | 291.42 | 1384.894 | .624 | . | .972 |
| Q58 | 291.27 | 1382.345 | .745 | . | .971 |
| Q59 | 291.62 | 1388.922 | .637 | . | .972 |

| | | | | | |
|---|---|---|---|---|---|
| Q60 | 291.31 | 1396.550 | .603 | . | .972 |
| Q61 | 291.21 | 1399.187 | .633 | . | .972 |
| Q62 | 291.42 | 1392.302 | .638 | . | .972 |
| Q63 | 291.37 | 1396.901 | .535 | . | .972 |
| Q64 | 291.46 | 1401.028 | .517 | . | .972 |
| Q65 | 291.39 | 1392.776 | .637 | . | .972 |
| Q66 | 291.36 | 1397.862 | .570 | . | .972 |
| Q67 | 291.35 | 1395.377 | .621 | . | .972 |
| Q68 | 291.34 | 1394.782 | .592 | . | .972 |
| Q69 | 291.28 | 1397.590 | .645 | . | .972 |
| Q70 | 291.23 | 1400.438 | .602 | . | .972 |
| Q71 | 291.07 | 1400.495 | .579 | . | .972 |
| Q72 | 291.17 | 1401.139 | .588 | . | .972 |
| Q73 | 291.31 | 1405.550 | .443 | . | .972 |
| Q74 | 291.22 | 1403.044 | .479 | . | .972 |
| Q75 | 291.12 | 1400.643 | .590 | . | .972 |
| Q76 | 291.17 | 1407.435 | .510 | . | .972 |
| Q77 | 291.11 | 1391.877 | .677 | . | .972 |

Table(3) shows **descriptive statistics**

Table(3): **Descriptive Statistics**

| | Mean | Std. Deviation | Analysis N |
|---|---|---|---|
| Q69 | 3.8349 | .75171 | 110 |
| Q70 | 3.8807 | .74193 | 110 |
| Q71 | 4.0367 | .76892 | 110 |

| | | | |
|---|---|---|---|
| Q72 | 3.9450 | .74330 | 110 |
| Q73 | 3.7982 | .84743 | 110 |
| Q74 | 3.8899 | .85353 | 110 |
| Q75 | 3.9908 | .75149 | 110 |
| Q76 | 3.9450 | .69168 | 110 |
| Q77 | 4.0000 | .82776 | 110 |
| Q1 | 3.7798 | .87515 | 110 |
| Q2 | 4.0275 | .78715 | 110 |
| Q3 | 4.1560 | .79552 | 110 |
| Q4 | 4.2661 | .80095 | 110 |
| Q5 | 3.7706 | 1.03309 | 110 |
| Q6 | 3.8624 | .95712 | 110 |
| Q7 | 3.8073 | .96683 | 110 |
| Q8 | 3.7248 | .95133 | 110 |
| Q9 | 3.9633 | .96154 | 110 |
| Q10 | 3.7615 | .96128 | 110 |
| Q11 | 3.8532 | .90088 | 110 |
| Q12 | 4.0092 | .94766 | 110 |
| Q13 | 3.6422 | 1.09310 | 110 |
| Q14 | 3.8073 | .90755 | 110 |
| Q15 | 3.7798 | 1.00331 | 110 |
| Q16 | 3.8349 | .97671 | 110 |
| Q17 | 4.0917 | .72701 | 110 |
| Q18 | 3.9266 | .79006 | 110 |
| Q19 | 4.1743 | .77989 | 110 |
| Q20 | 3.7431 | .88615 | 110 |

| | | | |
|---|---|---|---|
| Q21 | 3.7431 | .87563 | 110 |
| Q22 | 3.9908 | .78758 | 110 |
| Q23 | 3.8349 | .91807 | 110 |
| Q24 | 3.9358 | .86362 | 110 |
| Q25 | 3.0550 | 1.31117 | 110 |
| Q26 | 3.9633 | .74444 | 110 |
| Q27 | 3.8807 | .72934 | 110 |
| Q28 | 3.8073 | .82189 | 110 |
| Q29 | 3.6789 | .92176 | 110 |
| Q30 | 3.8257 | .74342 | 110 |
| Q31 | 3.9083 | .78812 | 110 |
| Q32 | 3.7890 | .89312 | 110 |
| Q33 | 3.8349 | .86617 | 110 |
| Q34 | 3.5872 | 1.04714 | 110 |
| Q35 | 3.6697 | .80571 | 110 |
| Q36 | 3.6147 | 1.03556 | 110 |
| Q37 | 3.8349 | .91807 | 110 |
| Q38 | 3.9174 | .57941 | 110 |
| Q39 | 3.9633 | .80423 | 110 |
| Q40 | 3.8349 | .92810 | 110 |
| Q41 | 3.9908 | .78758 | 110 |
| Q42 | 3.8349 | .77596 | 110 |
| Q43 | 3.9358 | .80824 | 110 |
| Q44 | 3.6881 | .89956 | 110 |
| Q45 | 3.7890 | .88269 | 110 |
| Q46 | 3.8624 | .86568 | 110 |

| | | | |
|---|---|---|---|
| Q47 | 3.8716 | .75891 | 110 |
| Q48 | 3.7615 | .82663 | 110 |
| Q49 | 3.8257 | .81473 | 110 |
| Q50 | 3.7706 | .86745 | 110 |
| Q51 | 3.9174 | .78326 | 110 |
| Q52 | 3.9908 | .77574 | 110 |
| Q53 | 3.7156 | .97270 | 110 |
| Q54 | 3.8440 | .79552 | 110 |
| Q55 | 3.7156 | .98217 | 110 |
| Q56 | 3.8165 | .84069 | 110 |
| Q57 | 3.6881 | 1.04259 | 110 |
| Q58 | 3.8440 | .92471 | 110 |
| Q59 | 3.4862 | .93902 | 110 |
| Q60 | 3.7982 | .82529 | 110 |
| Q61 | 3.8991 | .73213 | 110 |
| Q62 | 3.6881 | .86813 | 110 |
| Q63 | 3.7431 | .91696 | 110 |
| Q64 | 3.6514 | .84301 | 110 |
| Q65 | 3.7248 | .85928 | 110 |
| Q66 | 3.7523 | .84059 | 110 |
| Q67 | 3.7615 | .82663 | 110 |
| Q68 | 3.7706 | .87806 | 110 |

The matrix of correlation is too large; therefore we can't put it.

## 2- KM variables (1-37)

Table(9) shows total Cronbach's Alpha, that is 0.942. In table(10), there is no Cronbach's Alpha greater than 0.942 therefore, all variables should be in the questionnaire.

Table(9): **Reliability Statistics** of KM

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .942 | .943 | 37 |

Table(10): **Item-Total Statistics** of KM

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Squared Multiple Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|---|
| Q1 | 138.16 | 342.874 | .597 | . | .940 |
| Q2 | 137.91 | 347.103 | .520 | . | .941 |
| Q3 | 137.78 | 353.877 | .283 | . | .942 |
| Q4 | 137.67 | 352.038 | .343 | . | .942 |
| Q5 | 138.17 | 338.232 | .623 | . | .940 |
| Q6 | 138.07 | 342.939 | .540 | . | .941 |
| Q7 | 138.13 | 345.169 | .470 | . | .941 |
| Q8 | 138.21 | 342.150 | .566 | . | .940 |
| Q9 | 137.97 | 342.360 | .554 | . | .940 |
| Q10 | 138.17 | 342.645 | .546 | . | .941 |
| Q11 | 138.08 | 341.947 | .607 | . | .940 |
| Q12 | 137.93 | 341.402 | .591 | . | .940 |

| | | | | | |
|---|---|---|---|---|---|
| Q13 | 138.29 | 339.543 | .552 | . | .941 |
| Q14 | 138.13 | 347.520 | .433 | . | .941 |
| Q15 | 138.16 | 339.837 | .599 | . | .940 |
| Q16 | 138.10 | 339.240 | .634 | . | .940 |
| Q17 | 137.84 | 353.985 | .310 | . | .942 |
| Q18 | 138.01 | 346.250 | .548 | . | .941 |
| Q19 | 137.76 | 347.369 | .516 | . | .941 |
| Q20 | 138.19 | 344.194 | .548 | . | .941 |
| Q21 | 138.19 | 343.676 | .571 | . | .940 |
| Q22 | 137.94 | 348.608 | .468 | . | .941 |
| Q23 | 138.10 | 340.629 | .635 | . | .940 |
| Q24 | 138.00 | 347.926 | .444 | . | .941 |
| Q25 | 138.88 | 342.995 | .376 | . | .943 |
| Q26 | 137.97 | 346.546 | .573 | . | .940 |
| Q27 | 138.06 | 346.182 | .600 | . | .940 |
| Q28 | 138.13 | 344.891 | .571 | . | .940 |
| Q29 | 138.26 | 345.711 | .479 | . | .941 |
| Q30 | 138.11 | 345.284 | .621 | . | .940 |
| Q31 | 138.03 | 345.657 | .570 | . | .940 |
| Q32 | 138.15 | 340.978 | .643 | . | .940 |
| Q33 | 138.10 | 340.443 | .682 | . | .939 |
| Q34 | 138.35 | 337.766 | .627 | . | .940 |
| Q35 | 138.27 | 341.827 | .688 | . | .939 |
| Q36 | 138.32 | 343.942 | .468 | . | .941 |
| Q37 | 138.10 | 341.055 | .622 | . | .940 |

| **Table(12): Descriptive Statistics** of KM | | | |
|---|---|---|---|
| | Mean | Std. Deviation | Analysis N |
| Q1 | 3.7798 | .87515 | 110 |
| Q2 | 4.0275 | .78715 | 110 |
| Q3 | 4.1560 | .79552 | 110 |
| Q4 | 4.2661 | .80095 | 110 |
| Q5 | 3.7706 | 1.03309 | 110 |
| Q6 | 3.8624 | .95712 | 110 |
| Q7 | 3.8073 | .96683 | 110 |
| Q8 | 3.7248 | .95133 | 110 |
| Q9 | 3.9633 | .96154 | 110 |
| Q10 | 3.7615 | .96128 | 110 |
| Q11 | 3.8532 | .90088 | 110 |
| Q12 | 4.0092 | .94766 | 110 |
| Q13 | 3.6422 | 1.09310 | 110 |
| Q14 | 3.8073 | .90755 | 110 |
| Q15 | 3.7798 | 1.00331 | 110 |
| Q16 | 3.8349 | .97671 | 110 |
| Q17 | 4.0917 | .72701 | 110 |
| Q18 | 3.9266 | .79006 | 110 |
| Q19 | 4.1743 | .77989 | 110 |
| Q20 | 3.7431 | .88615 | 110 |
| Q21 | 3.7431 | .87563 | 110 |
| Q22 | 3.9908 | .78758 | 110 |
| Q23 | 3.8349 | .91807 | 110 |
| Q24 | 3.9358 | .86362 | 110 |

| | | | |
|---|---|---|---|
| Q25 | 3.0550 | 1.31117 | 110 |
| Q26 | 3.9633 | .74444 | 110 |
| Q27 | 3.8807 | .72934 | 110 |
| Q28 | 3.8073 | .82189 | 110 |
| Q29 | 3.6789 | .92176 | 110 |
| Q30 | 3.8257 | .74342 | 110 |
| Q31 | 3.9083 | .78812 | 110 |
| Q32 | 3.7890 | .89312 | 110 |
| Q33 | 3.8349 | .86617 | 110 |
| Q34 | 3.5872 | 1.04714 | 110 |
| Q35 | 3.6697 | .80571 | 110 |
| Q36 | 3.6147 | 1.03556 | 110 |
| Q37 | 3.8349 | .91807 | 110 |

## 3- BPM variables (38-68)

Table(20) shows total Cronbach's Alpha, that is 0.946. In table(21), there is no Cronbach's Alpha greater than 0.946, therefore, all variables should be in the questionnaire.

**Table(20): Reliability Statistics** of **BPM**

| Cronbach's Alpha | N of Items |
|---|---|
| .946 | 31 |

Table(21): **Item-Total Statistics** of **BPM**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| Q38 | 113.8727 | 257.378 | .448 | .946 |
| Q39 | 113.8273 | 253.465 | .467 | .946 |
| Q40 | 113.9636 | 249.412 | .537 | .945 |
| Q41 | 113.8000 | 249.978 | .622 | .944 |
| Q42 | 113.9545 | 252.080 | .543 | .945 |
| Q43 | 113.8545 | 250.052 | .601 | .945 |
| Q44 | 114.1091 | 249.438 | .556 | .945 |
| Q45 | 114.0091 | 247.128 | .653 | .944 |
| Q46 | 113.9273 | 250.325 | .548 | .945 |
| Q47 | 113.9273 | 250.875 | .604 | .945 |
| Q48 | 114.0273 | 248.926 | .631 | .944 |
| Q49 | 113.9727 | 249.788 | .604 | .945 |
| Q50 | 114.0273 | 250.320 | .544 | .945 |
| Q51 | 113.8909 | 251.805 | .533 | .945 |
| Q52 | 113.8091 | 249.257 | .657 | .944 |
| Q53 | 114.0727 | 249.756 | .500 | .946 |
| Q54 | 113.9455 | 251.483 | .553 | .945 |
| Q55 | 114.0727 | 245.811 | .627 | .944 |
| Q56 | 113.9727 | 253.660 | .437 | .946 |
| Q57 | 114.1000 | 244.183 | .639 | .944 |
| Q58 | 113.9455 | 244.327 | .724 | .943 |
| Q59 | 114.3000 | 245.496 | .669 | .944 |
| Q60 | 114.0000 | 248.991 | .627 | .944 |
| Q61 | 113.8909 | 251.016 | .626 | .945 |

| | | | | |
|---|---|---|---|---|
| Q62 | 114.1000 | 246.751 | .681 | .944 |
| Q63 | 114.0455 | 249.457 | .545 | .945 |
| Q64 | 114.1455 | 251.245 | .527 | .945 |
| Q65 | 114.0818 | 247.268 | .656 | .944 |
| Q66 | 114.0364 | 249.467 | .599 | .945 |
| Q67 | 114.0273 | 248.596 | .644 | .944 |
| Q68 | 114.0182 | 248.679 | .601 | .945 |

# 4- DMP variables (69-77)

Table(30) shows total Cronbach's Alpha, that is 0.879. In table(31), there is no Cronbach's Alpha greater than 0.879, therefore, all variables should be in the questionnaire.

Table(30): **Reliability Statistics** of **DMP**

| Cronbach's Alpha | N of Items |
|---|---|
| .879 | 9 |

Table(31): **Item-Total Statistics** of **DMP**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| Q69 | 31.4862 | 20.085 | .626 | .866 |
| Q70 | 31.4404 | 19.878 | .671 | .862 |
| Q71 | 31.2844 | 20.298 | .574 | .870 |
| Q72 | 31.3761 | 20.107 | .631 | .865 |
| Q73 | 31.5229 | 19.974 | .551 | .873 |

| | | | | |
|---|---|---|---|---|
| Q74 | 31.4312 | 19.618 | .598 | .869 |
| Q75 | 31.3303 | 19.760 | .680 | .861 |
| Q76 | 31.3761 | 20.755 | .577 | .870 |
| Q77 | 31.3211 | 19.035 | .713 | .858 |

Table(32): **DMP Correlations**

| | | | Q69 | Q70 | Q71 | Q72 | Q73 | Q74 | Q75 | Q76 | Q77 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Spearman's rho | Q69 | Correlation Coefficient | 1.000 | .490** | .345** | .391** | .260** | .288** | .436** | .290** | .410** |
| | | Sig. (2-tailed) | . | .000 | .000 | .000 | .006 | .002 | .000 | .002 | .000 |
| | | N | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| | Q70 | Correlation Coefficient | .490** | 1.000 | .425** | .271** | .410** | .310** | .374** | .396** | .464** |
| | | Sig. (2-tailed) | .000 | . | .000 | .004 | .000 | .001 | .000 | .000 | .000 |
| | | N | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| | Q71 | Correlation Coefficient | .345** | .425** | 1.000 | .375** | .339** | .299** | .395** | .337** | .389** |
| | | Sig. (2-tailed) | .000 | .000 | . | .000 | .000 | .002 | .000 | .000 | .000 |
| | | N | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| | Q72 | Correlation Coefficient | .391** | .271** | .375** | 1.000 | .353** | .325** | .343** | .280** | .279** |
| | | Sig. (2-tailed) | .000 | .004 | .000 | . | .000 | .001 | .000 | .003 | .003 |
| | | N | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| | Q73 | Correlation Coefficient | .260** | .410** | .339** | .353** | 1.000 | .512** | .242* | .287** | .417** |
| | | Sig. (2-tailed) | .006 | .000 | .000 | .000 | . | .000 | .011 | .002 | .000 |
| | | N | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| | Q74 | Correlation Coefficient | .288** | .310** | .299** | .325** | .512** | 1.000 | .343** | .399** | .443** |
| | | Sig. (2-tailed) | .002 | .001 | .002 | .001 | .000 | . | .000 | .000 | .000 |
| | | N | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q75 | Correlation Coefficient | .436** | .374** | .395** | .343** | .242* | .343** | 1.000 | .464** | .396** |
| | | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .011 | .000 | . | .000 | .000 |
| | | N | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| | Q76 | Correlation Coefficient | .290** | .396** | .337** | .280** | .287** | .399** | .464** | 1.000 | .486** |
| | | Sig. (2-tailed) | .002 | .000 | .000 | .003 | .002 | .000 | .000 | . | .000 |
| | | N | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| | Q77 | Correlation Coefficient | .410** | .464** | .389** | .279** | .417** | .443** | .396** | .486** | 1.000 |
| | | Sig. (2-tailed) | .000 | .000 | .000 | .003 | .000 | .000 | .000 | .000 | . |
| | | N | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | | | | | | | | | |
| *. Correlation is significant at the 0.05 level (2-tailed). | | | | | | | | | | | |

Table(33): **Descriptive Statistics** of **DMP**

| | Mean | Std. Deviation | Analysis N |
|---|---|---|---|
| Q69 | 3.8349 | .75171 | 110 |
| Q70 | 3.8807 | .74193 | 110 |
| Q71 | 4.0367 | .76892 | 110 |
| Q72 | 3.9450 | .74330 | 110 |
| Q73 | 3.7982 | .84743 | 110 |
| Q74 | 3.8899 | .85353 | 110 |
| Q75 | 3.9908 | .75149 | 110 |
| Q76 | 3.9450 | .69168 | 110 |
| Q77 | 4.0000 | .82776 | 110 |

**Spearman's rho**

| | | STRATEGIC | CULTURE | PEOPLE | GOVERNANCE | METHODS | INFORMATION TECHNOLOGY |
|---|---|---|---|---|---|---|---|
| KM PROCESSES | Correlation Coefficient | .656** | .652** | .506** | .652** | .506** | .568** |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | .000 |
| | N | 110 | 110 | 110 | 110 | 110 | 110 |
| KM TECHNOLOGY | Correlation Coefficient | .533** | .560** | .468** | .590** | .531** | .589** |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | .000 |
| | N | 110 | 110 | 110 | 110 | 110 | 110 |
| KM TEAM | Correlation Coefficient | .630** | .618** | .649** | .732** | .679** | .696** |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | .000 |
| | N | 110 | 110 | 110 | 110 | 110 | 110 |

**. Correlation is significant at the 0.01 level (2-tailed).

**The analysis of the integration between KM and BPM**

First hypotheses: H.1 There is significant relationship between KM and BPM. This hypothesis is subdivided into the following hypotheses.

H.1.1 There is a significant relationship between the processes of KM and **strategic alignment** .

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | .696[a] | .485 | .480 | .39509899 | 1.909 |

a. Predictors: (Constant), KMPRO

b. Dependent Variable: STRATEGIC

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 15.847 | 1 | 15.847 | 101.516 | .000[b] |
| | Residual | 16.859 | 109 | .156 | | |
| | Total | 32.706 | 110 | | | |
| a. Dependent Variable: STRATEGIC | | | | | | |
| b. Predictors: (Constant), KMPRO | | | | | | |

**Coefficients**[a]

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | 1.043 | .287 | | 3.632 | .000 | .474 | 1.613 |
| | KMPRO | .736 | .073 | .696 | 10.075 | .000 | .591 | .881 |
| a. Dependent Variable: STRATEGIC | | | | | | | | |

H.1.2 There is a significant relationship between KM processes and the **governance .**

**Model Summary**[b]

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | .737[a] | .543 | .539 | .44130896 | 1.772 |
| a. Predictors: (Constant), KMPRO | | | | | |
| b. Dependent Variable: GOVERNANCE | | | | | |

**ANOVA**[a]

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 25.007 | 1 | 25.007 | 128.403 | .000[b] |
| | Residual | 21.033 | 109 | .195 | | |
| | Total | 46.040 | 110 | | | |
| a. Dependent Variable: GOVERNANCE | | | | | | |
| b. Predictors: (Constant), KMPRO | | | | | | |

| Coefficients[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | .169 | .321 | | .526 | .600 | -.467- | .805 |
| | KMPRO | .925 | .082 | .737 | 11.332 | .000 | .763 | 1.087 |
| a. Dependent Variable: GOVERNANCE | | | | | | | | |

H.1.3 There is a significant relationship between the processes of KM and **methods .**

| Model Summary[b] | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .631[a] | .399 | .393 | .51159039 | 1.538 |
| a. Predictors: (Constant), KMPRO | | | | | |
| b. Dependent Variable: METHODS | | | | | |

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 18.747 | 1 | 18.747 | 71.630 | .000[b] |
| | Residual | 28.266 | 109 | .262 | | |
| | Total | 47.014 | 110 | | | |
| a. Dependent Variable: METHODS | | | | | | |
| b. Predictors: (Constant), KMPRO | | | | | | |

| Coefficients[a] |
|---|

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | .598 | .372 | | 1.607 | .111 | -.139- | 1.335 |
| | KMPRO | .801 | .095 | .631 | 8.463 | .000 | .613 | .988 |
| a. Dependent Variable: METHODS | | | | | | | | |

H.1.4 There is a significant relationship between KM processes and the **culture .**

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | .692[a] | .479 | .475 | .45222780 | 1.755 |
| a. Predictors: (Constant), KMPRO | | | | | |
| b. Dependent Variable: CULTURE | | | | | |

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 20.344 | 1 | 20.344 | 99.476 | .000[b] |
| | Residual | 22.087 | 109 | .205 | | |
| | Total | 42.431 | 110 | | | |
| a. Dependent Variable: CULTURE | | | | | | |
| b. Predictors: (Constant), KMPRO | | | | | | |

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | .540 | .329 | | 1.644 | .103 | -.111- | 1.192 |
| | KMPRO | .834 | .084 | .692 | 9.974 | .000 | .668 | 1.000 |
| a. Dependent Variable: CULTURE | | | | | | | | |

H.1.5 There is a significant relationship between KM processes and **information technology**.

| **Model Summary[b]** | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .563[a] | .317 | .311 | .56233890 | 1.627 |
| a. Predictors: (Constant), KMPRO | | | | | |
| b. Dependent Variable: INFORMATIONTEC | | | | | |

| **ANOVA[a]** | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 15.853 | 1 | 15.853 | 50.132 | .000[b] |
| | Residual | 34.152 | 109 | .316 | | |
| | Total | 50.005 | 110 | | | |
| a. Dependent Variable: INFORMATIONTEC | | | | | | |
| b. Predictors: (Constant), KMPRO | | | | | | |

| **Coefficients[a]** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Model | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| | B | Std. Error | Beta | | | Lower Bound | Upper Bound |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | (Constant) | .862 | .409 | | 2.110 | .037 | .052 | 1.673 |
| | KMPRO | .736 | .104 | .563 | 7.080 | .000 | .530 | .943 |
| a. Dependent Variable: INFORMATIONTEC | | | | | | | | |

H.1.6 There is a significant relationship between KM processes and **people (attitude, skills).**

| Model Summary[b] | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .565[a] | .320 | .313 | .48740132 | 1.510 |
| a. Predictors: (Constant), KMPRO | | | | | |
| b. Dependent Variable: PEOPLE | | | | | |

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 12.053 | 1 | 12.053 | 50.737 | .000[b] |
| | Residual | 25.656 | 109 | .238 | | |
| | Total | 37.710 | 110 | | | |
| a. Dependent Variable: PEOPLE | | | | | | |
| b. Predictors: (Constant), KMPRO | | | | | | |

| Coefficients[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | 1.364 | .354 | | 3.849 | .000 | .662 | 2.066 |
| | KMPRO | .642 | .090 | .565 | 7.123 | .000 | .463 | .821 |
| a. Dependent Variable: PEOPLE | | | | | | | | |

H.1.7 There is a significant relationship between the technology of KM and the **strategic alignment**.

| Model Summary[b] | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .493[a] | .243 | .236 | .47870518 | 1.764 |
| a. Predictors: (Constant), KMTEC | | | | | |
| b. Dependent Variable: STRATEGIC | | | | | |

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 7.957 | 1 | 7.957 | 34.722 | .000[b] |
| | Residual | 24.749 | 109 | .229 | | |
| | Total | 32.706 | 110 | | | |
| a. Dependent Variable: STRATEGIC | | | | | | |
| b. Predictors: (Constant), KMTEC | | | | | | |

| Coefficients[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | 2.400 | .261 | | 9.213 | .000 | 1.884 | 2.917 |
| | KMTEC | .409 | .069 | .493 | 5.893 | .000 | .272 | .547 |
| a. Dependent Variable: STRATEGIC | | | | | | | | |

H.1.8 There is a significant relationship between the technology of KM and the **governance .**

| Model Summary[b] | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .603[a] | .363 | .357 | .52108782 | 1.738 |

| a. Predictors: (Constant), KMTEC |
|---|
| b. Dependent Variable: GOVERNANCE |

| **ANOVA**[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 16.715 | 1 | 16.715 | 61.558 | .000[b] |
| | Residual | 29.326 | 109 | .272 | | |
| | Total | 46.040 | 110 | | | |
| a. Dependent Variable: GOVERNANCE | | | | | | |
| b. Predictors: (Constant), KMTEC | | | | | | |

| **Coefficients**[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | 1.582 | .284 | | 5.577 | .000 | 1.020 | 2.144 |
| | KMTEC | .593 | .076 | .603 | 7.846 | .000 | .443 | .743 |
| a. Dependent Variable: GOVERNANCE | | | | | | | | |

H.1.9 There is a significant relationship between the technology of KM and **methods .**

| **Model Summary**[b] | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .534[a] | .285 | .279 | .55781383 | 1.656 |
| a. Predictors: (Constant), KMTEC | | | | | |
| b. Dependent Variable: METHODS | | | | | |

| **ANOVA**[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 13.409 | 1 | 13.409 | 43.093 | .000[b] |
| | Residual | 33.605 | 109 | .311 | | |
| | Total | 47.014 | 110 | | | |
| a. Dependent Variable: METHODS | | | | | | |
| b. Predictors: (Constant), KMTEC | | | | | | |

| Coefficients[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | 1.756 | .304 | | 5.783 | .000 | 1.154 | 2.358 |
| | KMTEC | .531 | .081 | .534 | 6.565 | .000 | .371 | .692 |
| a. Dependent Variable: METHODS | | | | | | | | |

H.1.10 There is a significant relationship between the technology of KM and the **cul-ture.**

| Model Summary[b] | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .593[a] | .351 | .345 | .50486394 | 1.844 |
| a. Predictors: (Constant), KMTEC | | | | | |
| b. Dependent Variable: CULTURE | | | | | |

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 14.903 | 1 | 14.903 | 58.469 | .000[b] |
| | Residual | 27.528 | 109 | .255 | | |
| | Total | 42.431 | 110 | | | |
| a. Dependent Variable: CULTURE | | | | | | |
| b. Predictors: (Constant), KMTEC | | | | | | |

| Coefficients[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | 1.722 | .275 | | 6.267 | .000 | 1.177 | 2.267 |
| | KMTEC | .560 | .073 | .593 | 7.647 | .000 | .415 | .705 |
| a. Dependent Variable: CULTURE | | | | | | | | |

H.1.11 There is a significant relationship between the technology of KM and **information technology**

| Model Summary[b] | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .617[a] | .380 | .374 | .53571635 | 1.624 |
| a. Predictors: (Constant), KMTEC | | | | | |
| b. Dependent Variable: INFORMATIONTEC | | | | | |

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 19.010 | 1 | 19.010 | 66.239 | .000[b] |
| | Residual | 30.995 | 109 | .287 | | |
| | Total | 50.005 | 110 | | | |
| a. Dependent Variable: INFORMATIONTEC | | | | | | |
| b. Predictors: (Constant), KMTEC | | | | | | |

| Coefficients[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | 1.395 | .292 | | 4.785 | .000 | .817 | 1.973 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | KMTEC | .633 | .078 | .617 | 8.139 | .000 | .478 | .787 |
| a. Dependent Variable: INFORMATIONTEC | | | | | | | | |

H.1.2 There is a significant relationship between the technology of KM and **people (attitude, skill).**

| **Model Summary[b]** | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .486[a] | .236 | .229 | .51644774 | 1.604 |
| a. Predictors: (Constant), KMTEC | | | | | |
| b. Dependent Variable: PEOPLE | | | | | |

| **ANOVA[a]** | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 8.904 | 1 | 8.904 | 33.384 | .000[b] |
| | Residual | 28.806 | 109 | .267 | | |
| | Total | 37.710 | 110 | | | |
| a. Dependent Variable: PEOPLE | | | | | | |
| b. Predictors: (Constant), KMTEC | | | | | | |

| **Coefficients[a]** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | 2.267 | .281 | | 8.064 | .000 | 1.710 | 2.824 |
| | KMTEC | .433 | .075 | .486 | 5.778 | .000 | .284 | .581 |
| a. Dependent Variable: PEOPLE | | | | | | | | |

H.1.13 There is a significant relationship between the team of knowledge and **strategic alignment**.

| **Model Summary**[b] | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .608[a] | .369 | .363 | .43708874 | 1.971 |
| a. Predictors: (Constant), KMTEA | | | | | |
| b. Dependent Variable: STRATEGIC | | | | | |

| **ANOVA**[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 12.073 | 1 | 12.073 | 63.194 | .000[b] |
| | Residual | 20.633 | 109 | .191 | | |
| | Total | 32.706 | 110 | | | |
| a. Dependent Variable: STRATEGIC | | | | | | |
| b. Predictors: (Constant), KMTEA | | | | | | |

| **Coefficients**[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | 1.812 | .267 | | 6.774 | .000 | 1.282 | 2.342 |
| | KMTEA | .558 | .070 | .608 | 7.949 | .000 | .419 | .697 |
| a. Dependent Variable: STRATEGIC | | | | | | | | |

H.1.14 There is a significant relationship between team knowledge and **governance**.

| **Model Summary**[b] | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .745[a] | .555 | .551 | .43568628 | 1.806 |
| a. Predictors: (Constant), KMTEA | | | | | |
| b. Dependent Variable: GOVERNANCE | | | | | |

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 25.540 | 1 | 25.540 | 134.544 | .000[b] |
| | Residual | 20.501 | 109 | .190 | | |
| | Total | 46.040 | 110 | | | |
| a. Dependent Variable: GOVERNANCE | | | | | | |
| b. Predictors: (Constant), KMTEA | | | | | | |

| Coefficients[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | .718 | .267 | | 2.693 | .008 | .189 | 1.246 |
| | KMTEA | .811 | .070 | .745 | 11.599 | .000 | .673 | .950 |
| a. Dependent Variable: GOVERNANCE | | | | | | | | |

H.1.15 There is a significant relationship between team knowledge and **methods**

| Model Summary[b] | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .695[a] | .483 | .478 | .47451785 | 1.995 |
| a. Predictors: (Constant), KMTEA | | | | | |
| b. Dependent Variable: METHODS | | | | | |

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 22.696 | 1 | 22.696 | 100.794 | .000[b] |
| | Residual | 24.318 | 109 | .225 | | |
| | Total | 47.014 | 110 | | | |
| a. Dependent Variable: METHODS | | | | | | |
| b. Predictors: (Constant), KMTEA | | | | | | |

| Coefficients[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | .838 | .290 | | 2.887 | .005 | .263 | 1.414 |
| | KMTEA | .765 | .076 | .695 | 10.040 | .000 | .614 | .916 |
| a. Dependent Variable: METHODS | | | | | | | | |

H.1.16 There is a significant relationship between team knowledge and **culture .**

| Model Summary[b] | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .691[a] | .477 | .472 | .45315520 | 1.941 |
| a. Predictors: (Constant), KMTEA | | | | | |
| b. Dependent Variable: CULTURE | | | | | |

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 20.253 | 1 | 20.253 | 98.628 | .000[b] |
| | Residual | 22.178 | 109 | .205 | | |
| | Total | 42.431 | 110 | | | |
| a. Dependent Variable: CULTURE | | | | | | |
| b. Predictors: (Constant), KMTEA | | | | | | |

| Coefficients[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | 1.071 | .277 | | 3.861 | .000 | .521 | 1.620 |
| | KMTEA | .722 | .073 | .691 | 9.931 | .000 | .578 | .866 |
| a. Dependent Variable: CULTURE | | | | | | | | |

H.1.17 There is a significant relationship between team knowledge and **information technology**

| Model Summary[b] | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .667[a] | .445 | .440 | .50694950 | 1.725 |
| a. Predictors: (Constant), KMTEA | | | | | |
| b. Dependent Variable: INFORMATIONTEC | | | | | |

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 22.250 | 1 | 22.250 | 86.575 | .000[b] |
| | Residual | 27.756 | 109 | .257 | | |
| | Total | 50.005 | 110 | | | |
| a. Dependent Variable: INFORMATIONTEC | | | | | | |
| b. Predictors: (Constant), KMTEA | | | | | | |

| Coefficients[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | .881 | .310 | | 2.838 | .005 | .266 | 1.495 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | KMTEA | .757 | .081 | .667 | 9.305 | .000 | .596 | .918 |
| a. Dependent Variable: INFORMATIONTEC | | | | | | | | |

H.1.18 There is a significant relationship between team knowledge and **people (attitude , skills).**

| Model Summary[b] | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .649[a] | .421 | .416 | .44964949 | 1.810 |
| a. Predictors: (Constant), KMTEA | | | | | |
| b. Dependent Variable: PEOPLE | | | | | |

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 15.874 | 1 | 15.874 | 78.511 | .000[b] |
| | Residual | 21.836 | 109 | .202 | | |
| | Total | 37.710 | 110 | | | |
| a. Dependent Variable: PEOPLE | | | | | | |
| b. Predictors: (Constant), KMTEA | | | | | | |

| Coefficients[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | 1.458 | .275 | | 5.297 | .000 | .912 | 2.003 |
| | KMTEA | .639 | .072 | .649 | 8.861 | .000 | .496 | .783 |
| a. Dependent Variable: PEOPLE | | | | | | | | |

**The effect of KMBPM on DMP**

The second hypothesis: H.2 There is a significant effect of the integration of KM and BPM in DMP. Subdivided into the following hypotheses:

H2.1 There is a significant effect of integration of KM and BPM in problem identification speed (PIS).

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .726[a] | .528 | .523 | .41999 |

a. Predictors: (Constant), KMBPM

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 21.269 | 1 | 21.269 | 120.575 | .000[b] |
| | Residual | 19.051 | 109 | .176 | | |
| | Total | 40.319 | 110 | | | |

a. Dependent Variable: PIS

b. Predictors: (Constant), KMBPM

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | .520 | .312 | | 1.668 | .098 |
| | KMBPM | .889 | .081 | .726 | 10.981 | .000 |

a. Dependent Variable: PIS

H2.2 There is significant effect of integration of KM and BPM in the decision making speed (DMS).

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .574[a] | .330 | .324 | .54911 |

| a. Predictors: (Constant), KMBPM |
|---|

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 16.029 | 1 | 16.029 | 53.162 | .000[b] |
| | Residual | 32.564 | 109 | .302 | | |
| | Total | 48.593 | 110 | | | |
| a. Dependent Variable: DMspeed | | | | | | |
| b. Predictors: (Constant), KMBPM | | | | | | |

| Coefficients[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | .930 | .408 | | 2.281 | .024 |
| | KMBPM | .772 | .106 | .574 | 7.291 | .000 |
| a. Dependent Variable: DMspeed | | | | | | |

H2.3 There is significant effect of integration of KM and BPM in the extent of analysis in decision making (DMA)

| Model Summary | | | | |
|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | .675[a] | .456 | .450 | .46159 |
| a. Predictors: (Constant), KMBPM | | | | |

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 19.250 | 1 | 19.250 | 90.348 | .000[b] |
| | Residual | 23.011 | 109 | .213 | | |
| | Total | 42.262 | 110 | | | |
| a. Dependent Variable: DMA | | | | | | |
| b. Predictors: (Constant), KMBPM | | | | | | |

| Coefficients[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | .718 | .343 | | 2.095 | .039 |
| | KMBPM | .846 | .089 | .675 | 9.505 | .000 |

a. Dependent Variable: DMA

# **Appendix B**: Documents related to ethical approval: invitation letters, consent sheet, participants information sheet and ethical approval from ST Research Ethics panel.

University of Salford
MANCHESTER

**Research, Innovation and Academic Engagement Ethical Approval Panel**

Research Centres Support Team
G0.3 Joule House
University of Salford
M5 4WT

T +44(0)161 295 5278

www.salford.ac.uk/

25 May 2018

Sami Abuezhayeh

Dear Sami,

**RE: ETHICS APPLICATION STR1718-41 : The interrelationship between knowledge management and Business Process Management and its impact on Decision Making Processes in the Construction Sector. A Case study of Jordan**

Based on the information you provided, I am pleased to inform you that your application STR1718-41 has been approved.

If there are any changes to the project and/ or its methodology, please inform the Panel as soon as possible by contacting S&T-ResearchEthics@salford.ac.uk

Yours sincerely,

Dr Anthony Higham
Chair of the Science & Technology Research Ethics Panel

# Interview Invitation

Dear Mr/Ms.,

Greetings, my name is Sami Abuezhayeh, I am a PhD student in The School of Built Environment in The University of Salford.

I am currently in the process of pursuing my data collection under the supervision of Prof Les Ruddock. I am writing a thesis on "The interrelationship between knowledge management and business process management and its impact on decision making process in the construction sector: a case study of Jordan". The aim of this study is to investigate and explain how organizations in the construction sector can enhance decision making processes (DMP) by practicing knowledge management (KM) and business process management (BPM) activities. Because of the scope and limitation of this study, it will focus on the practice of decisions within the DMP.

I would be very grateful if I might interview you to discuss the role of integration between KM and BPM to improve decision making processes in the construction organizations. Your input is important to the success of this study, and your participation will ensure that your organization's views are represented.

Interview will last approximately 30-45 mins. The interview can be conducted via Skype or Telephone or face to face if possible at any time convenient for you.

Please be assured that your response will be anonymous and used with complete confidentiality for research purposes only. At the end of this study, a copy of the final research report and conclusions will be available upon request.

If you have any question regarding the research, please do not hesitate to contact with me by phone at + (44) 7873221201 or via e-mail at S.Abuezhayeh@edu.salford.ac.uk.
Your time and assistance are greatly appreciated, and I look forward to having your participation in my research.

Thank you
--
Kind Regards,
Sami Abuezhayeh
PhD Researcher
School of Built Environment,
University of Salford

## Questionnaire Invitation

Dear Mr/Ms.,

Greetings, my name is Sami Abuezhayeh, I am a PhD student in The School of Built Environment in The University of Salford.

I am currently in the process of pursuing my data collection under the supervision of Prof Les Ruddock. I am writing a thesis on "The interrelationship between knowledge management and business process management and its impact on decision making process in the construction sector: a case study of Jordan". The aim of this study is to investigate and explain how organizations in the construction sector can enhance decision making processes (DMP) by practicing knowledge management (KM) and business process management (BPM) activities. Because of the scope and limitation of this study, it will focus on the perspectives of decisions certainty within the DMP.

I am writing to you to kindly request your participation in an online survey. I would be very grateful if you could participate in my research. Your input is important to the success of this study, and your participation will ensure that your organisation's views are represented.

Completing the survey will take approximately 15-20 mins. You will just be asked to click on the answers. To complete the survey, kindly just click on the following link:

https://salford.onlinesurveys.ac.uk/bpm-km-dm

Please be assured that your response will be anonymous and used with complete confidentiality for research purposes only. At the end of this study, a copy of the final research report and conclusions will be available upon request.

If you have any question regarding the research, please do not hesitate to contact with me by phone at + (44) 7873221201 or via e-mail at S.Abuezhayeh@edu.salford.ac.uk.

Your time and assistance are greatly appreciated, and I look forward to having your participation in my research.

Thank you
--
Kind Regards,
Sami Abuezhayeh
PhD Researcher

## Consent Sheet

Please confirm that you understand and agree to the following:

- I am over the age of 18.
- I have sound data about the research and my role in the study.
- I understand that by consenting to take part in this study, I can still withdraw at any time without any consequences up to four weeks after the study is conducted and without being obliged to give reasons.
- I understand that after four weeks of submitting the answers I cannot withdraw my data anymore.
- I understand that I will not be personally identified at any report, and the results communicated by this study cannot be used to identify me.
- I understand that this information will be used only for the purpose set out in the information page, and my consent is conditional upon the university complying with the duties and obligation under the Data Protection Act

☐ I confirm that I have read and understood the aforementioned agreement, and I agree to take part in the research study.

Participant's Signature: ____________________________ Date: ____________________________

Researcher's Signature: ____________________________ Date: ____________________________

# Participants Information Sheet

## School of the Built Environment(SOBE)

**Introduction**

Semi-structured interviews and questionnaires will be conducted with the participants as part of a PhD research work namely **'The Interrelationship between Knowledge Management and Business Process Management and its Impact on Decision Making Processes in the Construction Sector: A Case study of Jordan'.** It aims to verify and validate a generalised model of "**Decision Making Processes**" developed for the purpose of this research. Participants will be asked to answer different questions related to various elements of the developed model. The provided feedback is highly valuable for the research and will allow to further develop and mature the framework for the next stages of the research.

**Confidentiality**

Please note that to protect the participant's confidentiality, no personal information will be collected that would identify any of the participants, and the results of this study will be used only for scholarly purposes and may only be shared amongst members of the research team, the results cannot be used to identify any of the participants. Furthermore, all the collected data will be stored in a password protected electronic format.

**Participation**

Please note that your participation in this study is completely voluntary. You may choose not to participate. However, if you do choose to participate, you may withdraw at any time within four weeks after completing the interviews. If you don't want to answer any of the questions you don't have to.

By answering the questions, you are agreeing to participate and cannot withdraw after four weeks of conducting the interviews. If you decide to withdraw at any point within four weeks, you will not be penalised, neither your manager will be informed.

**Questions about the research or your rights as a participant**

Please do not hesitate to contact the research team if you have any questions or concerns regarding your participation or the research.

**Contact us at:**

Sami Abuezhayeh (PGR student): S.Abuezhayeh@edu.salford.ac.uk
**Ethical approval from ST Research Ethics panel**

# **Appendix C**: Interview Questions

**Introduction**

The main purpose of this research is to provide guidelines to enhance decision making process in small and medium sized organisations in the construction sector in Jordan by practicing both knowledge management (KM) and business process management (BPM) activities. This research contributes in several ways toward(s) building a clear understanding of the role of KM and BPM in improving the decision making (DM) styles to attain the organisational goals. This interview is aimed decision-makers (senior management, managers, department heads, supervisors and decision makers in the organisation) in the Jordanian construction sector for small and medium sized organisations.

**This section explains some terminologies of the questionnaire:**

- Knowledge Management: the systematic management of processes by which knowledge is identified, created, gathered, shared and applied.
- Knowledge: is the fundamental basis of the experience of an individual in judging things
- Knowledge-makers: is one who makes or creates knowledge.
- Business Process Management (BPM: a systematic way of identifying, designing, implementing, documenting, measuring, monitoring and controlling of both computerised and non-computerised BPs to achieve consistent and results-oriented in line with the strategic objectives of the organisation.
- A business process: is an activity or set of activities that will accomplish a specific organisational goal. BPM is a systematic approach to improving those processes.
- Process: Sequence of interdependent and linked procedures which, at every stage, consume one or more resources (employee time, energy, machines, money) to convert inputs (data, material, parts, etc.) into outputs. These outputs then serve as inputs for the next stage until a known goal or end result is reached.
- Decision Making: process of choosing among two or more alternative courses of action for the purpose of attainting one or more goals.
- Methods: the set of tools and techniques that support and enable activities along the process lifecycle and within enterprise-wide BPM initiatives.

**Demographic Information**

- Name:
- Telephone number:
- Email:
- Gender:
- Age:
- Work experience:
- Your organisation name:
- Your organisation type (small-medium):
- Position:
- Department:

**Questions:**

1- From your point of view, which KM techniques you are using and how it helps your organisation? What are the benefits of KM techniques on your organisation?

2- From your point of view, which BPM techniques you are using and how it helps your organisation? What are the benefits of BPM techniques on your organisation?)

3- From your point of view, do you believe that the integration between KM and BPM is useful for your organisation? how it helps your organisation? What are the benefits of the integration between KM and BPM on your organisation?

4- From your point of view, do you believe that the KM & BPM or the integration between them will enhance DMP in your organisation? If yes, how it will improve the process of DM?

5- In my organisation, both BPM and KM help me to

| | Variable | Measurements | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|---|
| 1 | Problem Identification Speed | Determine potential problems faster. | | | | | |
| | | Identify the key factors that are impacting the area of my responsibility. | | | | | |
| | | Observe potential problems before they become serious crises. | | | | | |
| 2 | DM Speed | Shorten the time frame for making decisions. | | | | | |
| | | Spend less time in meetings. | | | | | |
| 3 | The Extent of Analysis in DM | Spend significantly more time analysing data before making a decision. | | | | | |
| | | Examine more alternatives in decision making. | | | | | |
| | | Use more sources of information in decision making. | | | | | |
| | | Engage more in-depth analysis. | | | | | |

6- Do you have any comments or recommendations to enhance the framework?

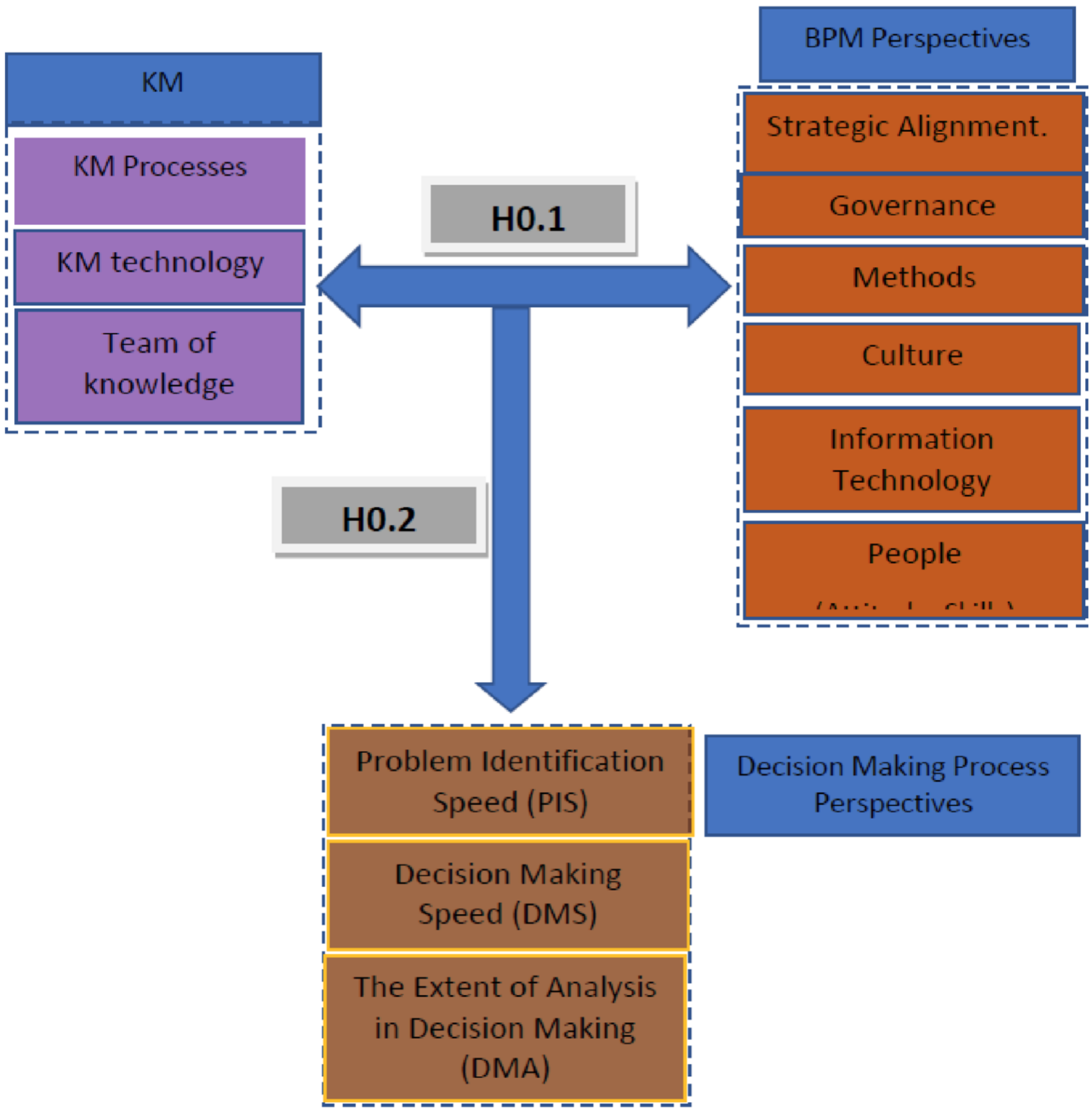


**Figure 1- 1 The current study research framework by different variables**

# **Appendix D:** Questionnaire Questions - Participant Recruitment Letter

**About the study**

Dear Sir/Madam,

Thank you for taking the time to complete this questionnaire. Your answer is important to us; the questionnaire comprises of four parts and all parts are required. It will take approximately 15-20 minutes to complete the questionnaire as you will just be asked to click on the answers. At the end of the questionnaire, you may leave your contact details if you wish to see the results of the questionnaire.

The main purpose of this research is to provide guidelines to enhance decision making process in small and medium sized organisations in the construction sector in Jordan by practicing both knowledge management (KM) and business process management (BPM) activities. This research contributes in several ways toward(s) building a clear understanding of the role of KM and BPM in improving the decision making (DM) styles to attain the organisational goals. This questionnaire is aimed decision-makers (senior management, managers, department heads, supervisors and decision makers in the organisation) in the Jordanian construction sector for small and medium sized organisations.

This questionnaire asks your opinion, so there in no right or wrong answers. Please respond to the questionnaire based on your judgment, regardless of what you think others expect. Please be assured that your response will be used for research purposes only and your details will be kept anonymous and confidential. Your participation is highly appreciated, as your paticipation is of the greatest importance to the success of this study.

Kind Regards,

Sami Wasef

PhD researcher

University of Salford

email: s.abuezhayeh@edu.salford.ac.uk

**This section explains some terminologies of the questionnaire:**

- Knowledge Management: the systematic management of processes by which knowledge is identified, created, gathered, shared and applied.
- Knowledge: is the fundamental basis of the experience of an individual in judging things.
- Knowledge-makers: is one who makes or creates knowledge.
- knowledge base: a database used for knowledge sharing and management.
- The experiential knowledge: knowledge gained through experience.
- Business Process Management: a systematic way of identifying, designing, implementing, documenting, measuring, monitoring and controlling of both computerised and non- computerised BPs to achieve consistent and results-oriented in line with the strategic objectives of the organisation.

- Business Process: it is the set of activities an organisation pursues to accomplish a particular objective for a particular customer, either internal or external.
- Process: Sequence of interdependent and linked procedures which, at every stage, consume one or more resources (employee time, energy, machines, money) to convert inputs (data, material, parts, etc.) into outputs. These outputs then serve as inputs for the next stage until a known goal or end result is reached.
- Decision Making: process of choosing among two or more alternative courses of action for the purpose of attainting one or more goals.
- Methods: the set of tools and techniques that support and enable activities along the process lifecycle and within enterprise-wide BPM initiatives.

**Part (1): Demographic Information**

- Name:
- Email:
- Gender:
- Age: ◎ 25-30 ◎ 31-40 ◎ 41-50 ◎ 51-60 ◎ more than 60
- Work experience: ◎ 1-5 ◎ 6-10 ◎ 11-15 ◎ 16-20 ◎ 21-30 ◎ more than 30
- Your organisation Type: ◎ Small ◎ Medium
- Position:
- Department:

**Part (2): Knowledge Management (KM)**

Please indicate the extent to which you agree or disagree of the following statements regarding factors affecting decision making process in your organisation. Choose only one option of the following choices [Strongly Disagree; Disagree; Neutral; Agree; Strongly Agree]:

1- A number of mechanisms have been used to create or acquire knowledge from different sources such as volunteers, clients, donors or competitors.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

2- Policies are placed to allow employees to present new ideas without fear and ridicule.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

3- It is important to capture the experiential knowledge of staff for organisational use.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

4- It is important to capture lessons learnt at various stages of the project.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

5- The experiential knowledge of staff is usually converted into written documents accessible to the organisation.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

6- Staff are encouraged to find alternative solutions to promote construction projects.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

7- New knowledge is usually created to solve specific problems during project development.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

8- There is a standard process for storing reference material such as policies, procedure manuals, standards, guidelines, strategies, directory of expertise, ideas, notable successes or other practical information.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

9- Databases or information technologies are utilized to store reference material.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

10- Records or various written documents such as newsletters or manuals to store captured information from employees and others are available.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

11- There is digital information media storage or database of skills, expertise and knowledge sources.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

12- knowledge in a form that is readily accessible to employees.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

13- There are regular symposiums, lectures, conferences, or training sessions to share knowledge and ideas.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

14- Key domain experts are readily identified and contacted.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

15- There are team works and regular meetings to transfer knowledge.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

16- Documents, publications and internal information network are used to distribute knowledge.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

17- Experienced staff members are encouraged to mentor the novice staff members.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

18- Individuals are asked to keep stored knowledge current and up to date.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

19- Outcomes from previous experiments feed into the new organisation's projects to improve them.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

20- There are mechanisms to convert knowledge into action plans.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

21- Barriers that stop individuals, experts and administrators from reaching to the knowledge are removed.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

22- Staff members are encouraged to apply their implicit knowledge and experience to subsequent projects.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

23- Technology is up-to-date in an organisation.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

24- There is a use of office automation systems (E- mail, automated retrieval of information, word processing, audio-video conferences) to carry out administrative tasks.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

25- Artificial intelligence systems are used in an organisation.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

26- Information technology supports collaborative work and intra-organisation communication.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

27- There are qualified Knowledge-makers that an organisation relies on them.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

28- Knowledge-makers maintain modernity and advancement of knowledge as well as communicate with the outside.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

29- Knowledge-makers act as consultants for the organisation in the field of knowledge.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

knowledge managers carry out the following: from Q30 to Q33

30- Collection, classification and knowledge transfer to the knowledge base.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

31- Draw results from the knowledge base.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

32- Development of knowledge management programs and its implementation.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

33- Representation and adaptation of Knowledge along with well application by organisation staff.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

Employee's knowledge management at an organisation is keen on: from Q34 to Q37

34- Collecting a great deal of knowledge about employees (their needs, their desires, and the degree of their loyalty to the organisation).

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

35- Linking-up employees to knowledge base system at the organisation.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

36- Linking employees to a group of experts.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

37- Motivating employees to submit their suggestions, opinions and ideas.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

**Part (3): Business Process Management (BPM)**

38- Goals are often for the processes and are aligned to the company's strategic goals.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

39- If strategic goals change, the goals of certain processes are adjusted correspondingly.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

40- The top management team have a good communication with the process managers or process owners, especially when the top management makes some big decisions.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

41- There are some plans for improving the existing processes of the company.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

42- Some plans exist when organisations going to build new processes.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

43- Constructing new dimension of process to combine different function areas is considered.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

44- Everyone in the management team clearly knows what BPM is.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

45- Everyone in the management team clearly knows how to apply process management to the organisation.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

46- The top management has the plan to change the company's culture towards the process-oriented.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

47- Processes play a prominent role in the corporate vision, mission and value statements.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

48- The top management has the plan to change the company's culture towards the process-oriented.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

49- The top management, process managers, and process owners receive an education in process measurement; control; and improvement.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

50- The process management can be used to predict the future results in order to find the suitable alternatives dynamically.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

51- The employees understand well the cross-functional department cooperation.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

52- The employees who work on the processes know exactly what they should do to accomplish the process goals.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

53- The staff have the chance to engage in the decision-making.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

54- The process roles and responsibilities are well-defined.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

55- The top management has a strong capability to deal with differences and contradictions between processes and polices.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

56- All the staff members clearly know the responsibility and authority of the process owners.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

57- There is a plan to put suppliers and customers into the process management.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

58- Process management standards are well-defined and documented.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

59- A functional team is in charge of BPM execution.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

60- There is a focus on process control and measurement.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

61- The top management has the plans to introduce some new methods and enhanced approach to support process management.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

62- The methods identify and conceptualise current (as-is) business processes and future (to-be) processes.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

63- There is a system that is applied in the IT department.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

64- IT system fits well with the companies' management structure.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

65- The responsibility of the IT department is clear towards the BPM.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

66- The IT department provides the needed support to the process management.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

67- The IT department jointly work with other departments during BPM implementation.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

68- There is a plan to improve the IT department to make it more suitable for the process management.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

**Part (4): Decision Making Process (DMP)**

In my organisation, both BPM and KM help me to

69- Determine potential problems faster.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

70- Identify the key factors that are impacting the area of my responsibility.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

71- Observe potential problems before they become serious crises.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

72- Shorten the time frame for making decisions.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

73- Spend less time in meetings.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

74- Spend significantly more time analysing data before making a decision.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

75- Examine more alternatives in decision-making.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

76- Use more sources of information in decision-making.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

77- Engage more in-depth analysis.

◎ Strongly Disagree ◎ Disagree ◎ Neutral ◎ Agree ◎ Strongly agree

**Finally**

Details contact Thank you for your time spent taking this questionnaire. Your response has been recorded.