



**Organisational Absorptive Capacity and Its Potential
Role in Achieving Business Intelligence Systems
Efficiency In Strategic Managerial Levels**

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By

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ABSTRACT

The available organisational capabilities engaged in the process of creating data processing intelligence inside organisations are still required to be limited, given the current outstanding competitive environments that deal with the global increase of available data and information production required to be transformed consistently into knowledge. This study investigates the relationship between Absorptive Capacity (ACAP) (i.e., the ability of organisations to gather, absorb, and strategically influence new external information), and Business Intelligence (BI), which are systems that convert data into valuable information, and then into knowledge throughout strong human consideration. The insight of the current study is to offer a detailed exploration from the standpoint of the two perceptions. ACAP is required to be a dynamic capability for generating strategic data transformation setting in an organisation. Similarly, ACAP is proposed to play a significant role in enriching the process of knowledge creation embraced inside contemporary organisational Information Systems (IS) environments.

The research uses a combination of quantitative and qualitative research methods. By offering a rich indication in presenting a rigours approach of systematic qualitative methods, Grounded Theory Methodology (GTM) coding techniques were used to analyse data collected using semi-structured interviews form (22) senior managers. The extracted grounded measures assisted in considering ACAP main dimensions treated as potential organisational dynamic capabilities and shaped as a grounded relational model. Drawing on the qualitative analysis results, the ACAP extracted measures were quantitatively validated for their possible effects on BI System efficiency. The quantitative methods used surveys conducted on a sample of (150) participants and analysed using Partial Least Squares - Structural Equation Modelling (PLS-SEM). The study targeted the telecommunication industry taking the country Jordan as a case example.

The findings indicate that ACAP dimensions are anticipated to influence the efficiency of BI systems inside organisations. The contribution of this study adds significantly to the existing body of literature by primarily providing a novel integration of the concept of ACAP, offering a relational model through which researchers can more fully leverage the measures of ACAP within organisations. Accordingly, the core contribution of the research provided a more comprehensive framework that serves managers and strategic professionals to assist them in classifying their ACAP measures before attempting to purchase state of the art BI systems with a high amount of expenditures. The extracted categories can be treated as guides to IS researchers, and senior managers in exploring the rich facets of ACAP proposed to offer foundations for shaping where and how to further potential organisational assets can be leveraged.

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DEDICATION

I dedicate this PhD thesis to my parents Professor. Dawud Al-Eisawi and Professor.
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Mom and dad, I am endlessly grateful.

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DECLARATION

The work in this thesis has led to the following publications, and submitted for publication:

Conferences

- Al-Eisawi, D. and Serrano, A. (2019) “Organizational Absorptive Capacity and Its Potential role in knowledge Creation: A Qualitative Approach “, proceeding of the 24th UK Academy for Information Systems UKAIS Annual Conference, Oxford University, Oxford, UK, 9th April – 10th April, (**Published**).
- Al-Eisawi, D. and Lycett, M. (2014) “Business Intelligence Definitions, Managerial Effects and Aspects: A Systematic Literature Review”, Proceedings of the 14th International Conference on Enterprise Information Systems (ECEIS), Wroclaw–Poland, INSTICC Press. Paper: 221 (**Published**).

Journals

Al-Eisawi, D. and Serrano, A. (2019) ” The Role of Organizational Absorptive Capacity in achieving Business Intelligence systems efficiency, “the Journal of Industrial Management and Data Systems, (**Review in progress**).

ACRONYMS

ACAP	Absorptive Capacity
AI	Artificial Intelligence
BI	Business Intelligence
BPM	Business Performance Management
CRM	Customer Relationship Management
DM	Data Mining
DSS	Decision Support Systems
DW	Data Warehouse
DQM	Data Quality Management
EIS	Enterprise Information Systems
GTM	Grounded Theory Methodology
OLAP	Online Analytical Processing
PLS	Partial Least Squares
R&D	Research and Development
SEM	Structural Equation Modelling

CHAPTER 1: INTRODUCTION

1.1 Background and Setting the Research Scheme

This section sets the scene of the presented thesis by introducing the key features of its contents and offering a brief of the involved aspects. A significant amount of empirical research used the concept of ACAP. However, very few qualitative valid categorisations that can integrate and further synthesize various dimensions have been established (Popovič, Puklavec, and Oliveira, 2019). Additionally, the study determination is to seize the attention of organisations to the importance of enhancing their ability to assimilate, transform, and apply valuable knowledge required for their business success before investing in a large amount of expenditure when purchasing state of the art BI systems (Liang and Liu, 2018). Many misperceptions and confusions lie in how the dimensions of ACAP can be applied, explained, and even understood as an organisational phenomenon. All past models representing ACAP attempted to explain only the overall dimensions of ACAP without taking further efforts in particularising each dimension separately. Consequently, how each dimension will have a potential role in influencing data processing systems (Guu, 2018). The goal in valuing this construct is to decrease such confusion by offering a detailed grounded based elaboration of the four ACAP dimensions.

The study is oriented towards acquiring and processing data, information, and knowledge in technology-based industries. The attempt is to decrease the misperception mentioned above in understanding organisational ACAP by providing qualitative grounded categories that determine its potential existence within firms. Aligned with this study, these categories can be defined as organisational capabilities within different areas of an organisation that can be further improved (Robert et al., 2012). The focus of the study is directed towards how these categorised and dimensions work in a structured sequence to present ACAP as a relevant dynamic competency that promotes the efficiency of BI systems. To do so, the suggested categories were extracted empirically using data collected from semi-structured interviews and conducted with (22) senior managers working with two companies in the telecommunication sector. Later, tested on a larger

sample of (150) participants following rigours set both quantitative and qualitative correlations techniques. ACAP is proposed to offer contemporary organisational data processing Information Systems (IS) with a strategic foundation that can provide systems as BI with the ability to combine organisational data through analytical tools to present complex and competitive information and knowledge to managers and decision makers. Manager's objective from implementing BI is to ensure the quality and relevance of the input to decision-making process, and recognise the generated knowledge, assimilate it and apply in different managerial aspects using useful and computerised tools.

Chapter one offers an intellectualised overview of the key substances of the thesis. It is organised initially from Section 1.2 an overview of ACAP, and its core aspects. Section 1.3 presents an overview of ACAP relationship with BI systems. Section 1.4 presents the research motivation. Then, in section 1.5 the research structure of the thesis chapters is presented including a comprehensive diagram for simplifying the reading of the thesis construction. Later, section 1.6 defines the research questions, aim, and objectives based on the established research background. Consequently, in Section 1.7 the key research methods and methodologies used for conducting this work are introduced. Finally, section 1.8 indicates an overview of the key contributions of the study.

1.2 Absorptive Capacity: Overview

Absorptive Capacity (ACAP) is the ability of a firm to integrate, transform, and apply valuable knowledge required for business success. Advanced exertions in re-conceptualizing the concept of ACAP with the aim of looking for a more profound understanding of the concept and saving it from being constantly corrected and rectified Zahra and George (2002), ACAP is proposed to play a significant role in enriching the process of knowledge creation embraced inside contemporary organizational Information Systems (IS) environments. This research aims to provide qualitative grounded categories for ACAP dimensions. Dimensions of ACAP are defined as a 'distinct but complementary capabilities that compose a firm's ACAP summarised by four main dimensions (acquisition, assimilation, transformation, and exploitation). The dimensions represent a set of capabilities or potentials that a certain organisation may acquire and exploit to serve its knowledge creation process. The standpoint of this research is that these categories can

be better attained, facilitated and applied as an input to organisational knowledge creation success by classifying two synchronised groups called; potential absorptive capacity (PACAP) and realised absorptive capacity (RACAP). PACAP in a firm offers capabilities for acquiring and assimilating knowledge, where prior knowledge plays a major role inside the organisation. RACAP is the ability of a firm to combine the prior owned knowledge with newly attained knowledge by having a set of procedures that can support this combination and refinement of knowledge, or in other words, knowledge transformation. RACAP refers to knowledge exploitation indicating the capacity of the firm to exploit newly gained knowledge, and efficiently apply it in services and product, which can lead to better performance and financial profit.

1.3 Absorptive Capacity Effect on Business Intelligence Systems

The current research key proposition suggests that organisational ACAP is anticipated to influence BI systems efficiency when employed in organisations. BI, as a concept, is required to be a strategic business-driven perception that can add value to organisational efficiency (Watson, 2009). Accordingly, organisational efficiency in the context of the current research is treated as the ability of organisations in reflecting a robust organisational culture influenced by the existence of efficient data-driven processing systems. The concept of BI was defined by Watson (2009) as “a broad category of applications, technologies, and processes for gathering, storing, accessing, and analysing data to help business users make better decisions.” BI is reviewed in much research as an umbrella term for systems and procedures that transform raw data into useful information for managers to make better decisions (Wixom and Watson, 2010).

Consequently, the study treats ACAP as being the conceptual form of BI, while a BI system is considered to be the technical application of ACAP; both are expected to aid the process of knowledge creation. Extracting this relationship between ACAP and BI was originated from realising several similarities amongst the two constructs. ACAP conceptual architecture, and BI systems technical architecture were found to be very similar in terms of components. The current research emphasis on treating BI systems adaptation inside organisations to be successfully assimilated, reflecting better managerial and organisational performance.

1.4 Research Motivations

The available organisational capabilities engaged in influencing the process of creating data processing intelligence inside organisations are still required to be limited, given the current competitive environments that deal with the global increase of available data and information production needed to be transformed consistently into knowledge. Past research attempting to link ACAP with BI has been theoretically and empirically uncertain and lacking in rigour. As most of the available research only emphasise the absence of previous empirical research that draws a logical link between technical data processing systems, and behavioural organisational capabilities.

The current study was motivated by the non-existence of prior research that values the concept of ACAP and its potential effects on BI systems, also the lack of the available fundamental models that reflect the proposed positive results anticipated between the three constructs engaged in the study. Another driver of the study is to uncover measures of ACAP from organisational knowledge foundations. The current thesis covers a comprehensive research study that uses a critical rationalist approach to measure the link between the potential roles of ACAP as a knowledge creation component on organisational data-driven technologies such as BI systems efficiency. The study combines and extends previous research on ACAP and BI setting, which allows the reconciliation of some absent contradictory findings concerning ACAP and knowledge creation and how they can affect the integration of BI systems. Consequently, by adding to the theoretical effort that attempted to save the concept from being frequently rectified or corrected.

1.5 Chapters Outline

This thesis is structured around seven critical chapters described as follows

Chapter One: presents an overview and background of this research. The chapter also discusses the research context by providing a brief theoretical background of the study related themes. Additionally, enlightening the research questions, aims and objectives, motivations, and contributions. Finally, a brief of the thesis is structure is presented.

Chapter Two: presents a two folds literature review of relevant research appraisal, giving general background of organisational ACAP in one part, and a state of the art literature review on BI managerial aspects and role on organisational efficiency in the second part. A comprehensive outline of the required technologies for BI systems is presented, leading to extracting an association for both components. The chapter proceeds by offering concerns and challenges that hinder introducing BI as a step towards a more effective ACAP environment visualization.

Chapter Three: develops a novel theoretical framework that identifies initially the illustrative hypothetical model seeking to explore ACAP as a key organisational capability. Later, in the second part of the conceptual model a proposed sequential casual association between ACAP and BI (ACAP-BI Model) is depicted, the purpose is to present an initial indication illustrated using a visual relationship model.

Chapter Four: presents a comprehensive philosophical methodology framework, and a sensible illustration of the employed quantitative and qualitative research methods that will aid the plotting and accomplishment of the research objectives. A detailed exploration of Grounded Theory Methodology is presented and treated as the core qualitative research method. Subsequently offering a detailed description of the quantitative research methods of PLS-SEM.

Chapter Five: delivers a practical implementation of the presented qualitative research methods, illustrating the data collection aspects that mainly relied on gathering data collected using semi-structured interviews. Two different telecommunication companies were targeted, providing a functional validation of the constructed framework. Later, data analysis using GTM coding techniques were entirely elaborated. Finally, a comprehensive discussion of the resulted qualitative data is presented. The chapter goal is to develop the first block of the theoretical framework. Finally, the chapter ends with validating the extracted measures by undertaking a significant bias reduction approach, which provided additional evidence of the openness of the selected research method.

Chapter Six: illustrates the quantitative data sample, and how it was analysed using PLS-SEM analysis, the section ascertains the fit of the proposed hypothesis given the resulted data. The chapter also delivers the final methodological model that uncovers the positive

proposed relation between the two facets. The chapter aims to implement the second block of the sequential theoretical framework.

Chapter Seven: summarises the research outcomes, conclusions. It also presents research contributions to theory, practice, and academia. Later, future work is also fully projected. The chapter ends with introducing the latest research trends in both ACAP and BI systems.

A thesis outline diagram is generated in Figure 1-1 to provide an abstract level structure that maps the research design, the thesis chapters, and the research objectives.

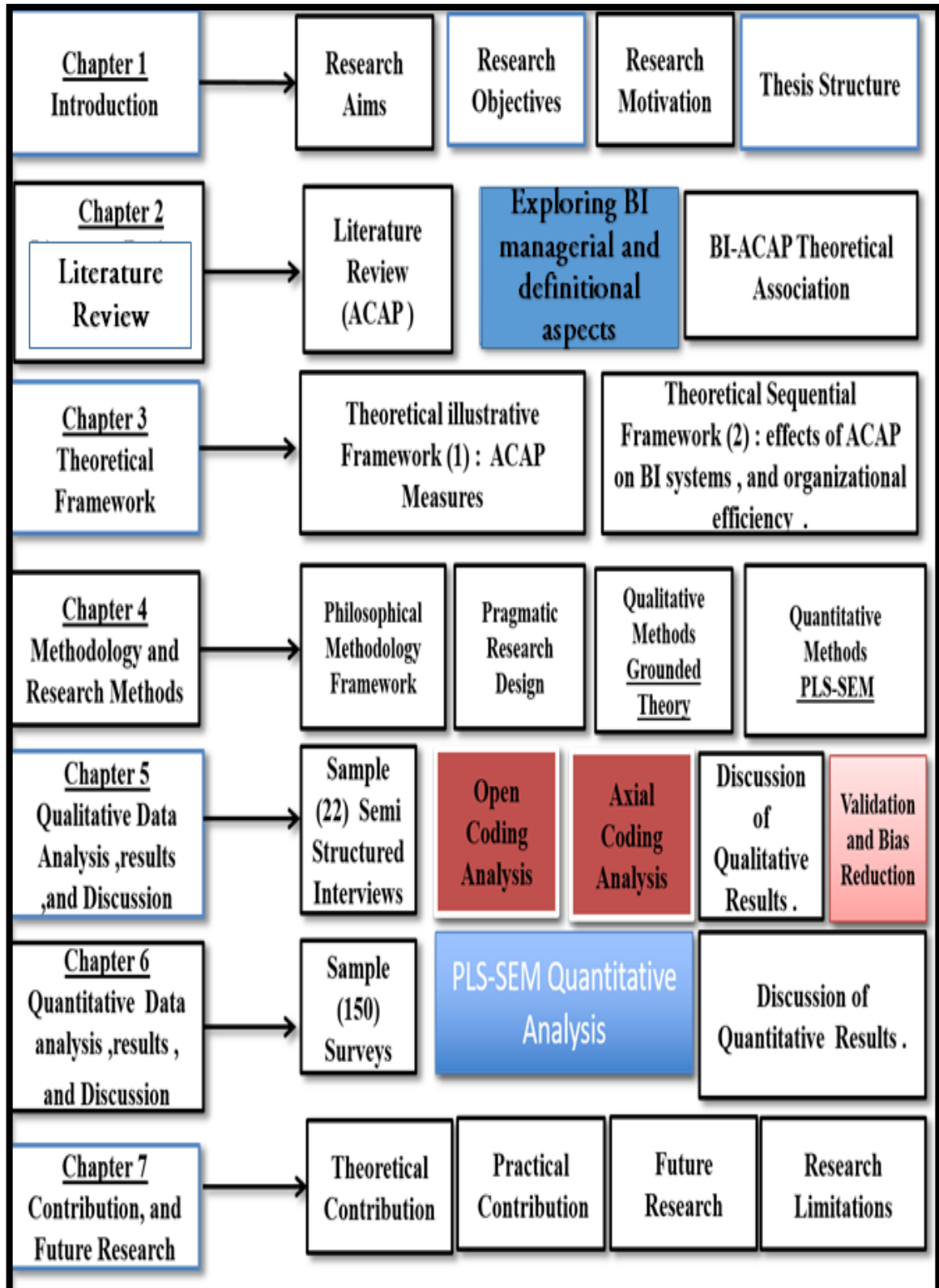


Fig 1.1: Thesis structure and key chapters

1.6 Research Questions, Aim, and Objectives

This research aim is to:

Assess the value of ACAP as a key organisational dynamic capability, and relate its potential positive effects with BI systems efficiency.

Accordingly, the goal is to answer the bellow research global questions:

- *What are the measures that determine organisational ACAP dimensions in supporting potential creation of knowledge?*
- *Can ACAP dimensions affect the efficiency of BI systems? Accordingly, can BI influence the overall organisational efficiency?*

The whole aim of this study is attained throughout the implementation of the following research objectives:

Objective 1: recognise the concept of ACAP as an organisational construct; consequently develop a theoretical setting that reflects its potential support for knowledge creation from a theoretical lens.

Objective 2: hypothetically consider the role of BI systems in achieving organisational efficiency by establishing a possible notional association between ACAP and BI systems.

Objective 3: empirically extract categories for ACAP, delivered as a relational model regarding their significant contribution to the theory and managerial practice.

Objective 4: empirically validate the extracted ACAP model by testing its effects on BI systems efficiency and overall organisational efficiency.

Objective 5: build a comprehensive causal methodological model that reveals the produced effects of ACAP specific dimensions as an organisational construct, on BI systems efficiency and organisational efficiency.

1.7 Research Methods and Methodology

The research follows interpretive and positivist philosophical standpoints. Both qualitative and quantitative methods were selected in performing this research. Grounded Theory Methodology (GTM) was chosen as a core qualitative research method that had a significant role in directing the study analysis process and results as a whole. GTM, as a qualitative research methodology, was applied to produce a conceptual relational model for extracting qualitative measures for ACAP dimensions. The data collection phase relied on conducting (22) semi-structured interviews from two telecommunication organisations in the Middle East in Jordan. While data analysis in this study used a set of cyclic coding processes categorised for GTM by applying early findings to shape the on-going data collection process. Moreover, semi-structured interviews facilitated the discovery of a broader scale observation compared with what was exposed and realised in the early stages of the research. Finally, the measures were validated through a bias reduction tactic, which provided additional evidence of the openness of the selected research method.

Quantitative data for this study were collected through online surveys that comprised Likert scale surveys with a larger sample of (150) respondents that engaged correspondingly senior managers working in telecommunication companies. The obtained sample data were analysed using PLS-SEM, the quantitative method was conducted to test the validity of the ACAP indicators extracted from the qualitative data analysis, and for testing the proposed hypothesis examining the effects of ACAP measures on the efficiency of BI systems.

1.8 Research Contribution

The research presented in this thesis provided a practical framework characterised as a contribution to the literature in understanding the construct of ACAP in technology-based industries, and in what ways it can affect other data-driven systems, precisely the effect of ACAP on the efficiency of BI systems, leading to overall organisational efficiency. Theoretical and managerial explanations were empirically derived, reflecting the proposed impacts on strategic managers and their future capabilities utilising the proposed measures

and effects on data-driven systems such as BI systems, besides offering benchmarking foundations for shaping where and how further potential organisational and managerial assets can be leveraged in a different department of an organisation. The contributions of the current research lie mainly in two-folded contribution theoretical and practical contributions. This research is believed to advance both theories contribution and management accompaniments of research engaged in the same focus.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter provides a literature review incorporating a narrative review for the seminal articles and scholarly research, which identified current and previous knowledge and gaps of the topics employed in the current study. The review comprised substantive findings, as well as theoretical and methodological contributions and evaluation to both topics. Furthermore, a state of the art integrated literature review was conducted aiming to demonstrate any apparent association mentioned in the literature between BI systems and organisational efficiency.

In presenting the review, the chapter is organised as follows; section 2.2 provides the structure of the overall literature review process and objectives of the process. Section 2.3 provides a review of the concept of ACAP; section 2.3.1 review available models of ACAP, later in 2.3.2 present an evaluation of the reviewed models of ACAP. Afterwards, section 2.4 offers an overview of the concept of BI and BI systems as a managerial data processing system. Later, section 2.5 explained the process of the conducted literature review concerning ACAP and its potential association with organisational efficiency. Finally, section 2.6 offered a critical evaluation of the conducted literature review, and enlightened the current research direction building on the literature review.

2.2 Literature Review Structure

The literature review is structured by means to achieve the following key goals; (1) review evidence available on the concept of ACAP, and ACAP available models from theoretical aspects, (2) evaluating the limitations and gaps of the reviewed models of ACAP, (3) review the concept of BI, and BI systems from a managerial perspective. Then evaluating some technical aspects of the concepts as a managerial data processing system. (4) finally, assisting the direction of the current study by conducting a state of the art literature review aiming to offer a clear validity for the association of both managerial facets of ACAP and BI systems.

The literature review in the current research serves in establishing a theoretical lens that connects BI and ACAP by exploring previous work on both sides, and which can contribute to building a methodological and pragmatic model in the upcoming phases of the current study. Hence, the literature review deliberately reviewed content that treated both concepts as a solid perception that aids companies to recognise, and build both skills and ability to grasp knowledge, than retain such knowledge, and finally make use of it to improve their decisions and organisational performance in terms of assimilating BI systems. Moreover, discovering paradigms associated with the research area and any material breaches that occur and that are required to be addressed for future research actions.

2.3 Absorptive Capacity: An Overview

The concept of ACAP was created by Cohen and Levinthal (1990), who defined it as: “*the ability of organisations to identify, assimilate, and exploit knowledge coming from external sources.*” Researching ACAP has been one of the most frequently stated and explored subjects in organisation management throughout the last two decades (Volberda et al., 2009). There are very few review articles for such a large research focus that moderately presents support for the review of the construct definition such as Bosch et al. (1999). Historically, the concept of ACAP was mentioned since the seventies. Nevertheless, the latest application of its practice has been related to Cohen and Leventhal (1990). Their definition of ACAP became dominate in almost all research associated with knowledge management. A proposition by Lane et al. (2006) indicated that ACAP is required to be one of the principal significant elements needed in organisations to develop research due to its correlation with other widespread organisational fields. ACAP developed rapidly within the literature in line with the unique standpoint that the concept can offer as a dynamic organisational capability (Dabic et al., 2019). To make the concept more familiar Roberts et al. (2012) presented a real-world analogy by building a similarity between the mechanisms of ACAP inside organizations and a sponge, they correlated the ACAP to a sponge given its material, number of holes, and its nature of water resistance when amount of water enter inside it. All are all strong indicators of its ability to absorb water. Now, the water can flow within the holes in the material as the sponge absorbs the water, and as we squeeze the sponge, we are facilitating the flow of water. Likewise, any

organisation can absorb knowledge from external sources; nevertheless, it will only do so if the capabilities of its employees are responsive and open to any new knowledge source that can be integrated with their current knowledge base. Importantly, such knowledge streams or flows are enabled using suitable fitting processes, structures, and supporting technologies.

ACAP, as a construct, is seen to be located amongst various fields of organisational learning (Harris and Yan, 2018). Furthermore, studies have examined ACAP as an organisational capability of both individuals and organisation (e.g., Cohen and Leventhal (1990); Minbaeva et al. (2003), or countries as proposed by Mowery and Oxley (1995), and Buzzacchi et al. (1995). While in technology, licensing it was referred to the seminal work of Nicholls-Nixon and Woo (2003). ACAP in Strategic Alliance was related to Lane and Lubatkin (1990). The below in 2.1 illustrated more ACAP field of study. Studies also have examined ACAP as the capability of individuals and organisation to acquire knowledge (e.g., Cohen and Leventhal (1990); Minbaeva et al. (2003), or examining its existence in countries as a whole (Cooper and Molla, 2016). Moreover, Silva et al. (2014) applied the construct in banking studies.

Areas of Interest in ACAP	
Banking	(Silva et al. (2014)
Technology Licensing	(Nicholls-Nixon and Woo, 2003)
Strategic Alliance	(Cui, Wu and Tong, 2018)
Organizational Learning	(Cooper and Molla, 2016)
Product Development	(Stocke et al., 2001)
Theoretical Construct	(Lane et al., 2006)
Cooperative Network	(Dyer and Singh, 1998) (Tsai, 2009)
Organization Financial Performance	(Kostopoulos et al., 2011)

Table 2.1: Areas of interest in ACAP

2.3.1 Models of Absorptive Capacity

The current section captures the main ACAP models reflected within the literature; the illustrated models were built from ACAP scholars in an initiative to make the concept more understandable, and to save it from being frequently rectified (Zahra and Georg, 2002). Rectification is described as having a concept such as ACAP that has been detached from the roots of its origin (Floor, Cooper and Oltra, 2011). Four ACAP models were dominant and will be evaluated within this section.

Primarily Cohen and Levinthal (1989; 1990) who are the establishers of ACAP did a relatively early conceptualisation and modelling of the concept in the late 80s early '90s. They also had several interests in linking ACAP with learning and innovation. Cohen and Levinthal (1989; 1990) argued that an organisational capability to absorb external knowledge depends mostly on investments on research and development (R&D). Later, the same scholars stretched their understanding of ACAP, treating it as an intellectual appearance of knowledge and learning. Also, they proposed separation between individual learning and organisational learning, arguing that organisational learning is more than the summation of only individual learning, as it incorporates individuals and their units. As in model in fig 2.1.

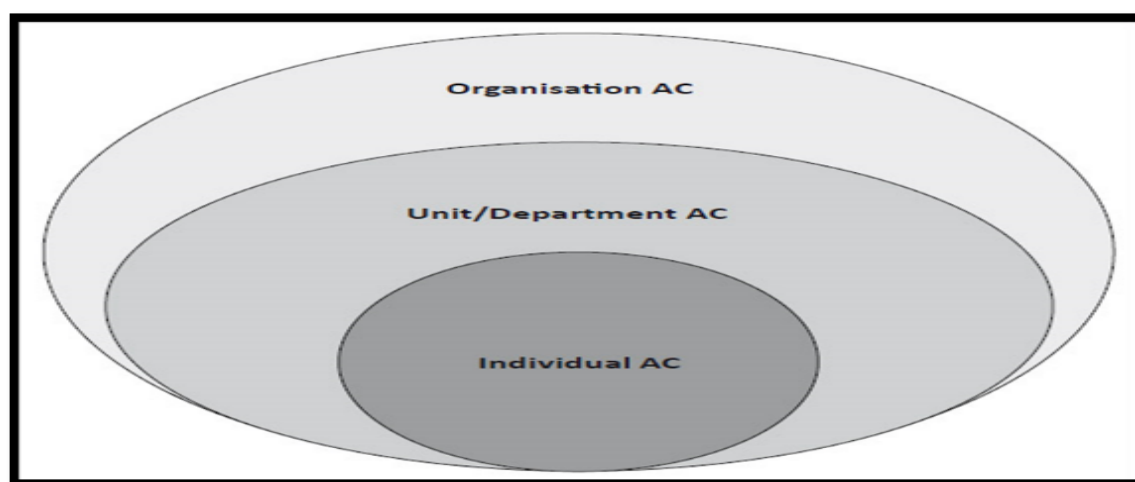


Fig 2.1: ACAP model Cohen and Levinthal (1989; 1990)

The second model or conceptualisation was proposed by (Lane and Lubatkin, 1998) who looked into ACAP as a learning tool or process, and they suggested that each firm has an

equivalent capability to learn and acquire knowledge from all other firms. However, they created a model that increased the emphasis on knowledge and knowledge base, and which is considered vital in the context of this review. The model again is engaged with valuing a firm's capability in learning from another firm; different factors determine this learning capacity as : (1) knowledge base of the firm, (2) connection between two firms, and (3) governing rationalities plus organisational configurations and strategies. The outcome from testing their model revealed the importance of having similarities' among firms, the similarities in technological aspects, i.e. such as between the receiver of technology/knowledge and supplier, in a knowledge base, in research domination, and the low-level management reinforcement were all similarities linked positively to organizational learning (Flor, Cooper and Oltra, 2018).

After proposing their initial model, Cohen and Levinthal (2002) again suggested advancement on their previous model, incorporating issues connected to knowledge learning. The model stressed on organizational learning beliefs such as (1) Individuals learn through accumulating prior knowledge from different sources, (2) Organizations ACAP can appear after the knowledge source by initially recognizing the value of prior knowledge, assimilating knowledge, and later applying it, (3) finally, organizational consequence of ACAP can be summarized as an output of innovation, and innovative performance as illustrated in fig 2.2.

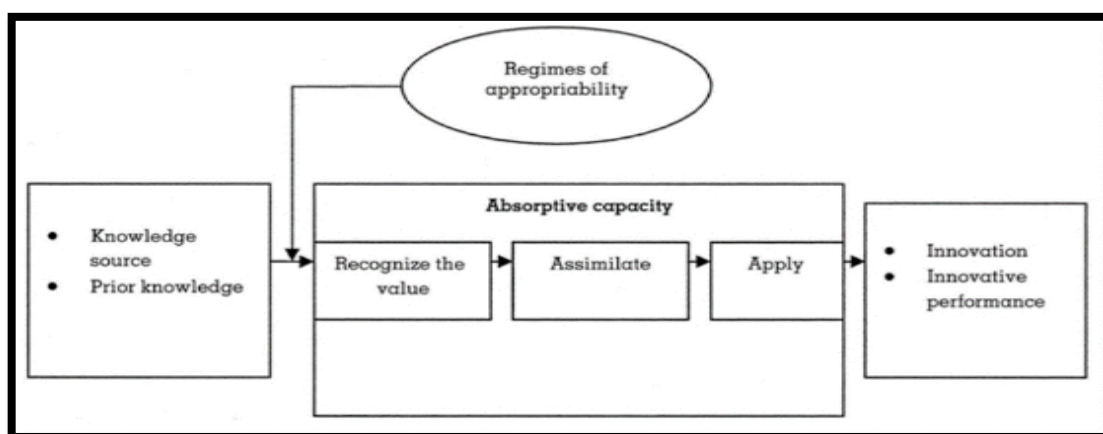


Fig 2.2: ACAP Model by Cohen and Levinthal's work (2002)

A different ACAP advanced modelling efforts to re-conceptualize the concept of ACAP to look for a more profound understanding of the concept, and saving it from being

rectified is the one proposed by Zahra and George (2002). These authors re-conceptualised ACAP and redefined it as: “*A dynamic capability embedded in a firm's routines and processes, making it possible to analyse the stocks and flows of a firm's knowledge, and that contributes to the creation and sustainability of competitive advantage*”. The re-conceptualisation treated ACAP as a dynamic capability plus adding emphases on the competitive advantage aspect of its application. Further, Zahra and George (2000) perceived a difference between a dynamic capability and a capability. A capability is defined by Winter (2000) as: “*a high-level routine that together with its implementing input flows, confers upon an organisation's management a set of decision options for producing the significant output of a particular type*”.

Moreover, Winter (2000) treated a capability as a paradigm that is presented within organisational activities, and that is significant for generating critical outcomes. On the other hand, Zahra and George (2002) considered dynamic capability as a key competency in generating strategic nature in an organisation, which is more or less concerned with the element ‘change’ in a certain organisation. Consequently, ACAP for Zahra and George (2002) is essentially a dynamic capability that leads to change. This change can generate a certain level of competitive advantage by the connections between these elements and their effect on a firm's strategic sets, and by identifying conditions under which the components of ACAP generate importance in delivering perceptions into the motivations of performance dissimilarities inside the same industry.

Zahra and George (2002) added more to their conceptualisation of ACAP by classifying two synchronised groups called; Potential Absorptive Capacity (PACAP) and Realized Absorptive Capacity (RACAP). They suggested that PACAP in a firm offers capabilities for obtaining and assimilating knowledge; in this case, prior knowledge plays a major role inside organisations. Conversely, the organisation relies on prior gathered knowledge to recognise and understand new external knowledge (Kim, 1998). External knowledge references any knowledge coming from different departments, division, and also coming from the different organisations either inside the firm’s country or outside (Alexander, 1995).

(RACAP) is the ability of a firm to combine the prior owned knowledge with newly attained knowledge. Organisations can do so by having a set of procedures that can support this combination and refinement of knowledge. (RACAP) refers to knowledge exploitation indicating the capacity of the firm to exploit newly gained knowledge, and efficiently apply it in services and product, which can lead to better performance and financial profit. Zahra and George (2002) summarised specific indicators that describe both PACAP and RCAP by way of a series of capabilities named 'dimensions' of ACAP as follows;

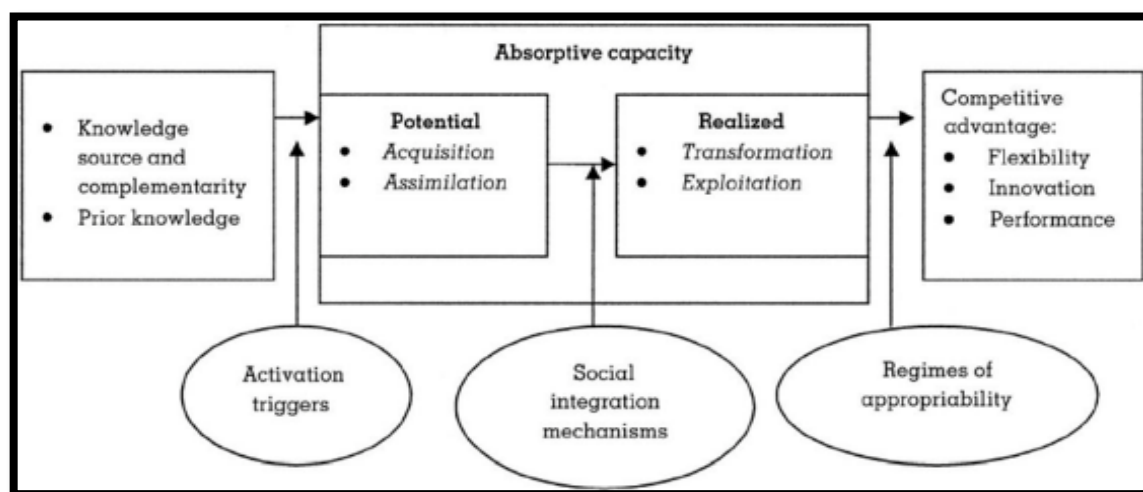


Fig 2.3: ACAP model according to (Zahra and George, 2002)

The dimensions of ACAP are explained in details in section 2.3.2. The model of Zahra and George (2002) added contribution to the ACAP literature by: (1) Identifying ACAP as a dynamic competency with the ability to affect the environment of a company's competitive advantage, (2) distinguishing between functions and distinctive modules of an organization's ACAP preparing it for future research (Floor, Cooper and Oltra, 2018). The final model presented in this section was proposed by Todorova and Durisin (2000). The model added on the two synchronised groups (PACAP) and (RACAP), and the difference between (PACAP) and (RACAP). Alternatively, they suggested the component 'efficiency' within their proposed model. Additionally, they attempted to add to what Zahra and George failed to include. They presented a new model building on both studies done by Cohen and Levinthal (1990), and Zahra and George (2002) as the model presented in fig 2.4.

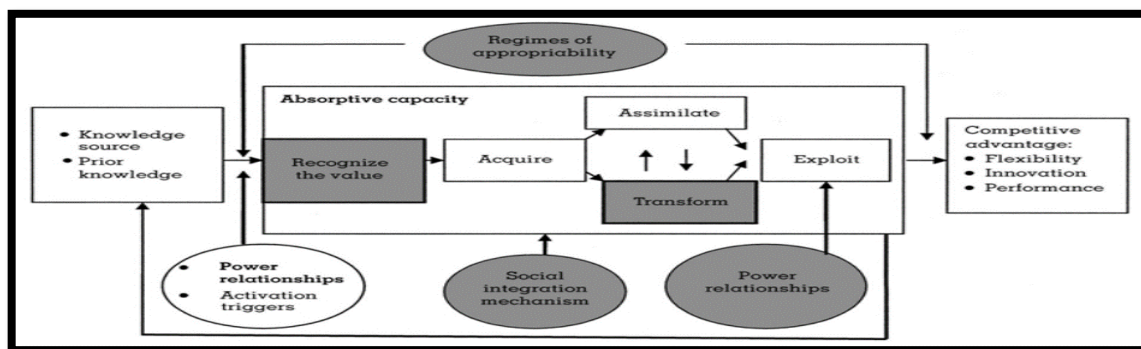


Fig 2.4: Advanced Model of ACAP adapted from (Todorova and Durisin, 2007)

The model presented in figure 2.4 indicates that Todorova and Durisin (2007) applied critical adjustments to the available models. They claimed that the element 'power relationship' mentioned in their model affects the exploitation of acquired knowledge and its value. Moreover; their interest in social integration and relating it to all ACAP dimensions contradicts with what was proposed by Zahra and George (2002) who suggested that social integration only exists between the overall construction of (PACAP), and (RACAP) (Todorova and Durisin, 2007).

2.3.2 Dimensions of Absorptive Capacity

Dimensions of ACAP are defined as a 'distinct but complementary capabilities that compose a firm's ACAP (Floor, Cooper and Oltra, 2018). By looking into the presented dimensions, it is understood that they signify a set of capabilities or potentials that a certain organization may acquire and exploit to serve its knowledge creation process. ACAP dimensions are exemplified in figure 2.5. The standpoint in this research is to that these dimensions as potential capabilities can be better attained, facilitated and applied as an input to organizational Knowledge creation success treated as a set of dynamic organizational capabilities. The model bellow, illustrated in fig 2.5 presents the main dimensions of ACAP suggested by (Zahra and George, 2002). The dimensions are fully explained, and each dimension is explained separately.

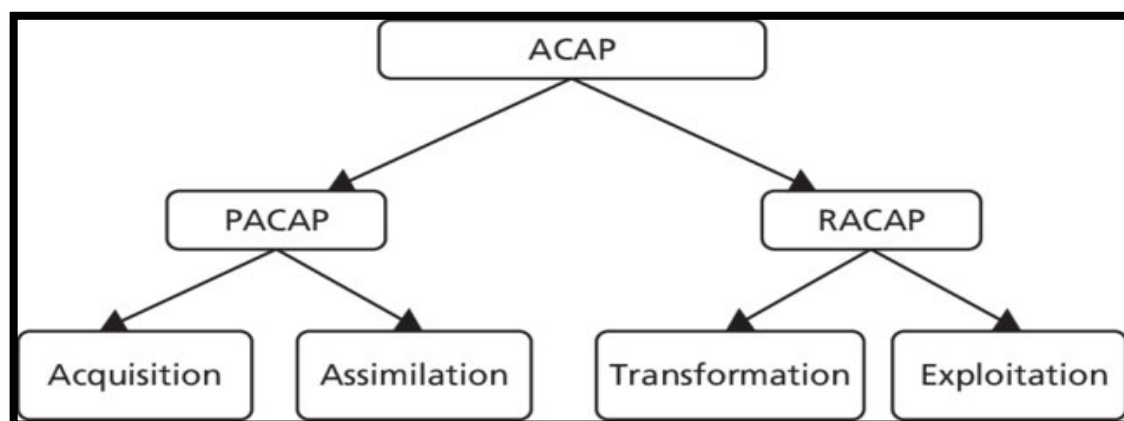


Fig 2.5: ACAP Dimensions adapted from (Zahra and George, 2002)

- **Acquisition**

The acquisition dimension is the ability to recognise, obtain, and grasp the external knowledge required for organisational processes and growth (Lane and Lubatkin, 1998). Many scholars considered dimension acquisition as an effective generator of knowledge that seems to appear through proper investments in R&D (Chaudhary and Batra, 2018). They suggested three important aspects that describe the effort used in knowledge acquisition and which can eventually influence ACAP, the aspects are (intensity, speed, and direction). Intensity, coupled with the speed of effort is vital aspects of recognising and collecting knowledge in firms; moreover, they can define the quality and degree of a firm's acquisition competencies. In other words, and according to (Kim, 1997) the extra the effort the firm provides in acquiring knowledge, the more quickly the firm will shape necessary capabilities

- **Assimilation**

The definition of Assimilation by Kim (1997), and Szulanski (1996) was cited in Zahra, and George (2002) refers to the firm's routines and processes that allow it to analyse, process, interpret, and understand the information obtained from external sources. Zahra and George (2002) explained that philosophies and findings that lie outside an organisation's search zone are somehow disregarded since the firm cannot easily understand them externally. Moreover, external knowledge coming from outside either outside a department or outside the organisation may involve heuristics that are inconsistent with the current heuristics used by that firm or organization. Consequently,

this may cause a delay in understanding knowledge and processing (Leonard-Barton, 1995). External knowledge is required to be specific in terms of context and contents. The difficulty of grasping knowledge lies in the value of knowledge when the value of knowledge is dependable on its complementary asset; the more difficulty appears in grasping and relating it with external knowledge (Silva et al., 2014). Eventually, the comprehension of knowledge and being able to understand is a key role successfully assimilating the external knowledge (Pittz et al., 2018).

- **Transformation**

Transformation describes the ability of the organisation to do a series of refinement on its current routines so that it can be combined with newly acquired knowledge. Zahra and George (2002) acknowledged that the process of refinement can be done by the addition or deletion of knowledge, or may also be accomplished by augmenting the same acquired knowledge in different directions. Zahra and George (2002) suggested using what is called Bi-Association; in their description of the transformation dimension. Bi-Association is a process that leads to transformation. Bi- Association arises when an idea appears in two dependable but incompatible settings of resources. Subsequently, the capability of the organisation to absorb information formulated in a shape of two inconsistent forms coming from different resources and then associate these pieces of information with producing knowledge is required to be a successful practice of transformation (McGrath and MacMillan, 2000). The transformation has been linked to a strategic change in many positions within the literature. Strategic change or strategic organisational transformation is described when a constructive change appears within the firm's routines and knowledge. According to Zahra and George (2002), strategic change presents new knowledge for reframing organisational description of the industry and competitive strategy (Floor, Cooper and Oltra, 2018).

- **Exploitation**

Exploitation highlights the application of knowledge. Exploitation as an organizational competency is grounded on practices and routines that permit organisations to refine, outspread, and influence existing capabilities, otherwise to generate new and different ones by incorporating acquired and transformed knowledge into its operations (Cohen and

Leventhal's, 1990). Exploitation key role lies in reflecting a firm's capability in producing and integrating knowledge into its processes and operations (Van den Bosch et al., 1999). This integration mechanism desires to retrieve the knowledge that has been previously produced and adopted for practice (Lyles and Schwenk, 1992). Consequently, the output of the exploitation capability is the formation of new services, products, systems, and knowledge. A good example of the exploitation capability can be apparent when looking at new projects that tend to collect knowledge from different essential resources such as customers, competitors, and market. And they later use this captured knowledge in creating novel proficiencies. Likewise, prosperous recognised organisations are expected to integrate routines that position their knowledge and target it to improve current visions or inspire new creativities inside their environment (Liang and Liu, 2018)

2.3.3 Limitations of Available Models

It can be observed from the literature investigation that existing models provided limited exploration to the ACAP dimensions needed to understand more the concept of ACAP. The literature recognised several ways of generating ACAP. However, qualitative and quantitative measures concerned with ACAP were always found as being a 'black box' as they required being a complicated construct, especially with regards to how they are empirically generated. Previous empirical literature and measurement efforts did not succeed in simplifying ACAP's primary characters and routines treated as measures (Duchek, 2013). The process of specifying exactly how the concept of ACAP is generated in previous empirical research can be somewhat challenging as claimed by Duchek (2013) who carried out a critical review on ACAP explaining how ACAP has been measured in previous empirical research. The classification proposed different measures of ACAP by distinguishing only quantitative methods. According to Lane et al. (2006), the large number and broad range of fields examining ACAP in different denotations created vital worries about the literature stream of ACAP presented as a theorised model.

To conclude the limitations of the models it should be stressed that no obvious clarity in the presented models to demonstrate a real contribution and deep explanation to its dimensions and how they are conceptualised and measured (Lane et al., 2006), the specific limitation of the presented models can be characterised by the following;

- (1) Relating diverse irrelevant fields and processes within the models to ACAP.
- (2) Paying slight attention within ACAP dimensions to the importance of data, information, and knowledge acquiring to the construct.
- (3) Not relating ACAP dimensions to overlapping and similar constructs.
- (4) Not linking ACAP dimensions to technological aspects.

The observed gaps are concerned mainly with construct classification and disconnection from other vital technological constructs. The present research attempts to explore ACAP in a way that helps in connecting it with intersecting technological and organisational constructs such as BI systems and tools. While the original classification of ACAP has constantly been facing restructuring concerns, very few researchers attempted to unravel this type of challenge and support in limiting the number and scope of construct interpretations (Cronbach and Meehl, 1955).

2.4 Association between Information Systems and Absorptive Capacity

A connection between ACAP and (IS) research appeared in a revision by Robert et al. (2012), the main driver of the study was to refine the current understanding of ACAP and to direct its operative practice in IS studies. They reviewed this construct by tracing the evolution of ACAP literature in organisations observing issues linked to its conceptualisation effects and organisational learning. Moreover, they examined how ACAP has been measured, theorised, and then utilised in the IS research field. Consequently, they proposed a framework aimed at researches that links ACAP to IS and Information technology. The current research looks into ACAP creation in a slightly value-added approach or direction. The research is oriented towards acquiring and processing data, information, and knowledge in technology-based industries. Interesting work that focused on this connection includes Elbashir et al. (2011) and Robert et al. (2012), both ascertained on the importance of the capability to collect, absorb and strategically control new information coming from external sources for creating a suitable technological set-up, and to integrate information systems for achieving better organizational performance. Additional outcomes of their studies demonstrated issues

related to managerial hierarchy; they proposed that top management plays an indirect but critical role in effectively positioning information systems.

2.5 Business Intelligence: An Overview

BI as a concept is required to be a business –driven perception that can add value to organisational efficiency (Watson, 2009). The concept was defined by Watson (2009) as *“a broad category of applications, technologies, and processes for gathering, storing, accessing, and analysing data to help business users make better decisions.”*

BI is reviewed and preserved as an umbrella term for systems and procedures that transform raw data into useful information for managers to make better decisions (Wixom and Watson, 2010). According to Laursen and Thorlund (2010), BI in the operational level is required to be an information system that is made up of three significant components: (1) a technological component that collects raw data, stores the data, transform data into information, (2) a human component that accelerates the human competencies urging humans to retrieve data better and deliver it as processed information, and then generate knowledge and decision accordingly, (3) the last component is that used in supporting organisational business process the requires the transformation of information into useful knowledge to give organisations more business values and profits. According to Liang and Liu (2018) also that BI systems are required to be much different than only a type of IT infrastructure. BI systems need IT infrastructure to operate such as hardware and shared services like database shared services, and security services, etc. Another exploration of BI by McBride (2015) who attempted to review BI research published before 2015. One of their significant discovery concluded that BI research focused mostly on exploratory research: formal theory and literature review, and very few empirical studies. The other finding is that prior research only addressed new technologies and issues in BI without attempting to explain the fundamental issues of IS research as it relates to BI, such as its relation to organisational efficiency and what are the required organisational capabilities that needed to support the assimilation of BI.

2.5.1 Association between Business Intelligence and Absorptive Capacity

Important recognition came across the influential work of Mashingaidze and Backhouse (2017) that the ACAP of an organisation or its capacity to absorb varies regarding the source of knowledge, this source can be any type of data processing systems. An important aspect recognised here, and that can be relatively relevant to what Lane et al. (2006) stated in regards to the knowledge source variation is that when an organization is engaged in part of the industry there is an existence of data systems sources such as BI. All these sources are required to be diverse in regards to knowledge formation. In reality, it is more likely to notice that professional entities such as professional unions, councils or associations, etc. are proposed to improve BI related actions to the market and economise trends. Simultaneously, organisations keep a good level of exchange with other organisations regarding their professional practice in the industry as partners, customers, suppliers, and competitors (Chen, Chiang and Storey 2012). However, It was noticed thru reviewing the literature that the there is a clear absence of studies that directly pointed out to a direct potential relation between ACAP and BI systems.

2.6 Business Intelligence and Organisational Efficiency

The review in the current sections proposes a valuation of the available literature that has a relationship with the research theme; this is achieved by following a precise and rigorous approach. Therefore, the researcher of the current research followed a course of action derived from (Brereton, 2010). Other researchers can utilise these studies as the base of future exploration into BI Implementation. The goal of the literature review in this section is to analyse a novel and comprehensive definitions of BI that includes a coherent relation between BI and a set of key managerial elements.

This section illustrates the core concepts of BI and their effect(s) on certain organisational aspects based on a literature review process. The process derived from Brereton (2011) is based on accumulating a representative pool of articles, classifying them according to research questions, evaluating and synthesising that literature concerning the research questions and, finally, documenting the review and its outcomes. The review addressed two key research questions:

Q1: what are the core organisational facets of BI systems?

Q2: How can BI systems affect the efficiency of the explored aspects?

The literature review questions act jointly to provide an absolute explanation of the BI systems aspects from the current research focus. Information relating BI definitions was collected for (Q1) to expand the understanding of traditional definitions, and extract key managerial aspects embedded within those definitions. Papers were then analysed to provide a more detailed understanding of BI about those addressing (Q2).

The review once rationalised, examined (65) studies spanning 2010 to 2019. Also, proposed a novel and comprehensive definition of BI that includes a coherent relation between BI and a set of key managerial elements. The coherent relation indicated that "Decision making," "Business Performance Management," and "Data Management" are interrelated and cohesive managerial and key organisational aspects that can be affected positively when applying and implementing BI within organisations. (AL-Eisawi, Lycett, 2012).

In accordance with literature review guidelines of Brereton (2011), the following steps were undertaken: (1) recognizing the need for the review; (2) formulating a set of research questions; (3) accumulating a representative pool of articles; (4) evaluating and synthesising the gathered articles; (5) dividing the papers according to research questions; and (6), documenting the review and outcomes. Figure 2.6 illustrates the detailed process of literature review (AL-Eisawi and Lycett, 2012).

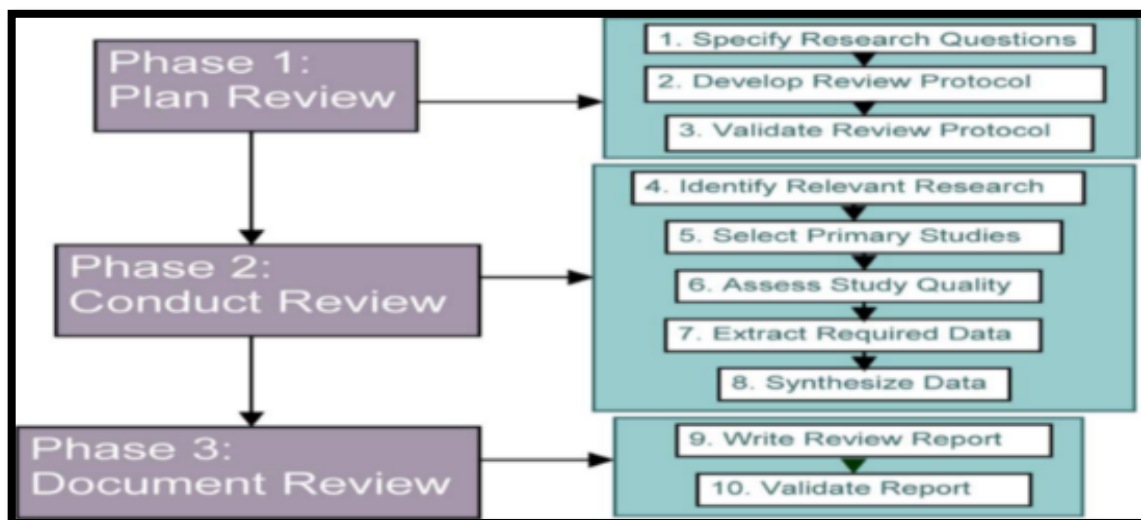


Fig 2.6 : literature review process adopted from (Brereton, 2011).

2.6.1 Searched Resources

In conducting the literature search, a group of keywords were used, these being 'Business Intelligence,' 'Decision Making' and 'Business Performance Management', and 'Knowledge Management'. These specific words were drawn up for each research question. The research also relied on valid research databases for searching including; the IEEE/IET electronic library, ABI Inform, Academic Search Complete (ASC), Institute of Electrical and Electronic Engineers, Scopus and Science Direct. These sources were supplemented with selected conference proceedings and specific journals including; The International Journal of Business Intelligence Research (IJBIR), Institute of Electrical and Electronic Engineers proceedings (IEEE), and the European Conference on Information Systems proceedings (ECIS). Overall, the researcher established an ultimate list of (65) papers that match our search requirements (AL-Eisawi and Lycett, 2012).

2.6.2 Involving Study Papers, Data extraction, and Synthesis

The process of including and excluding gathered studies is a crucial step in the methods, as it provides and assures a strong backbone to generating a quality based literature review. All published studies that answer the author's research questions and are published within the years 2009–2019 were integrated with the inclusion list. Moreover, the included research study must be published in conference proceedings or journal paper, to ensure that all references included will be recorded in a fully organised structure

RefWorks system (www.refworks.com) was used to document reference information and details for each study. Data were synthesised through classifying themes derived from the findings and results documented in each accepted paper. The categorised themes consequently revealed the creation of the categories and segments for the results section. Also, conducted a type of analysis called sensitivity analysis; it is a technique for assessing the riskiness of a certain investment. For the given research purposes, the sensitivity analysis was used to test how certain factors affected the field of BI Research. Key factors analysed were based on year of publication, type of study, and finally based on which Journal or conferences are preceding these papers were published. The sensitivity analyses gave us a clear idea and explicit information on where to find partial and biased data. The sensitivity analysis is also reported in the results section (AL-Eisawi and Lycett, 2012).

2.6.3 Categories of study papers

From the 65 studies, 47% were found to be theoretical or conceptual, and 37% empirical. A small number of studies (16%) presented literature reviews. Empirical and literature review related to BI was less found within the pool of BI research, most of the studies were either conceptual or theoretical.

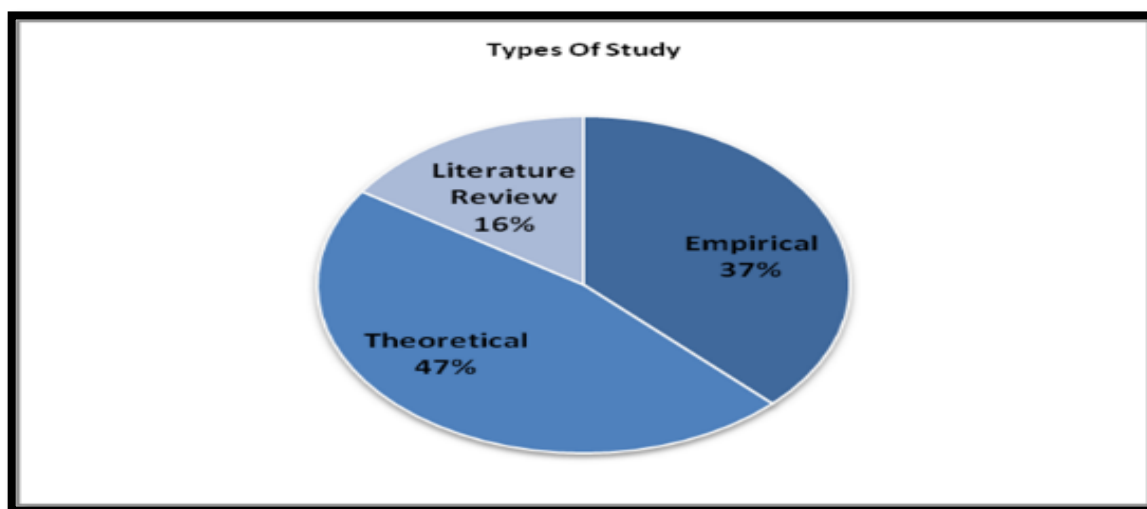


Fig 2.7 : Types of study papers

As for the data collection methods used in the case studies and empirical studies, they were primarily questionnaires/surveys, interviews by telephone or face-to-face interviews, field studies, and 46 % of the empirical research papers used questionnaires and surveys.

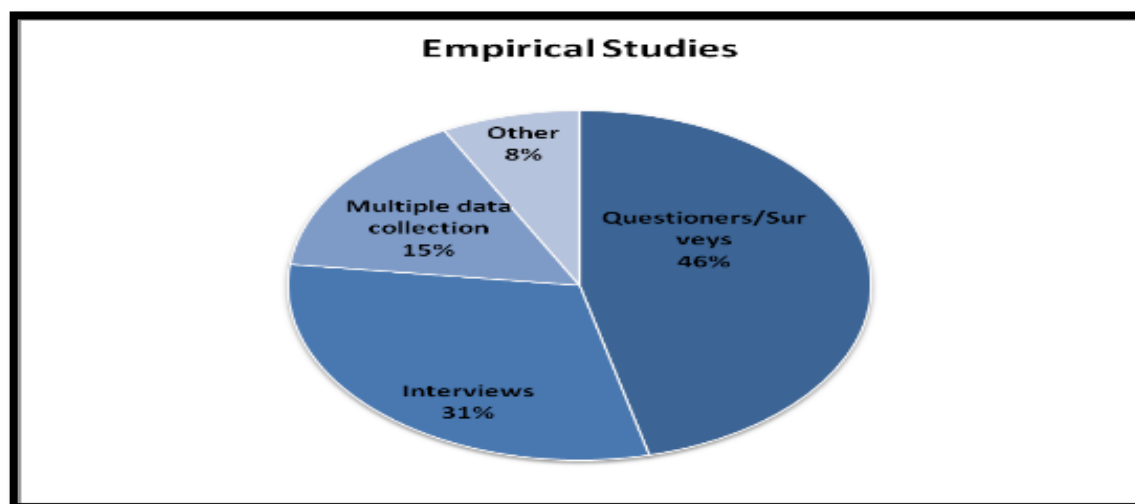


Fig 2.8: Research methods used in empirical studies.

2.6.4 Chronological View of Publications

Analysis for studies engaged in the review based on an almost ten-year period was performed, it showed that within the years there is an observed rise in published papers related to BI implementation in organisations and its effects on decision making. It was also noticed that before the year 2009, studies on BI were almost not present. The observed increase in BI research is in-line with emergent and increasing organisational awareness of the significant role of BI (and spends on technology). Alternatively, this increase might perhaps just counterpart a common rise in recently published papers in IS and Decision Support Systems (Fitriana, 2011).

2.6.5 Literature Findings

This part of the research illustrates how the literature provides answers to the literature review research questions mentioned above. The current research questions act jointly to provide an absolute explanation of the research focus. Information relating BI definitions was collected for (Q1) to expand the understanding of traditional definitions, and extract key managerial aspects embedded within those definitions. Papers were then analysed to provide a more detailed understanding of BI about those (addressing Q2).

- **The Core Aspects of Business Intelligence**

Definitions within the analysed papers recognised as answering Q1, these papers emphasised, or had a direct relation to a certain attribute, which relates to ‘definitions’ of BI such as Decision Making, Business Performance Management (BPM), Data Management, Knowledge Management, and finally better organisational relations. A closer assessment noticed from analysing a set of definitions resulted in proposing that when defining BI, it is always linked with any of the linked aspects as follows:

- BI definition can contain a direct link with knowledge creation and knowledge management, which can support the potential proposed association between ACAP and BI in the context of the current research.
- BI definition can contain a direct link with BI role in Decision Making (DM) is defined as the process that assists managers in choosing a course of action. Decisions can be categorised as structured or unstructured; they also can be classified according to managerial levels such as strategic decisions and tactical.
- BI definition can contain a direct link with BI role in business performance management (BPM). BPM is a key business initiative that enables companies to align strategic and operational objectives with business activities to fully manage performance through better-informed decision-making and action (Shi and Lu, 2010).
- BI definition can contain a direct link with BI role in Data Management and control. Data management and control refer here to how BI can assist an organisation in controlling a large amount of data generated daily, monthly, or annually (Zheng, Wu and Chen, 2018).
- BI definition found to have a weaker direct relation contained by its definitions with aspects such as business knowledge, and effective organisational relationships. However, these two aspects might be required as very important facets, which are indirectly affected by BI, and the benefit of BI on them is required to be as an intangible benefit sometimes impossible to enumerate. They are however significant, and often hidden sources of business value.

The bellow table 2.2 gives a clear indication of the most relevant BI definitions;

Review of BI Traditional Definitions							
Author	Year	BI Explanation	Direct relation in the definition				
			DM	BPM	Data control	Management	Knowledge Management
(Ahmad, 2015)	2015	<i>"(BI) is a set of products, which are sets of tools and technologies designed to extract useful information from oceans of data efficiently."</i>	No	No	Yes	No	Yes
(Loon, 2019)	2019	<i>"BI is a term that encompasses a broad range of analytical software and solutions for gathering, consolidating, analysing and providing access to information in a way that is supposed to let an enterprise's users make better business decisions"</i>	Yes	No	Yes	No	No
(Wang and Byrd, 2017)	2017	<i>"The concept of Business Intelligence (BI) is brought up by Gartner Group since 1996. It is defined as the application of a set of methodologies and technologies, that improve enterprise operation effectiveness, support management/decision to achieve competitive advantages."</i>	Yes	Yes	No	No	No
(Grèzes, 2015)	2015	<i>"Business intelligence systems are interactive computer-based structures and subsystems intended to help decision makers use communication technologies, data, documents, knowledge, and analytical models to identify and solve problems. The new generation of BIS offers the potential for significantly improving"</i>	Yes	Yes	No	No	Yes

		<i>operational and strategic performance for organisations of various sizes and types".</i>						
(Liang &Liu, 2018)	2018	<i>"BI refers to a broad category of applications and technologies for gathering, storing, analysing, and providing access to data that helps the decision-making process."</i>	Yes	No	Yes	No	No	
(Watson, 2009)	2009	<i>"BI is a system that supports activities such as data analysis, managerial decision making, and business-performance measurement".</i>	Yes	Yes	Yes	No	No	
(Wixom and Watson, 2010)	2010	<i>"Business intelligence (BI) is an umbrella term that is commonly used to describe the technologies, applications, and processes for gathering, storing, accessing, and analysing data to help users make better decisions."</i>	Yes	No	Yes	No	No	
(Foley and Guillemette, 2010)	2010	<i>"A combination of processes, politics, culture, and technologies for gathering manipulating, storing, and analysing the data collected from internal and external sources to communicate information, create knowledge and inform decision making. BI helps report business performance, uncover new business opportunities and make better business decisions ".</i>	Yes	Yes	Yes	No	Yes	
(Patrick; Christian; Christian; Peter and Martin, 2010)	2010	<i>"Business Intelligence (BI) a concept provides a means to obtain crucial information to improve the decision-making process."</i>	Yes	No	No	NO	NO	
Hill, Ariyachandra and Frolick, 2011)	2011	<i>"(BI) is seen as the ultimate solution that will help organisations leverage information to make an informed, intelligent business decisions."</i>	Yes	No	Yes	No	No	
(Glancy and Yadav, 2011)	2011	<i>"Business intelligence (BI) a system that provides relevant competitive intelligence, combine it with a business</i>	Yes	Yes	Yes	No	Yes	

		<i>'internal information, provide expert information, incorporate advanced analytical decision techniques, and can inform the executive of the relevance of the knowledge created from the system.'</i>						
(Mashingaidze and Backhouse, 2011)	2017	<i>"BI is a data-driven decision support system (DSS) that combines data gathering, data storage, and knowledge management with analysis in the interests of better managerial decision making."</i>	Yes	No	Yes	No	Yes	

Table 2.2: Key BI definitions.

The current section aimed at delivering an initial level of transparency by presenting and scrutinising the results from analysing several definitions available in the literature of the BI concept, as in table 2.2, it was looked at a sample of (12) different definitions. The content of column (direct relation of BI) denotes the significant attributes proposed from the authors understanding of BI definitions, and that can present a direct relation as a role or effect on specific managerial and organisational aspects. Moreover, revealing these relations will have an impact on assisting the author in finding answers for Q2. A number of these definitions were stated in the article, whereas others were implicit in the text. Since the current review is concept-centric explicitly, the researcher of the current research performed a qualitative content analysis on the collected sample that answers Q2; the content analysis is explained as in the following definition; "A research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns" (Zhang and Wildemuth, 2009). The content analysis of the definitions revealed that it was not comprehensible if BI is required to be a 'Process' or a 'Product', the "*process is composed of methods that organisations use to create useful information or intelligence that will support companies and organisations succeed and have a competitive advantage in the global economy*" (Jordan, Rainer& Marshall, 2008). And a "*product is information that will permit organisations to forecast and expect the performance and behaviours of their competitors, suppliers, customers, technologies, acquisitions, markets, products and service* (Zheng, Wu and Chen, 2018). As for other indicated that BI could be both a process and a product. Only

two definitions out of the (12) pointed to a direct relation between BI role with all the three roles defined previously by the author, within the definitions almost 90% of definitions mentioned a direct relation between BI and DM, and few had a relation with data management, BPM, both, or all three attributes. Since most of the study papers were collected for this research found to be theoretically based, it was noticed that few of the given definition extracted from an empirical and observed practice. Therefore, this will lead to an interruption in the understanding of what BI characterises to business leaders and researchers. Finally, it was not clear if BI is required to be a technological or managerial concept, or it can be both. As a result, applying a content analysis on the collected definitions recognised a main and general concern as follows; "BI did not yet reach a standardised and unified definition." Another synthesis to answer Q2 was undertaken; the synthesis shows that 55% of papers illustrate a role of BI in (DM), 22 % Role on BI in Data Management and Control, and 23% are related to (BPM), and these statistics are more explained as follows:

- **(BI and Decision Making):** most of the papers searched agreed that BI has a direct effect on DM; according to literature, BI has to turn out to be a vital aspect of decision-making, not only at the top but at each particular hierarchical level. That is the reason behind the needs for it to be associated with the business and organisational strategy to be capable of supporting analytical decision-making. Nevertheless, this relation is turning to be as a known fact rather than just a proposition since it has been researched and proven in a large number of study papers (Loon, 2019).
- **(BI and Business Performance Management (BPM)):** as defined earlier BPM "is a key business initiative that enables companies to align strategic and operational objectives with business activities to fully manage performance through better-informed decision making and action"(Mashingaidze and Backhouse, 2017). According to the synthesised literature, BPM will start within the coming future to be as the last constituent of BI systems, and the following stage in the growth of BI, organisation, and information systems. If BPM is a consequence of BI and better decision-making and contains many of its technologies, tools, and techniques, then BI itself can play as a key role and deliver the insight needed to improve overall business

performance. The authors from a theoretical viewpoint and sensible perspective hypothesised this.

- **(BI and Data Management)** Management and control refer here to how BI can assist the organisation in controlling a large amount of data generated daily, monthly or annually. This effect was related in most papers to the use of Data Warehouse technology that can assist the transformation of organisational, operational data system into an analytical data system construction, and that can sustain business requirements and needs. Thus, this formation enables the business executive to attain a chronological view of operational data, moreover, eliminating the load on organisational information technology assets and enabling managers to create positive decisions instead of unconsidered ones (Ahmad, 2015).

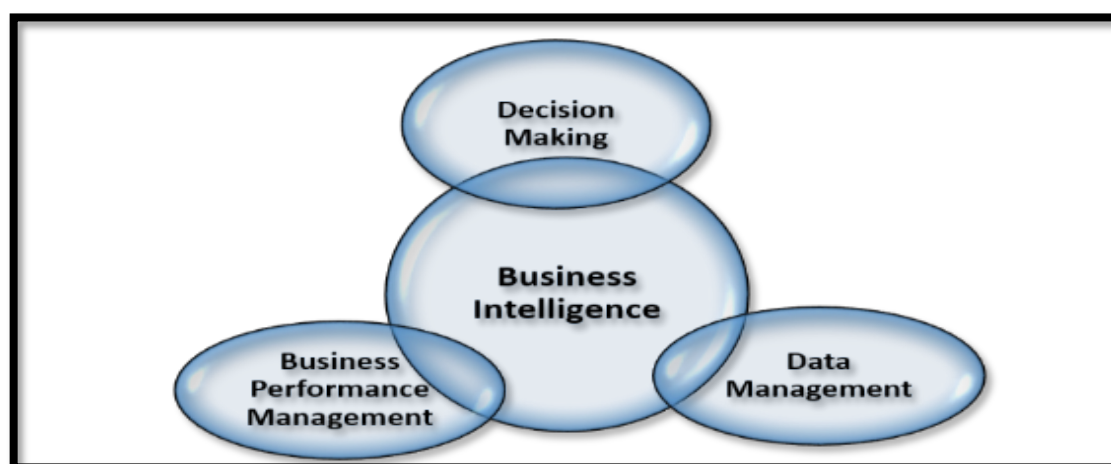


Fig 2.9: findings /cohesive effects of BI on organisational efficiency.

As a conclusion for answering Q2: "Decision Making," "Business Performance Management," and "Data Management" are interrelated and cohesive managerial and key organisational aspects that can be affected when applying and implementing BI within organisations like the above figure 2.9.

2.7 Theoretical Association ACAP – BI Systems

This section critically reviews the two interconnecting fields of study that are essential for this research: BI systems, and ACAP. The discussion of the association is originated from investigating available prior research on both concepts and critically analysing them. The goal of generating this association is to: (1) identify an existing theoretical lens for the

association of BI and ACAP, (2) define key technical and managerial relations between both ACAP and BI.

The current research is oriented towards acquiring and processing data, information, and knowledge in technological means supported by the use of BI systems. Consequently, the proposition is that BI systems provide a key means of input and data information facilitation, therefore the capability to absorb and acquire the given input and transform, assimilate it into the unified required output as a sequence of refined knowledge, better organisational performance, better decision making and eventually financial profit. In reviewing the literature, it was established that very limited research that seeks to create a connection between ACAP and systems efficiency. The influential research that provided a concentration on this connection includes Elbashir, Collier, and Sutton (2011), and Robert et al., (2012). The former authors examined the role of organisational ACAP in the strategic use of BI to support integrated management control systems. The work proposes that for organisational ACAP or as they stress, the capability to collect, absorb and strategically control new information coming from external sources, it is vital to create a proper technological set-up and to integrate BI systems for achieving benefits and performance. Additional outcomes demonstrate issues related to managerial hierarchy; for instance, they proposed that top management plays an indirect but critical role in effectively positioning BI systems. However, a connection between ACAP and Information Systems (IS) research but not directly to BI appeared in a revision by (Robert et al., 2012), the main driver of the study was to refine the current understanding of ACAP and to direct its operative practice in IS studies. They reviewed this construct by tracing the evolution of ACAP literature in organisations observing issues linked to its conceptualisation effects and organisational learning.

Moreover, they examined how ACAP has been measured, theorised, and then utilised in the IS research field. Consequently, they proposed a framework aimed at researches that links ACAP to IS and Information technology (IT) as presented in Figure 2.10. The findings resulted in analysing the proposed connection of ACAP with IS and IT disclosed the following; (1) ACAP is incoherently theorised as a capability and asset, (2) ACAP is examined at several stages of analysis, and finally (3) ACAP IS utilized and employed in numerous ways (Robert et al., 2012).

Generating ACAP (The ACAP-BI model) in this review looks into BI as basically a generator of ACAP. The model accomplished presents BI systems as being technological and systematic facilitators of ACAP. The research suggests that ACAP when recognised in organisations, can act positively to effect BI systems, In other words, ACAP is treated as being the conceptual form of BI, while BI is considered to be the technical facilitator of ACAP. Extracting this relationship between ACAP and BI originated from realising several similarities amongst the two constructs while undertaking the literature review of both concepts. The current research analysed potential critical theoretical connection discussed in the following;

- Both ACAP dimensions acquisition and BI systems explained as a means of receiving data, and or information as inputs. Extract, Transform, Load (ETL) processes in BI systems are proposed to be the technical drive of the ACAP dimensions. As in Fig 2.10 BI systems ETL processes Extract, Transform, Load are processed within the data warehouse that encompasses extracting data from external sources, transforming the extracted data so that it will be adequate for business requirements, and finally loading data into the data warehouse. The expression ETL references any process related to loading database. The term ETL was clearly defined by (Foley and Guillemette, 2010) as: *“A process and a tool that retrieve data from one database (extract), convert it so that it is readable in another (transform), and then write it into the target database (load). The term is normally used in BI during the data integration phase.”*

The first function of the ETL process is to extract the data from the source systems; each distinct system in the organisation may use a different data format or structure. Common data sources format are relational database structures. The second function is the transform; in the transform phase groups of rules are applied to the extracted data to derive data from being loaded. Finally, the load function loads data into the data warehouse, according to the requirement of the organisation; this process might differ widely. In many of the literature on ETL, most researchers agreed that ETL processes could be quite complex, and important operational problems can appear with inappropriately designed ETL. Both ACAP dimension Assimilation and BI systems are explained as a means of generating

'knowledge' as output. BI technical processes that are engaged in processing knowledge are supported by the use of Data Marts that are a subset or a specialised version of the data warehouse. The only difference that it contains a subset of the data for a single aspect of the company's business that stores all enterprise data in one database (Xu, Zeng, Shi, He&wang, 2007). Online Analytical Processing (OLAP) is sets of front-end analysing approaches to quickly providing answers to analytical queries that are multi-dimensional (Che, Huang and Tseng, 2009). OLAP is technical processing technologies used in BI systems and can be enhanced by the ACAP element assimilation.

- Both ACAP dimensions and BI systems follow a systematic set of actions for processing their inputs. Which can interpret the main purpose of applying BI is to turn operational data into significance knowledge, which means that BI must be coupled with organisational data to be effective. The challenge is to place all the necessary data in one place and one common format. Scheps (2007) argued that data warehouse is the perfect architecture to meet all data challenges faced by organisations. There are vital variances between a traditional database system and a data warehouse system. However, and to a certain level, all databases are designed to assist in a basic managerial purpose, e.g., to deliver a quick response to transactional data processes such as entry, update, query, and retrieval. Enterprises have progressively implemented data warehousing as the backbone technology for BI reporting and query performance (Lin, Hong, and Lee, 2009).
- Both ACAP dimension exploitation and transformation and BI's system broad-spectrum objective is to generate strategic value and better performance. By enhancing the use of exploitation dimension of ACAP and relating it to the strategic value derived by BI systems.
- Both ACAP four dimensions and BI systems are required to be vital aspects in a modern, efficient, successful organisation.

To reflect the current research proposition, an illustration of the subsequent model in figure 2.10 presented in the following page.

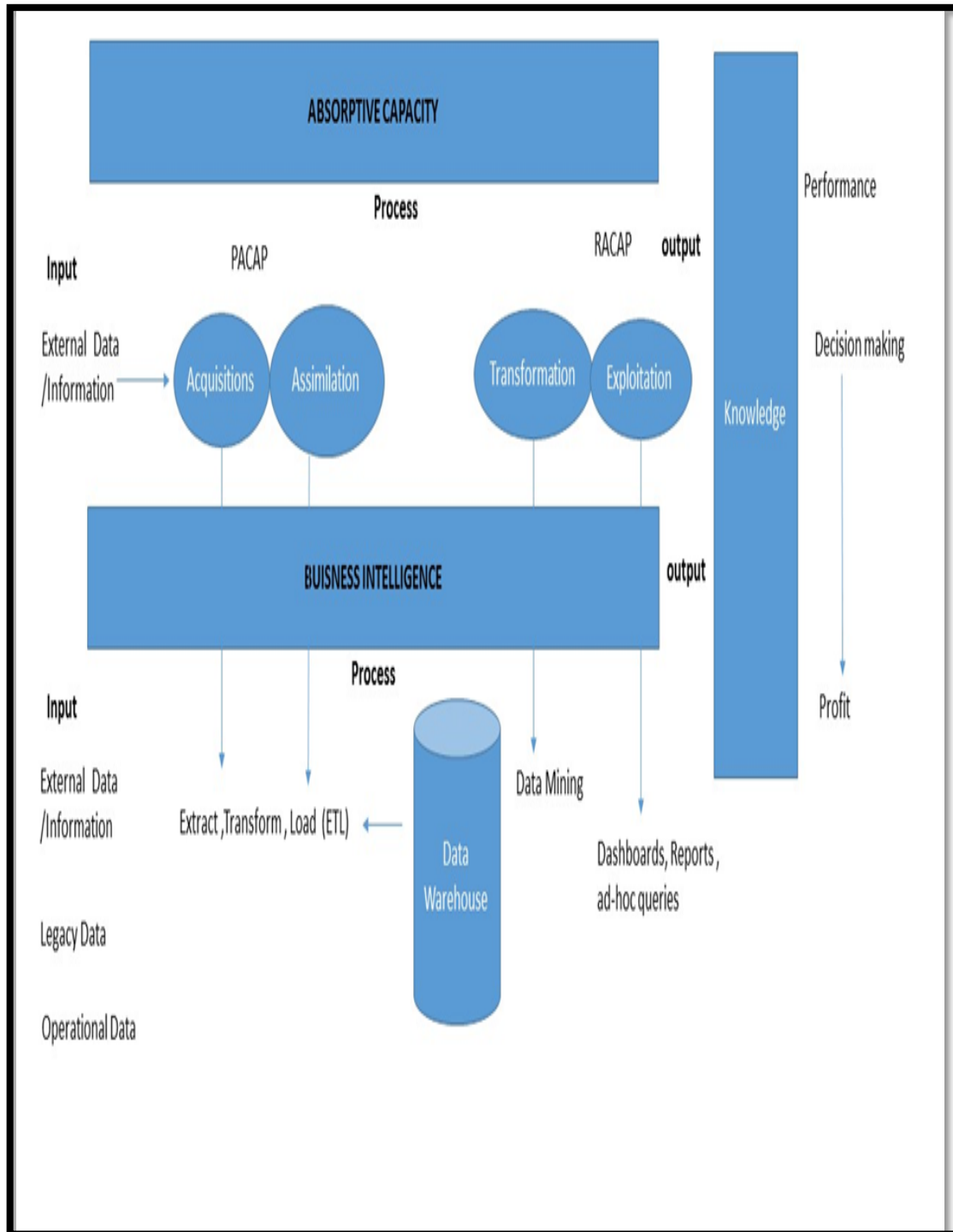


Fig 2.10: Theoretical connection extracted from literature review process

The model presents as exploration that illustrates the key proposed relation between the two facets of ACAP and BI systems given the main dimensions and components of both, and building on the extracted similarities extracted above.

2.8 Research Direction

In the current research, the literature on both ACAP and BI was reviewed with an emphasis to acquire a general overview of the concept of ACAP, and extract preliminary relation between the two facets. The literature findings directed the current study towards treating ACAP as a capability engaged with the company's higher levels of strategies, procedures, and departmental routines. While the researcher decided to analyse the organisational role of ACAP on BI systems by examining ACAP natural perspective in the organisation. To a certain extent, the researcher of the current study is not very familiar with some parts of significant literature on ACAP, and that is why the concept was not engaged within the conducted review process. Naturally, this is done deliberately in an attempt to add a more genuine future proposed contribution to the field of ACAP and to extract grounded results rather than allowing the literature review to surpass the process of extraction. The goal was to permit this full understating to be revealed while conducting the pragmatic part of the research. In doing this, a vital part of the study will be enlightened, as this explanation is required to be the crux of the research outcomes. The research direction resulting from reviewing the literature review will be oriented towards extracting the grounded categories for ACAP that found to be absent while analysing previous ACAP models, and later examine the measures and their relations with BI systems efficiency.

2.9 Summary

The chapter presented a global review of BI and ACAP concepts, definition, and available models according to previous analysis of the current literature aiming to draw a logical and rational link between both perceptions in the subsequent sections of the study. The ACAP concept was not engaged in the review proposes due to finding the concept as an uncommon organisational concept and need to be reviewed in a different direction that is more likely to be more empirically grounded. An inclusive understanding of effects and roles derived from a state of the art literature review was derived for the concept of BI and its organisational effects. Thus, the chapter presented clear face validity to understanding the managerial facets of BI and ACAP available in previous literature. The chapter introduced the theoretical provision for being able to construct the BI-ACAP link by

proposing the notional theoretical linkage extracted from the literature. Within the BI literature review process analysis, it was observed that there is a noticed increase in BI published research, and this increase might be an indication of the emergent organisational awareness of the significant role of BI and information technologies. The review process investigated that the empirical and case studies related to BI systems were scarcely obtainable within the pool of BI research; most of the studies were either conceptual or theoretical rather than practical.

CHAPTER 3: THE PROPOSED THEORETICAL FRAMEWORK

3.1 Introduction

The overall purpose of the chapter is to build a theoretical framework that can serve as a blueprint in which supports the process of defining the main research constructs, the choice of the appropriate research methodologies that will be utilised, and later generating research findings and results that are meaningful and generalizable. A theoretical framework is defined by Lovitts (2005) as the visual representation of the explanatory theory, and the hypothesised relationship between the main constructs that guide the research; it is a non-statistical diagram, as it is required to be more comprehensive (Lovitts, 2005).

The chapter is initiated by explaining the process of integrating the theoretical framework; the integration part presents a graphical exemplification of the proposed structure. Later, in sections 3.3 and 3.4 presents an explanation of the main two phases of the theoretical model; the first phase is the interpretive framework for measuring ACAP, then phase two explained the sequential framework that included the research hypothesis and dependent and independent variables of the sequential framework.

3.2 Integrating the Theoretical Framework

It was imperative that all four constructs of the study to be tightly associated, also to be interconnected so that the framework can serve as a foundation being able to guide the choice of the research design and data analysis described in chapter four. It was also essential to integrate a conceptual framework that can visualise the research variables given the following vital reasons that are influenced by Lovitts (2005),

1. The need to identify the critical phenomena of the research.
2. The need to identify concepts to structure the research core elements.
3. The need to develop a set of research hypothesis.

4. The need to interpret research results.

The theoretical framework is perceived to direct the research methods and the choice of methodology that should provide assumptions compatible with the proposed framework. The current research required building a theoretical framework that can serve as a blueprint for the entire research due to its role in assisting as a guide that the researcher will build on, and support all aspects of the study. Moreover, the theoretical framework provided a structuring for how to methodologically and analytically define the approach of the study as a whole. Consequently, the use of a theoretical framework played an essential role in guiding the entire process of the research study. Theories were constructed to explain, predict, and master the main study phenomena. Later, relationships, events, and effects behaviour were also extracted upon the initial theory development (Lovitts, 2005).

The proposed framework involves one dominant construct that is Absorptive Capacity, and other subsequent constructs, which are BI systems efficiency, and organisational efficiency. In the context of the current study, the constructs are defined as in the below table 3.1.

Organisational Construct	Definition In the Context of the current study
Absorptive Capacity	A dynamic organisational capability that assists the organisation in acquiring, assimilating, transforming, and exploit knowledge from different internally, and externally resources.
Business Intelligence System Efficiency	The ability of BI systems adopted inside organisations to be successfully integrated, reflecting better managerial and organisational performance.
Organisational Efficiency	The ability of organisations of reflecting a successful organisational culture influenced and affected by the existence of efficient data-driven processing systems.

Table 3.1: Constructs definitions for the current study

While Looking at the proposed theoretical model presented in fig 3.1, it indicates that two key blocks build the framework; the initial upper block referred to the first part of the framework that follows an interpretive approach for investigating ACAP construct.

Consequently, extracting key organisational measures of ACAP. The second block of the framework is required to be a sequential framework as it contains both dependent and independent variables, and also hypothesis for proposing relations amongst the constructs ACAP and BI systems efficiency. In total, the framework built around three main organisational constructs defined in the bellow figure 3.1 in line with the context of the research concentration.

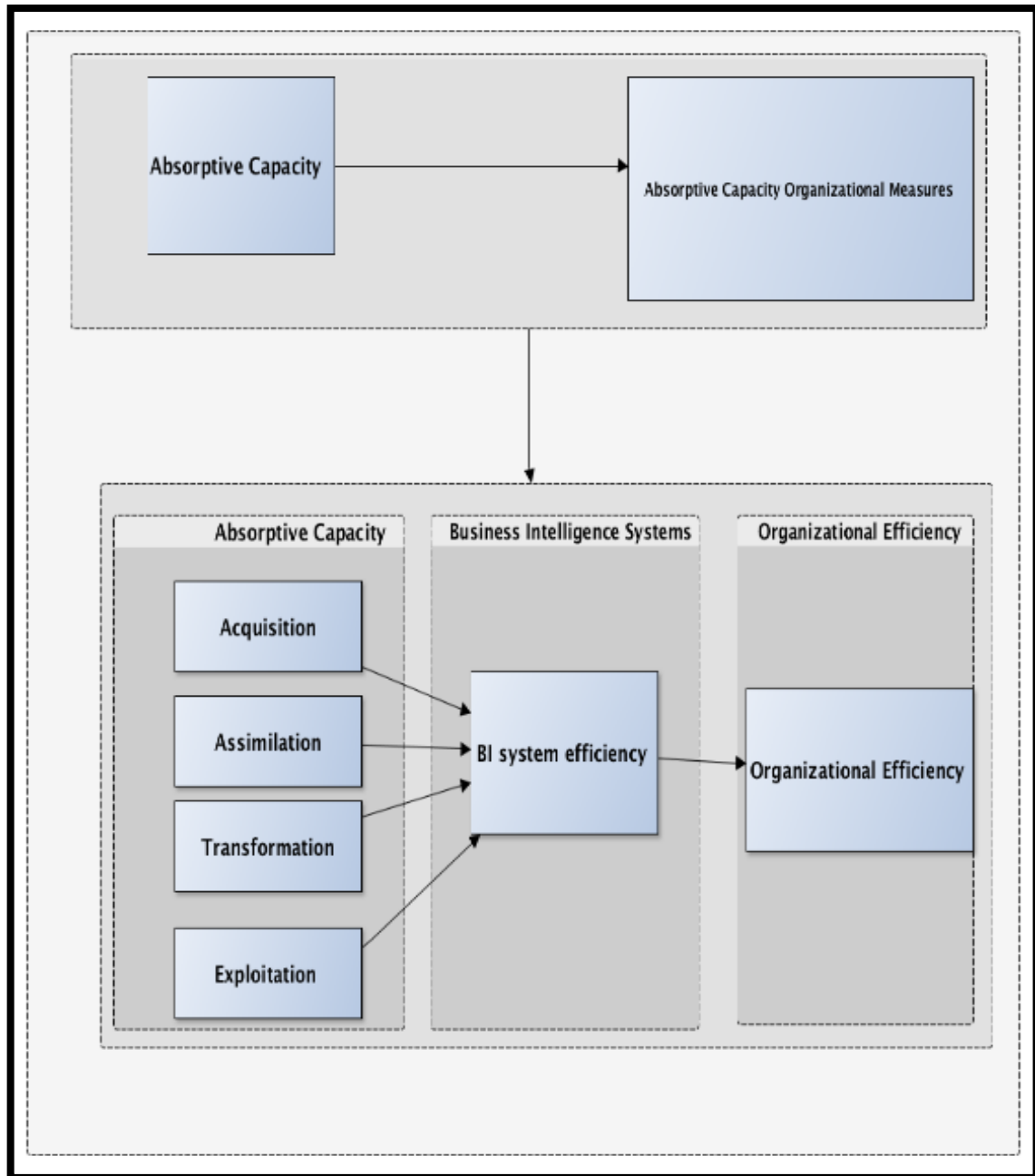


Fig 3.1 : Propsoed theoretical framework for the current research

3.3 Phase 1: The Interpretive proposed Framework: Measuring Absorptive Capacity

The initial part of the framework illustrated in the upper block of the model is required to be an interpretive framework. An interpretive framework is defined by Huff (2009) as a “*Sociological research approach that seeks an in-depth understanding of a topic or subject through observation or interaction*”. For the current research, the main intention was to understand the subject of ACAP and observe the interaction amongst its four dimensions: acquisition, assimilation, transformations, and exploitation. Consequently, extracting categories for each of these dimensions and presenting them as a relational model. This interpretive approach for understanding ACAP is not based on any hypothesis.

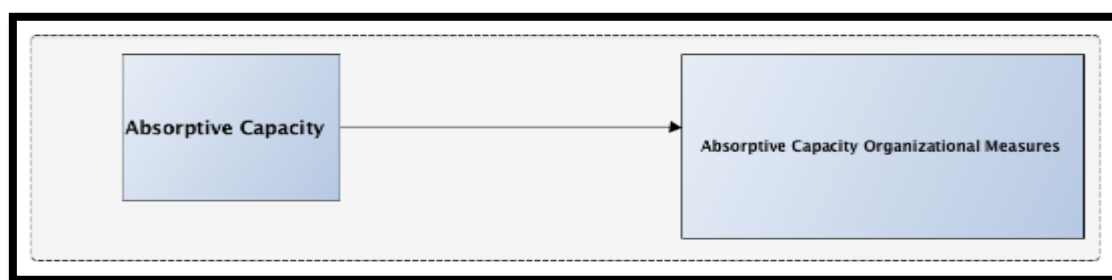


Fig 3.2: The interpretive proposed framework of the current research

The role of the model is setting the theoretical framework to direct the process of investigating and understanding the construct of ACAP. The proposed extracted categories of ACAP will serve as input to the second block of the framework as presented in fig 3.2.

3.3.1 Absorptive Capacity Construct and Dimensions

Drawing on the literature review, ACAP was defined as the ability of organisations to assimilate, transform, and exploit knowledge and apply it to commercial ends. Moreover, the study relies on the adopted model of Zahra and George (2012) to determine the ACAP key four dimensions acquisition, assimilation, transformation, and exploitation. The goal here is to extract measures for each of the four dimensions of ACAP that can operate as organisational knowledge creation measures. Section 3.3.1 stated that the research would build on the Zahra and George (2012) model to determine the ACAP vital four

dimensions: acquisition, assimilation, transformation, and exploitation. Dimensions of ACAP are defined as a 'distinct but complementary capabilities that compose a firm's ACAP. By looking into the dimensions, it is understood that they represent a set of capabilities or potentials that a particular organisation may acquire and exploit to serve its knowledge creation process. Consequently, these dimensions will serve as building blocks to direct the process of investigating the organisational construct measures. The categories relate to each dimension of the ACAP dimension will test how they will affect the efficiency of the business intelligence systems in the telecommunication companies engaged in the study, later proposing a positive effect on the overall organisational efficiency.

3.4 Phase 2: The Sequential Proposed Framework: Potential Effects of ACAP on BI systems

The theoretical framework presented in the second block shown in fig 3.3 is based on a sequential proposition in which it includes a set hypothesis that suggests casual effects between two construct that is likely to be a positive effect of ACAP dimensions on BI system efficiency. The present study proposes that the existence of ACAP within organisations a significant means of input and data information facilitation, therefore the capability to absorb and acquire the given input and transform, assimilate it into the unified required output as a sequence of refined knowledge, resulting in an improved business intelligence systems efficiency. Eventually, attaining better overall organisational efficiency. The theoretical framework in fig 3.3 proposes a set of hypothesis for the potential positive relation between ACAP dimensions and BI systems efficiency. Moreover, another hypothesis suggesting a positive association between BI systems and organisational efficiency.

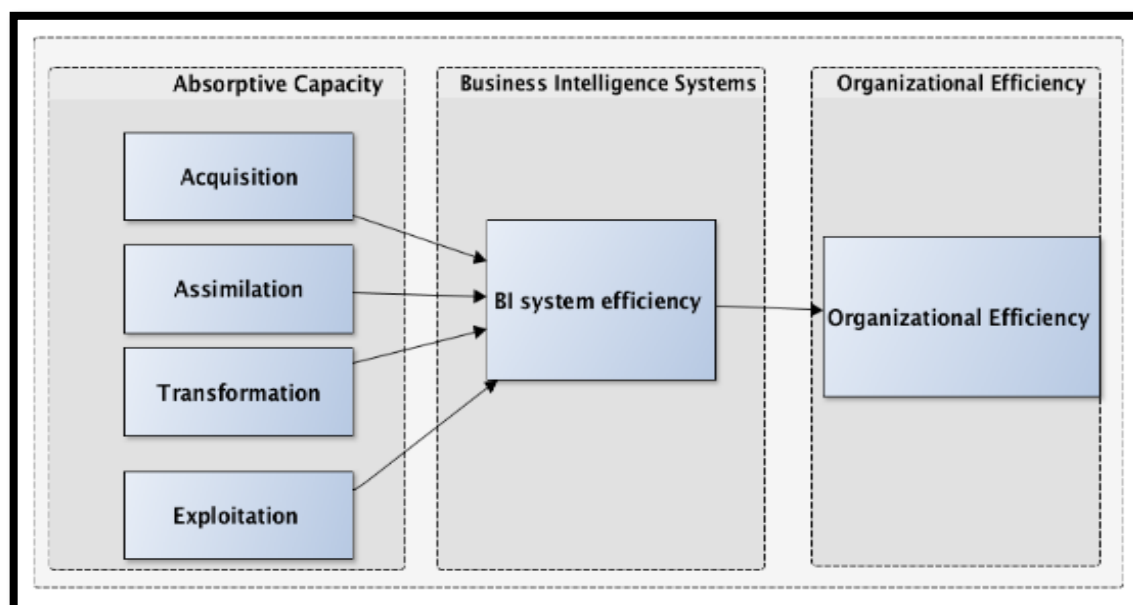


Fig 3.3: The sequential theoretical framework.

3.4.1 Independent Variable: Absorptive Capacity Categories

ACAP in the sequential model is required to be an independent variable; the model will rely on the proposed extracted measures of ACAP to test their effects on BI systems efficiency. Taking into account the four main dimensions of ACAP, and the proposed extracted categories for each dimension. Each set of categories for the dimensions will act as inputs to the sequential model.

3.4.2 Dependent Variables: Business Intelligence Systems Efficiency

BI systems are treated in the proposed framework as a dependent variable that relies on ACAP dimensions to work effectively within organisations. BI systems are described in the context of the current research following the considerations of Olaru (2014), and Elbashir et al. (2008). The measurement focuses and examines if BI systems efficiency can enhance benefits related to the perspective of the system in improving adequate data collection from different systems resources using BI technical tools. Moreover, developing internal and external communication with partners, suppliers, and departments. Other measurements focused on testing BI systems efficiency in enhancing the processing of data in timely and efficient manners, referring to data management extracted from an in-depth review process. Finally, measures are related to examining the

output of BI systems in producing decision-making processes, and finally providing enhanced products in marketing and creation, leading to effective organisational performance.

3.4.3 Dependent Variable: Organisational Efficiency

A clear theoretical link appeared in the influential work of Chen et al. (2004) appealing a possible direct linkage between BI systems efficiency and organisational efficiency; their work concentrated on creating organisational schemes based on successful data processing systems assimilation and their positive effects. It was revealed that the potential key objective of having BI system inside the organisation is its ability to offer information to strategic managers to enable them to generate faster pace of decisions making process leading to organisational performance and more efficient data management environment. The mentioned propositions are in line with extracted results from the current study detailed literature review that resulted in extracting main effects of BI systems on organisational efficiency from their main perspective inclusion data management, organisational performance and finally decisions making. Conversely, researchers such as Bergeron et al. (2004) disclosed that low-performing organisations are more likely to face inconsistent situations in their management and organisational efficiency, as a result of having poor assimilated BI systems, this might refer to not having ACAP measures available within their organisational environment in the context of the current research focus. This is one of the key propositions of current research.

3.4.4 Proposed Relation between ACAP and BI systems

In reviewing the literature, a motivating effort uncovered a concentration on creating a relation between the two concepts includes the effort of Elbashir, Collier, and Sutton (2011), and Robert et al., (2012). The former authors examined the role of organisational ACAP in the strategic use of BI to support integrated management control systems. The work proposes that for organisational ACAP or, as they stress, the capability to collect, absorb and strategically control new information coming from external sources, it is vital to create a proper technological set-up and to integrate BI systems for achieving benefits and performance. Additional outcomes demonstrate issues related to managerial hierarchy; for instance, they proposed that top management plays an indirect but critical role in

effectively positioning BI systems. The current research builds on the above, and proposes four hypotheses that support the relation between ACAP and BI systems efficiency as below:

1. **Hypothesis H1:** There is a positive relation between the acquisition dimension of ACAP and BI systems efficiency.
2. **Hypothesis H2:** There is a positive relation between assimilation dimension of ACAP and BI systems efficiency.
3. **Hypothesis H3:** There is a positive relation between transformation dimension of ACAP and BI systems efficiency.
4. **Hypothesis H4:** There is a positive relation between exploitation dimension of ACAP and BI systems efficiency.

A connection between ACAP and Information Systems (IS) research but not directly to BI appeared in a revision by (Robert et al., 2012), the primary driver of the study was to refine the current understanding of ACAP and directing its effective practice in IS studies. They reviewed this construct by tracing the evolution of ACAP literature in organisations observing issues linked to its conceptualisation effects and organisational learning. Moreover, they examined how ACAP has been measured, theorised, and then utilised in the IS research field. Consequently, they proposed a framework aimed at researches that links ACAP to IS and Information technology. The findings resulted in analysing the proposed connection of ACAP with IS and IT disclosed the following; (1) ACAP is incoherently theorized as a capability and asset (2) ACAP is examined at several stages of analysis, and finally (3) utilized and employed in numerous ways (Robert et al., 2012). Also, another challenge that might be enhanced with ACAP is the sheer volume of data could be a prescription for trouble for any industry dealing with a large amount of data (Nicoli, 2007). There are several methods available for controlling, integrating and organising data and data assets. However, many situations are too complex or require flexibility more than some traditional operational options allow (Pareek, 2007). Enterprise wants to rationalise the complex data-driven environment by creating well-designed data architecture. However, there will always be challenges associated with achieving a BI oriented environment; these challenges are mainly engaged with factors such as data, technology, process, users, strategy and finally cultural challenges (Bogza, Zaharie 2008). Challenges can be more explained as follows: there will always be challenges associated

with achieving a BI oriented environment; these challenges are mainly engaged with factors such as data, technology, process, users, strategy and finally cultural challenges (Bogza, Zaharie 2008). Challenges are discussed as follows, and are proposed to be enhanced by applying ACAP dimensions within the modern organisations:

1. **Data challenges:** Data concerns are the most crucial among all challenges, as it is a costly element of BI employment. The problem here is mainly related to the large amount and distinct data sources that need a lot of time, effort, and cost to be collected from several places in the organisation, managed, unified into certain formats, and to finally make certain that data is used constantly and precisely across the organisation (Cvitaš, 2010).
2. **Technology challenges:** organisations have gathered within time complex types of various tools and technologies that are not well cohesive (Dayyani 2009). Therefore, this heterogeneity in technological infrastructure inside all departments in an organisation signifies a big technological challenge for BI to get a more flexible and unified balance to the organisation (Jiang et al. 2010).
3. **Process challenges:** As defined earlier in this section that BI is a process more than it can be a product or software. The challenge for BI processes here is to succeed in the adaption within the changing business requirements and incessantly changing demands of their clients.
4. **Strategy challenges:** The strategy challenge can be featured by the ability to have available a combination of information technology, business, and analytical tools and skills that generate reports able to respond to the changing strategies and business environments.
5. **User Challenge:** this challenge is greatly linked with decision making (Goh, Taniar 2008), and the role of BI in improving decision-making through the organisation. Moreover, accepting the different levels and everyone's information needs within the organisation, abilities, and goals is very important for the accomplishment of a BI implementation (Liang and Liu, 2018).
6. **Cultural Challenge:** BI should be able to add more understanding to the culture of the organisation. Thus, to influence it for its best benefit (Liang and Liu, 2018). The information incorporated from a variety of sources and accustomed to a

certain level of detail is necessary for the support of the decision-making process. Thus, adequate volumes of information turn out to be a key aspect of accomplishment in all fields of human being faction. Quantity and configuration of sources can transform within time, and the level of detail is important too. It is required from organisations to ensure initial rate information associated with reality, comprehensiveness, and on time delivery of data to clients and users (Sadegh and Banan, 2009). Consequently, and to achieve this demanding need, BI systems started to be implemented in organisations recently (Tvrdikova, 2007).

3.4.5 Proposed Association between BI systems Efficiency

And Organisational Efficiency

In the light of theoretical framework extracted from the literature review, the significant relationship between organisational culture and organisational efficiency, the effect of stable or variable organisational environment in internal and external context on the organisational culture and efficiency relations can be proposed for this research. Based on these propositions, it was hypothesised that:

Hypothesis H5: A positive relationship between BI systems efficiency and organisational efficiency exists in companies using BI systems.

The self-direction, stimulation and power values of the organisational founder or top leaders are the criteria shaping organisational culture as one of the elements, and its emerging effects can be diminished or empowered via the values mentioned. The other proposal for this study is the moderating effect of these values. Organisations effectiveness construct used a total of five measures presented in chapter six and extracted to test the construct. Measures relied on previous studies and literature. Furthermore, measures were slightly altered to fit the current study requirement. Organisations effectiveness is perceived to be improved by BI systems, according to Turban et al. (2007). Moreover, researchers revealed that the existence of BI within organisations could provide significant members of organisations such as employees, partners, and suppliers with relaxed access and acquisition to information, and the ability of practical data analysis and sharing. Consequently, this can reflect on organisational efficiency compared

with other competitors, also can increase profit and productivity. The current research intends to provide an empirical standpoint to assess theoretical build up.

3.5 Summary

The chapter illustrated the theoretical framework made of two main vital elements; the first element or what is referred as phase one; is the interpretive framework that proposes presenting ACAP as an organisational construct necessary for knowledge creation in organisations. Moreover, introducing ACAP as a critical constituent of the study that needs to be interpretively comprehended, as it is required to be relatively a different organisational control that needs to be understood and investigated. Consequently, the process of understanding ACAP is proposed to result in extracting categories that will serve as input to the sequential model presented in phase two of the sequential framework. The framework suggests that the extracted categories are expected to affect BI efficiency and overall organisational efficiency.

CHAPTER 4: METHODOLOGY AND RESEARCH METHODS

4.1 Introduction

This study, at its initial phases, intended to recognise and create a theoretical framework that can connect the role of ACAP in achieving organisational BI efficiency within the telecommunication industry as a case example. To reach the realisation of this standpoint and translate the proposed theoretical framework into the pragmatic framework, it was imperative to comprehensively and thoroughly review different forms of research methodologies and methods available.

The chapter is organised as the following; Section 4.2 is initiated by explaining the emergence of the main research methods and techniques utilised in the IS research cycle by revealing the importance of each of them. Section 4.3 presents the philosophical perception presented in the shape of philosophical framework describing rationalisation and motive behind choosing the research philosophy, strategy, and approach and time horizon of the research. Within the same section, the chapter also conducted a profound literature review on the qualitative research methodology, Grounded Theory and different school of GTM. The section seeks to reveal the roots, concepts, approaches, and diverse views of GTM. Later, the chapter also explained the quantitative method of SEM-PLS and the motive behind following it. Finally, section 4.4 presented the systematic research design, including key stages for qualitative and quantitative research, and how it will be conducted.

4.2 Information System Research Cycle

The Information Systems (IS) discipline is characterized as a very a diversified discipline that has been evolving considerably over the years (Vachon, et.al 2011), its straightforward and simple form can be described as a technological system that manipulates, stores, and disseminates symbols that are expected to have relevance and an impact on socially organized human behaviour. The goal of IS research is to create knowledge that facilitates the application of IT for both organisational and managerial

functions (Hevner and March 2003). IS investigators and researchers pursue two corresponding but separate patterns or paradigms, the behavioural science paradigm which sights IS as social science, while design science paradigm views it as a technological science. The behavioural science research paradigm concentrates on developing and mitigating assumption that clarifies and forecast observable facts related to the acquirement, implementation, management, and utilisation of such technologies. Moreover, behavioural science obtains technology as it is. The Design science research paradigm is targeted towards the production and the appraisal of ground-breaking IT artefacts that permits organisations to tackle significant information associated responsibilities. As a result, IS research must be treated as a sensible technology needed as an energetic approach in which IS research influencing people, organisations, and technology Crotty and Saunders (2007).

4.3 Research Methodology Framework

In building a methodological framework, the research philosophy, approach, strategy, choice, time, horizon, and data collections were all considered and carefully selected. It was one of the most challenging phases within the current research to recognise a reliable research methodology course and to decide on the best order and nature of the research stages. Confusion in research stages and design also came into view with Crotty and Saunders (2007); they categorised research into six stages and called the research onion model. The partitioning proposed by Saunders (2007) consists of philosophies, approaches, strategies, choices, time horizons, techniques and procedures. Alternatively, Crotty (2007) summarised them into only: epistemology; theoretical perspective; methodology; and methods. Furthermore, it has been frequently noted from analysing previous research studies that no single research methodology is intrinsically better than any other methodology (Bombast, 1987). A group of authors are still calling for a combination of research methods so that to advance the quality and excellence of research perfective and position (Kaplan and Duchene, 1988). Similarly, several associations have undertaken a constructive "house style" methodology (Galliers, 1991).

The figure in 4.2 demonstrated a framework that illustrates the interconnected nature of the key research stages that will be followed in the current research. The research

followed theories adopted from IS research and tracked the main research stages adopted from the onion model adapted from Saunders et al. (2007) determining the research philosophy, on the way to selecting grounded theory and structural equation modelling - partial least squares (SEM-PLS) as the research strategy. Ending with carefully choosing the optimum techniques and procedures of data collection and analysis. The theoretical view and strategies of inquiry combined are vital to direct the advanced level approach. Moreover, the research procedures offer a systematic input and contribution to the research design, unfolding the facts of the research procedure.

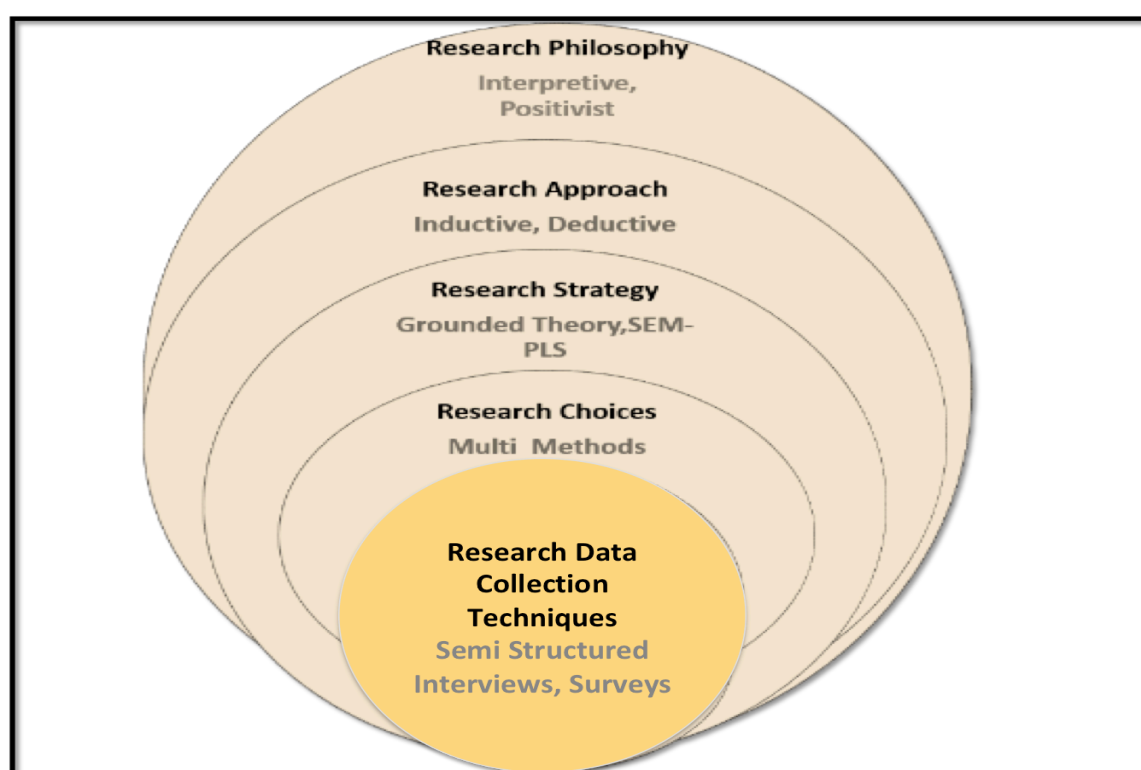


Fig 4.1: Research methodology framework for the current research.

4.3.1 Research Philosophy

The initial conceptual research methodological phase refers to the research philosophy. An interpretive, and positivist philosophies were chosen as the current research is entirely oriented towards understanding ACAP, and later connecting its understanding with BI systems efficiency and competencies that are mainly improved or affected by ACAP. The qualitative part of the research is an interpretive approach. The interpretive approach

directs the researcher to value the differences between humans and the explanation of their social function (Saunders et al., 2007). Nevertheless, features of positivist will also be included, incorporating quantitative methods and statistical breakdown, to advance the results of the research as a whole.



Fig 4.2: Research philosophy for the current research

The interpretive philosophy highlights the biased sense of reality that is constructed and reconstructed throughout a human and social communication process (Chen and Hirschheim, 2004). The two research philosophies are common in IS research and being followed by researchers; positivism and interpretive. Positivists believe that reality exists objectively and independently from human experiences (Orlikowski, 1993). Numerous debates have been initiated between positivists and interpretive on quite a few issues. Positivism sets out a systematic research design. Sometimes the difference is made when positivist's results can be modelled, while the phenomenologist's results cannot (Remenyi and Williams 1996). Therefore, the positivist's model is more likely to be expressed mathematically than the phenomenologist's, which is usually expressed either in words or in diagrams. But both are utilized paradigms and are capable of being used to explore different assumptions. Positivism takes on a reductionist move toward discovering the relationships between the variables being studied (Remenyi and Williams, 1996).

Criterion	Positivism	Interpretive
Reality is:	Objective, 'out there,' to be 'found.'	Subjective in peoples mind
	Perceived through the senses	Created not found, and interpreted differently by people
	Governed by universal laws	
	Perceived uniformly by all	
	Based on integration	
Human beings are:	Rational individuals	Creators of their world
	Obeying external laws	Making sense of their world
		Not restricted by external laws
	Without free will	Creating systems of meanings
Science is:	Based on strict r rules and procedures	Based on common sense
	Deductive	
	Relying on sense impressions	Relying on interpretations
	Value-free	Not value free
Purpose of research	To explain social life	To interpret social life
	To predict the course of events	To understand social life
	To discover the laws of social life	To discover people's meanings

Table 4.1: Comparison between positivism and interpretive

The study will be implementing grounded theory coding techniques, which is required to be an interpretive methodology, and used to define the world of individuals engaged in the study. In the GTM approach trusting on the knowledge from inside is the main role of interpretive scholars (Charmaz, 1995). Moreover, in grounded theory, the participants of the research are the ones who form the way and guides the research, as for the researcher he/she only seeks to study the way of building their knowledge following beliefs and their philosophies (Charmaz, 1995). Also, the positivist part of the study refers to having the quantitative approach and relying on hypothesis testing.

4.3.2 Research Approach

The research approach points out if the theory is explicit and unconfined in the research design (Sandures, 2000). The research approach enables the researcher to obtain more informed knowledgeable resolutions on the research design. It also supports in deciding on what will work and not work while conducting the research (Sandures, 2000).

Two main research approaches were categorised in the research onion model; the inductive research approach; which is often associated with qualitative research, and the deductive approach; which is typically linked with quantitative research. The inductive approach emphasises on obtaining access to the understanding of human connection to actions, a more in-depth understanding of the research, the gathering of qualitative data, and what is more important; it appreciates that researcher is a vital element of the research process. Within the inductive approach, data is composed, and the theory is built up as a consequence of data analysis.

Qualitative research methods are joined with social context and are used to control social life as practised by participants. This kind of research commences with observations that are subsequently used to expand (induce) a general clarification, or theory, that accounts for the data. Qualitative research becomes more and more practical (Myers, 1997). Moreover, quantitative approaches are also required in the IS research to examine objective theories and to examine the connection among the research variables. Therefore, the research adopted a qualitative – inductive approach and quantitative - deductive approach.



Fig 4.3: Research approach for the current study

The clear study direction is to focus on the inductive and deductive approaches as it's using both the qualitative GTM and quantitative structured equation modelling PLS. Inductive aims at generating a systemically analysed grounded theory (Wolfswinkel et al., 2013). The mechanical drive of GTM is concerned with theory development, without paying attention to any clear obligations such as particular routes of research, precise types of data, or hypothetical backgrounds, GTM is more considered as a tactic of performing qualitative analysis that applies coding patterns and a group of divergent topographies that can assure the analytical creation of a theory.

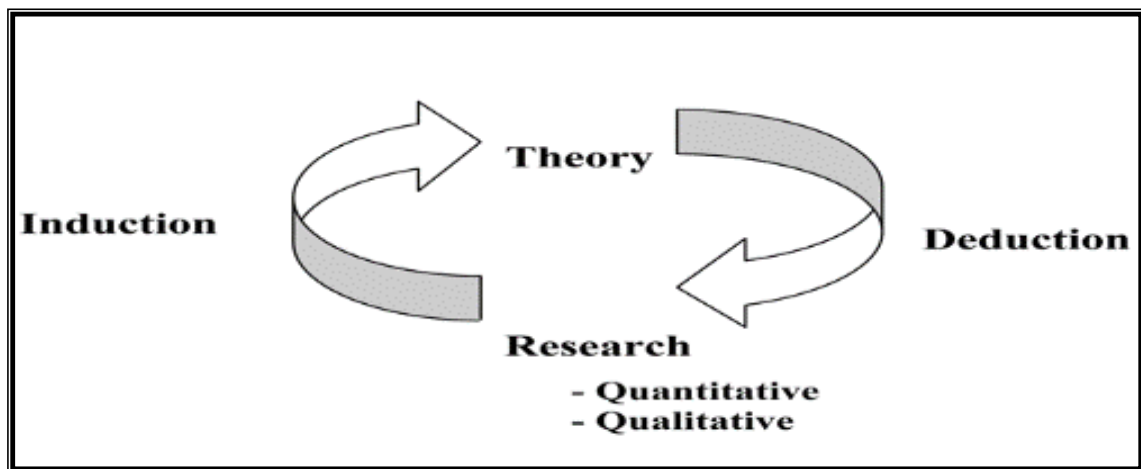


Fig: 4.4 Relationships between research approaches

4.3.3 Research Strategy

The research strategy is well-defined as being the most used as a transferrable research method which takes a level of fundamental values but does not completely accept the mechanical rigour adopted by its originators (Suddaby, 2006).



Fig 4.5: Research strategies for the current research

The critical research strategies implemented in the study are Grounded Theory Methodology (GTM), and PLS-SEM, both will be explained in separate sections as bellow.

4.3.3.1 Grounded Theory Methodology (GTM)

The goal of this section is to provide a literature outline of the GTM research strategy to address controversies and issues surrounding its applications, and to provide some guidance on how it may be used to donate the current research.

In this study, the choice to undertake GTM as research strategy was motivated by the effort of Locke (2001) who ascertained the appropriateness of undertaking GTM for investigating organisational behaviour related research themes such as the ACAP research. The choice of undertaking GTM was also driven by the work of Watson (1994) who suggested allowing both researchers and participant in owning their philosophy, which will be derivative from a linking of features from the effort of others, and which will together be suitable with their personal view of the world. What motivated Barney Glaser and Strauss (1967) to create the GTM that they felt unsatisfied about how existing theories dominated sociological research. They also claimed that researchers required a methodology in which it can enable them to be transferred from data into theory (Karpf, 2007). These theories are known to be grounded in the data shape and formation particularity to the background in which they had been established, and not to rely on analysing pre-existing theories.

For this reason, grounded theory was created to make space for the expansion of novel theories that are contextualised (Glaser and Strauss, 1967). By reviewing most of the significant literature regarding GTM, it was established that there is mainly three well known grounded theorists who had a great impact on the GTM research strategy. Glazer (1967), Strauss and Corbin (1990), and Charmaz (2002). The original school was created by Glaser and Strauss (1967) then a separation happened between the two, and a new version of GTM was recognised by Strauss and Corbin (1990). Next, Charmaz (1999) presented a constructive approach to GTM in late (2006). Glaser and Strauss (1967) presented a grounded theory as an applied methodology for conducting a study that concentrates on the descriptive course of action through scrutinising the real construction

of denotations and theories used by social actors in actual backgrounds. They both discussed that innovative and novel theory could be generated by giving worthy consideration into the gap amongst what is happening, i.e. regular realism of daily functional areas and their explanations by persons who contribute in them or what is called the "actors" (Suddaby, 2006). An increased interest within the field of qualitative research occurred within the past fifteen years assisted researchers in understanding a more comprehensive and thorough description of the inductive research approaches and methods.

Conversely, qualitative research has been relatively confused in some researchers with the book published by Glaser and Strauss (1967). Researchers have treated the Glaser and Strauss comparative detachment concerning both inductive qualitative research and quantitative deductive research as entirely two different detached notions. Where the understanding of grounded theory is that it is neither inductive nor deductive, nevertheless grounded theory considers using the two methods in certain means. Another confusion is the vagueness that appeared in Glaser and Strauss formative effort regarding if to find out and discover theories in an unbiased world, or to create theories in a socially built world. Lastly, not enough examples and cases are established for researchers in the book regarding researching organisations, such as organisational practice.

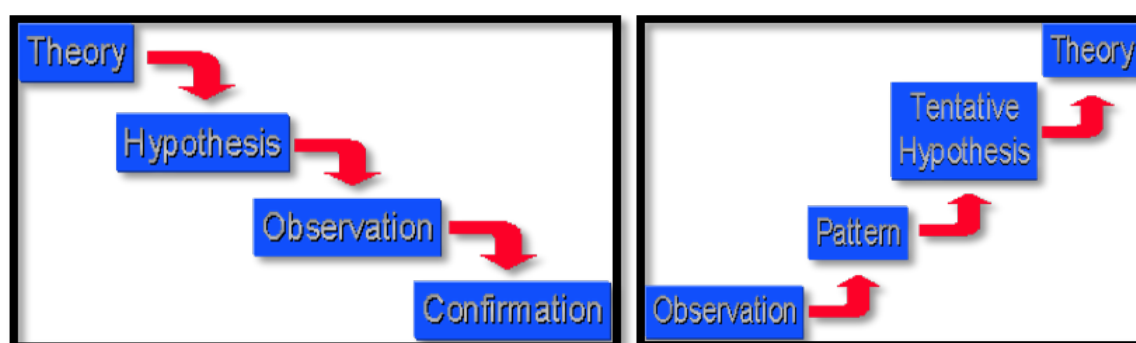


Fig 4.6: Inductive and deductive research approaches

Later, in (1978) GTM was extended by Glaser to include more clarifications and comprehensive methodological notions such as hypothetical sampling, iterative coding, and using memos, on the other hand, Strauss and Corbin (1990) had more concentration and attention to novice researchers, and moreover they focused on evolving the systematic methods and practices. Understanding different views in GTM can be valuable for novice

researchers who wish to carry out a qualitative study, most of the times these type of researchers are uncertain which specific approach to follow and choose among the available GTM approaches. Stern (1994) explored several dissimilarities between Glaser (1992), and Strauss (1990), and appealed that the differences between the two had continuously been apparent, the disagreement was further broadly acknowledged when Strauss (1990) published a comprehensive direction to GTM. Generally, Glaser (1992) stayed faithful to a definitive GTM theory, while Strauss created a reconstruction of the typical approach. Both, Annells (1996), and Glaser (1992) revealed that that other mentioned approaches are all about a theoretical description and not considered to be a grounded theory (Lloyd, 2007).

Moreover, the well-known disagreement on the approach where GTM is supposed to be applied amongst Glaser (1992), and Strauss (1990) as both made a mixed effort by publishing their '*Basics of Qualitative Research*'. The published book remained to be as a set of guidelines for directing researcher on how to form a theory or scheme from collected data

4.3.3.2 Current Research Choice of Grounded Theory

The GTM approach in the current research was mainly used to guide the research questions, and that is necessary for directing the second stage for the final stage of the model structuring. However, theory extraction was not the main aim of the analysis. Thus, the objective was to extract categories that may serve as measures for determining knowledge ACAP in organisations, and later link it with BI systems efficiency.

In the current research, the choice was to follow the analytical approach that is also inspired by the evolved approach by Strauss and Corbin (1990); as a result, the research was influenced from the current approaches.

1. **Classical Grounded Theory** by Glaser and Strauss (1960) and Glaser (1992) the founders of Grounded Theory: Classical grounded theory approach is a method of analysis that prescribed no rigour or rules regarding data collection procedures.

2. **Evolved Approach** by Strauss and Corbin (1990, 1998) is a more flexible approach that arises from personal experience, suggestions by others, and the literature emerges in the study.
3. **Analytical Approach:** The application of grounded theory techniques, typically for data analysis purposes and can follow either classical or evolved approach. The theory will be derived from following the step-by-step analysis (Urquhart, 2013).
4. **Constructive Grounded Theory** by Charmaz (2012), in her approach theory emerges within the research, a theory should emerge with constant comparison of derived categories, and most importantly she argues the researcher should start with a blank open mind of the studied phenomenon without any pre hypothesis, a theory emerges. Emphasis is on theory development and verification of theory and hypotheses concerning a social process the developed through the researcher.

Different approaches to grounded theory needed to be compared for coding development in the current research. These are versions that are used in the analysis process in most qualitative research. The section compared three four strands of grounded theory, classical, evolved, analytical, and constructive approaches to extracting a grounded theory.

4.3.3.4 Core Elements of Grounded Theory

As explained in previous sections that GTM is required by far the most common and popular technique in qualitative analysis (Gibbs, 2018). Additionally, it is becoming more widespread in the IS qualitative research, in order to ascertain this opinion of GTM popularity in qualitative research, (Gibbs, 2018) discussed a study undertaken which included (200) respondent from researchers that are mostly postgraduates, research associates and research fellows, and more than 40% of participants mentioned were undertaking grounded theory in their projects.

Grounded Theory aims to be inductive, and the impression is to discover theory (Strauss and Corbin, 1990). In most research, it is rather a way of analysing data that focuses on discovering things, uncovering theories that are grounded and justified. GTM core elements in the following points that mentioned the distinctive features of the grounded theory.

- 1) **Inquiry Shaped:** it refers to social areas and can be applied in different allied areas, and it can be used in variety of research areas.
- 2) **Simultaneous Process:** data collection and data analysis are produced simultaneously: a combination of analysis and collection process, so the analysis process can start before the researcher is complete with the collection process with an initial part of collected data.
- 3) **Inductive approach:** in GTM researcher does not normally start with a hypothesis (Charmaz, 2000). However, the aim is to discover them through the analysis process.
- 4) **Theoretical Sampling:** refining and elaborating the categories that will be discovered as the researcher goes through the analysis; theoretical sampling is a kind of sampling that can be done alongside the analysis process.
- 5) **Progressive Move:** the progressive move from very descriptive coding to the more analytical coding of the data, so towards the end of the research the aim is to reach to a more abstract theoretical understanding of the phenomenon being investigated.

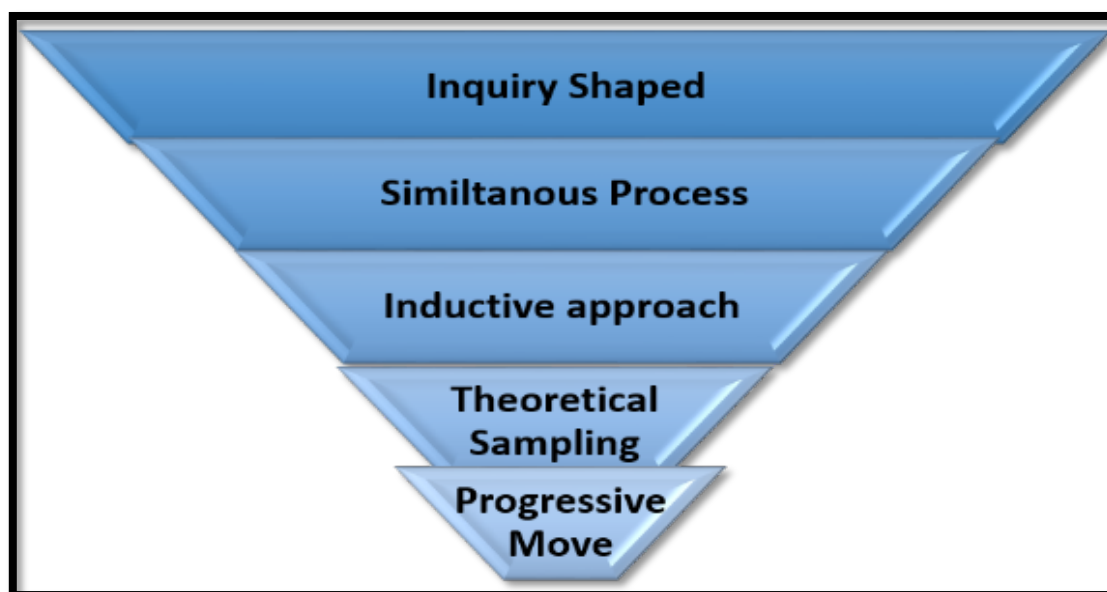


Fig 4.7: Core elements of GTM analysis process.

In this research GTM was mainly used as a coding approach, coding in this expression refers to the way the researcher relied upon to analyse data collected via semi-structured interviews grounded theory is not the method its self it is the technique of determining the theory that is resulting from the study occurrence it signifies (Strauss and Corbin, 1999).

The bellow points and table summarise the main focus of GTM when aiming to analyse the data (Strauss and Corbin, 1999).

- 1) Producing theoretical ideas from the collected data inductively.
- 2) Not having the hypothesis and theoretical ideas forehead.
- 3) The key focus of GTM analysis is a reflective reading of the text and the application of the code.

The points are further discussed within the table in 4.8.

COMPONENT	STAGE	DESCRIPTION
Openness	Throughout the study	Grounded theory studies are required to be open in terms of extracting data with no restriction proposed by previous knowledge or literature review. The focus of grounded theory might always change within time, as the researcher understanding of the researched phenomenon will enhance by collecting more data from the participant.
Analysing immediately	Analysis and data collection	Grounded theory studies include the process of simultaneous data analysis and collection. Both processes can interact, and data analysis can start with data collection in parallel. Moreover, analysis is suggested to start as soon as possible (Gibbs, 2018).
Memo-writing (sometimes also drawing diagrams)	Analysis	Within the data analysis in grounded theory the researcher documents memos, memos are valuable instrument during data collection and data analysis, as they were required to be a tool in drawing and tracing the process until final codes were extracted.
Theoretical saturation	Sampling, data collection and analysis	Theoretical saturation is a process that makes grounded theory studies differently than any qualitative study. Process of knowing when exactly to stop with collected data, and also with coding the data needed for extracting new categories, seeking for variation or similarities
Production of a substantive theory	Analysis and interpretation	The results in grounded theory are a set of codes, categories, location, and finally, a theory or storyline. The results are systematically extracted from three coding phases Open, Axial, and finally selective coding.

Table 4.2: GTM main specifications

4.3.3.5 Comparing Available Qualitative Strategies

An important issue that should be discussed in this section is what makes GTM a slightly different approach compared to other qualitative data collection and analysis

methodologies such as thematic analysis and content analysis. Reasons might be justified within the bellow table in table 4.3. The table explains that GTM always starts with openness while collecting the data, openness refers here to the researcher being open-minded in receiving answers from participants and not being biased to any previous knowledge owned such as from other resources like a literature review.

Moreover, in GTM, there is an apparent interaction between collection and analysis of data as they both initiate synchronously. Memo writing in grounded theory makes this approach dissimilar from other approaches; memo writing is a process where the researcher writes memos throughout the project, memos might include events, categories, or relationships observed and written while initiating the collections and analysis phase. Memos are used here to develop the researcher thinking in creating categories and answers to questions (Karpf, 2007). Consequently, theoretical sampling and theoretical saturations are stages that refer more to both data collections and analysis, and theoretical sampling is when the researcher draws relations between documented memos, codes, and categories while collecting data and analysing it at the same time.

Other qualitative techniques, such as thematic analysis and content analysis that are both techniques that found to be not appropriate in line with the current research requirements. The need for deriving themes was not applicable as the research already relied on utilising the four main dimensions of ACAP adopted form Zahra and George (1990) model. Other qualitative methods that were under investigation to be considered or not are shown in bellow table in 4.3.

Comparison	Grounded theory	Thematic analysis	Content analysis
Research Goal	Extract theory, or a grounded conceptual relational model	Extract themes from categories, Interpret “big picture” “meaning of data.	Describe data, or compare the frequency of the categories being analysed.
Type of Data	Qualitative from semi-structured interviews, interviews, open-ended, surveys.	Qualitative data from semi-structured interviews, interviews, open-ended, surveys.	Qualitative data from semi-structured interviews, interviews, open-ended, surveys.

Research Question	The question should include a relation.	No relation should be engaged in the question.	Initiates the research, no relationship should be engaged in the question.
Output	Codes, categories, relational model	Codes, categories, themes.	Codes, categories, description.

Table 4.3: Comparing different qualitative methods

4.3.3.6 Structural Equation Modelling – Partial Least Squares

Structural equation modelling (SEM) using Partial Least Square (PLS) is required as an analytical and statistical instrument that integrated both factor analysis for testing reliability of indicators and constructs, and path analysis for testing relationships and hypothesis. Moreover, PLS was used to analyse the association of multiple independent and multiple dependent variables in the research model. The software Smart PLS version 3 initially was used to present the proposed model, the three constructs, indicators, and the hypothesised relationships. The choice was to choose between SEM-PLS, and covariance SEM .in the context of the current research; the main difference is that the covariance SEM relies on the larger sample than PLS-SEM. PLS consistent algorithm was used to test the reliability of the ACAP, BI systems efficiency, and organisational efficiency indicators.

4.3.4 Research Choices

Three types of research choices are mainly categorised when conducting a research study and linked with the term (methods); mono methods, mixed methods, and multi-methods.

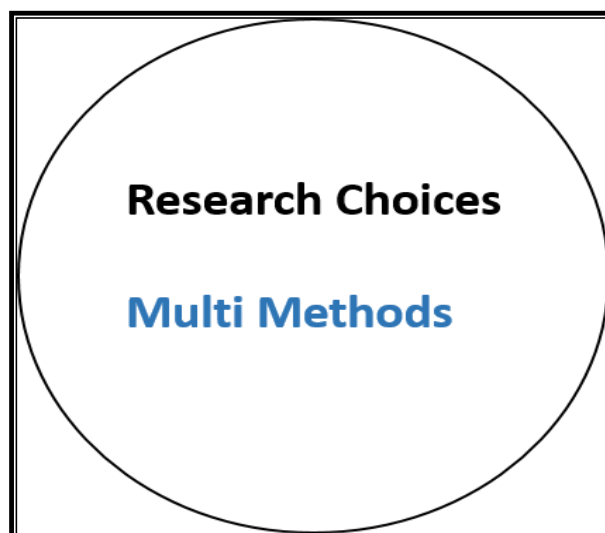


Fig 4.8: Research choice for the current study

The research applied multi-methods recognised as set of methods that appoints the application of two approaches in one single study (Myrick, 2001), qualitative and quantitative methods implemented by GTM and SEM-PLS.

4.3.5 Research Data Collection Techniques

According to Marshall and Rossman (2000) that qualitative researchers tend to use four main types of data collection techniques, summarised by in-depth interviews, observations field studies and the review of materials and documents. This research used the semi-structured interviews approach for the qualitative part of the study in this research. Semi-structured interviews were used in the illustrative phase of understanding ACAP and for extracting categories for its four dimensions. Using semi-structured interviews aimed to examine the participant's level of ACAP using pre-defined questions that are linked with findings from the literature review and research questions. Later, the research relied on the use of survey as its quantitative data collection technique. The survey used Likert scale survey questions distributed to participant electronically using emails.

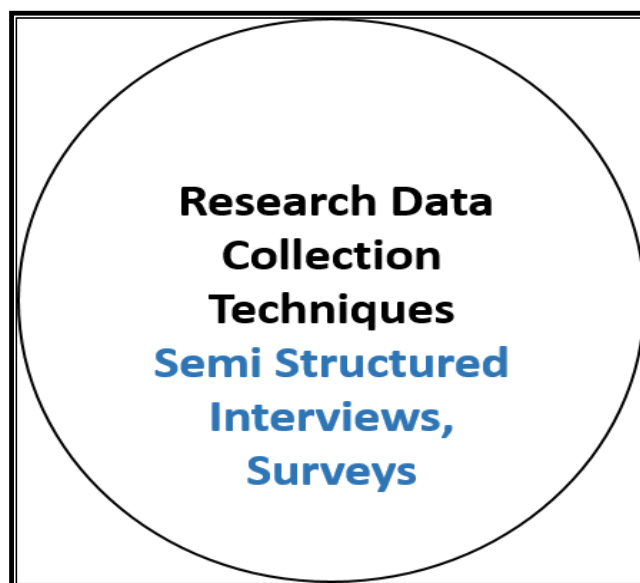


Fig 4.9: Data collection techniques for the current study

4.3.5.1 Preparing Interview Questions and Entering the Field

Describing the empirical data collection process in the current research remained crucial in addressing the analytical research questions identified earlier in the exploratory phase. This section explains aspects of undertaking the data collection process when entering the field and commencing interviews in the telecommunication companies. The section describes the organisation and a brief of their profile, organisational structure, the reason behind choosing them as a sample, and criteria for the sample selection process. The research followed a qualitative semi-structured interviews study to represent the relationship between BI capabilities, ACAP, and organisational benefits in the context of decision environment and performance. On this basis, the sample designed and collected to explore BI-ACAP model potential as means by which organisations and BI vendors can resolve the challenge of exploring organisational BI benefits. The semi-structured interviews and surveys finalised, amended, and were generated accordingly. The interviews enclosed open questions given the fact that the research is mainly following a Grounded Theory Methodology, questions probed into how the research participant can use their pre ACAP and knowledge improving the assimilation of BI in their organisations, how they went about exploiting such knowledge. The questionnaires contained two important stages, and the first stage is assumed to be an icebreaker in which it helps both parts the researcher

and interviewee to feel more comfortable, and then the main questions for collecting the core information.

4.3.5.2 Ethical Considerations: Role- players

After preparing the questioners and relating them to the previous literature and themes of the study, it was important for the researcher to start arranging for the real process of entering the exploration field, in doing so it was essential to follow ethical considerations to account for. Ethical considerations were completed succeeding to predefined standards given by Brunel University, and both telecommunication companies under investigation. Role players here references who will be the key determinants involved in selecting the study sample selection and participants to this study. This process of choosing the role players was implemented using pre-defined standards also followed while reviewing literature.

4.3.5.3 Researcher Role

The current section is required to be related to a constructive research issue that depended on both the researcher and the participant. The researcher was considered to be a personal channel engaged in the research process, as for the participants they were required to be instrumental for the researcher to understand the relation between the organisational control ACAP and if it can facilitate BI assimilation and efficiency. For that reason, ethical consideration was extremely imperative (Cohen et al, 2007). The current research is influenced by what so-called "ethical mindfulness." In which the data collection process in the sense of the researcher was considered to be a discussion between two equivalent participants using some open questions in the semi-structured interviews. This opinion assumed that the researcher was applying the openness that is a vital aspect of grounded theory methodology and assures the involvement of the researcher role in the study, and not only act as a neutral role. Meanwhile, the study has proceeded from a constructivist-grounded theory that endorsed the investigation an occurrence rather than the approaches of examining viewed as an ethical positioning and this by itself is required to be an ethical positioning (Charmaz, 2005).

4.3.5.4 Brunel University Role

According to the universities regulation for undertaking the experimental research, it was mandatory to submit the official ethics application form to the College of Engineering and Computer Science at Brunel University. Accordingly, approval was granted after submitting the ethics forms to complete the research in the telecommunication companies, using semi-structured interviews that do not have any conflicts of interests or breach any of the laws and policies. Ethical approval and consent letter are provided in Appendix B.

4.3.5.5 Telecommunication Industry Role

Telecommunication companies regularly produce and store enormous amounts of high-quality data, and have a very large customer base. Moreover, they operate in a quickly varying and highly competitive environment; that's why the telecommunications industry was one of the first to implement data mining technology. Telecommunication companies develop data mining to advance their marketing efforts and handle their telecommunication networks. However, these companies also face several data and decision management challenges due to the enormous size of their data sets, the chronological and sequential aspects of their data, and the demand to predict very rare actions, such as customer fraud and network breakdown in real-time. The use of BI in the telecommunications industry can be viewed as an input to assist in different aspects of their business starting with a large amount of data management, the need for the better decision-making process, an ending with affecting the overall performance of the company. BI is developed to address the complexity associated with the problem faced by these companies. BI systems can significantly help in almost all aspects of the business value chain and value networks to achieve what is required. The telecommunication industry general business value chain is presented in figure 4.10.

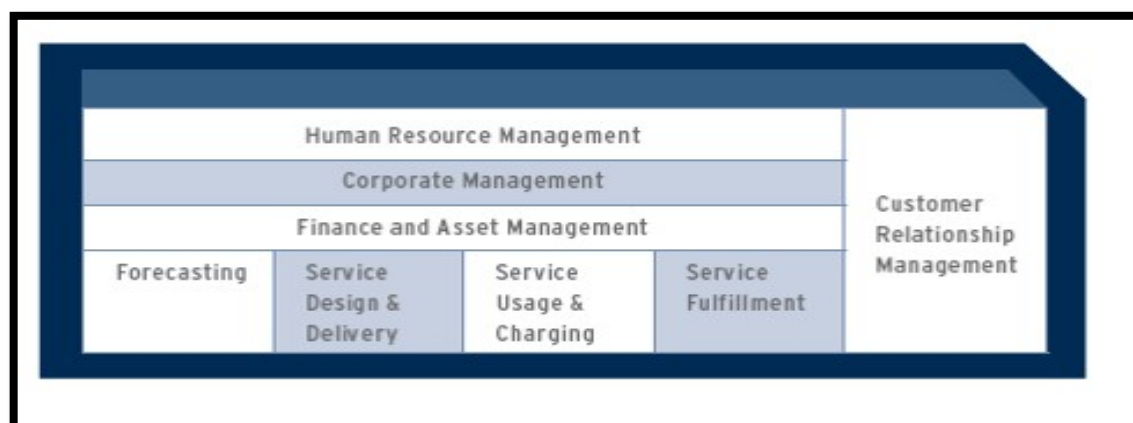


Fig 4.10: Telecommunication business value chain

Both qualitative and quantitative data collection required ethical consent letter to be sent to each participant in the two-targeted companies, and that was recommended by the BI vendor providing BI solutions. These were chosen as best fitting to the current research context from a long list provided by the vendor. A copy of the consent is attached in appendix B. Not any kind of communication was acceptable from any participant before signing the consent letter and accepting the terms of the research. The letter initiated by an explanation of procedures, then explanation of any potential risks, discomforts, and benefits. Subsequently, the letter explained withdraws procedures; confidentiality issues and follows up contacts in case needed for any reason. Both companies had lots of data confidentiality concerns for protecting their data, as they both required to be leading telecommunication providers in the Middle East and Jordan, and they always have concerns to protect their users and internal privacy. Both companies were assured throughout the consent letter that their provisions will be protected, and that the data that will be produced throughout this study will be handled with the highest level of confidentiality. This means that no other person except the researcher will have access to it, and the data will be stored on a password-protected computer. Besides, the company name will not appear anywhere in the final report; where necessary, a pseudonym will be used. The same applies to the name of the organisation. Moreover, after the thesis has been examined, the recorded data will be erased from the recorder, and the notes taken during the interview will be destroyed upon completion of the study.

4.3.5.6 Tele-Communication Company (A)

It is a leading mobile telecommunications provider in the Middle East and North Africa. Their main approach is to build a maintainable and advanced digital and telecommunication company that can serve and operate customers and corporations with an outstanding telecommunication experience offering mobile and Internet services. The foremost strategies of the company are based on main initiatives that can be somehow transformational. This initiative lies in value management, business to business, talent developments, and customer experience. The company was chosen to take part of the research given their interest in customer experience and talent development within their staff, and this by itself assisted the investigation of both ACAP potential and BI assimilation success. The hierarchy chart for the company was provided as in figure 4.11 bellow.

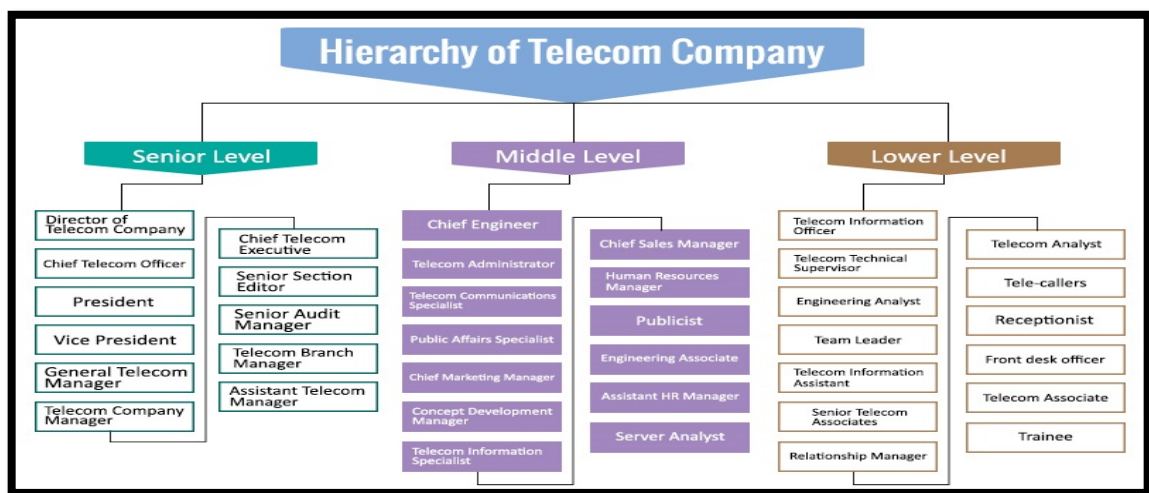


Fig 4.11: Hierarchy chart for the company (A)

As mentioned earlier, the study will not concentrate on the telecom industry business value chain; the goal was to find companies in the IS environment that deal with data challenges and already have BI solution assimilated. The positions were altered to match the companies' different position categorisation. Telecom company (A) did not always follow the given organisational structure. The goal of the current study was to conduct interviews with senior managers and middle managers not reflecting the operational level for this stage.

4.3.5.7 Tele-Communication Company (B)

The company is currently using BI systems solution "Cogons"; it is required to be as a strong competitor to company A, with similar employee's number and size, the target was to find two similar companies with least differences. Consequently, to accumulate the greatest number of seniors engaged as a participant in the study. The company had an extreme demand to deploy BI solutions as they are dealing daily with the sheer amount of data daily. Also located in the Middle East, specifically in Jordan. Also, the company was chosen to take part of the research given their interest in customer experience and human resources and technological development within their staff, and this by itself assisted the investigation of both ACAP potential and BI assimilation success. Telecom Company B required that the hierarchy chart remain confidential and not disclosed in any documentation.

4.3.6 Interaction amongst Data Collection and Analysis

Merriam (2009) suggests below statement in regards to not separating the data collection and analysis and processes: *"data management is no small aspect of analysis.* Section 4.3.6 stated the main differences that made the GTM a slightly variant approach in terms of data collection and analysis. As for this section, it will focus on explaining the stages that were also mentioned in the differences table in the above, and that is engaged with stressing the interaction amongst both the data collection and data analysis phases in grounded theory. When following a grounded theory methodology, it should be known that the researcher does not normally separate between collection and analysis, in most cases, the researcher does not wait to collect all data to start the analysis, however, the researcher should start straightaway when having an initial amount of data and continue discretely with data collection. This process of commencing the analysis as early as possible what will allow what is called the theoretical sampling that will be described in the coming section.

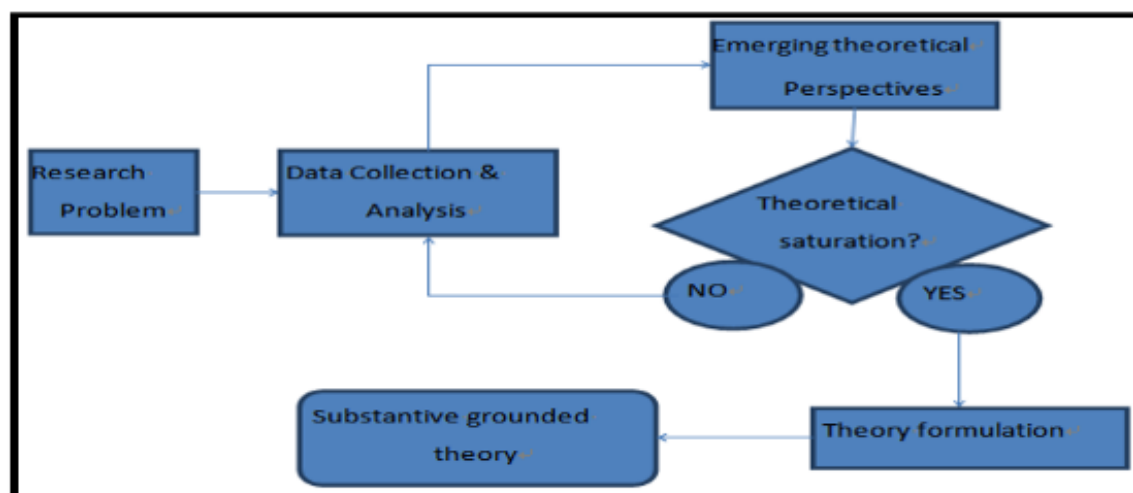


Fig 4.12: Data collection process and analysis in GTM

In the current research and as mentioned earlier in the chapters that the researcher relied to some extent on literature review to achieve a slight predefined knowledge of two main themes being explored, particularly the ACAP theme is required relatively an imprecise type of organisational controls that needed to be investigated using GTM. However, the control was still unclear until explored openly using the grounded theory approach in undertaking the semi-structured interviews. The researcher in the current study believes that previous slight knowledge of the field of ACAP and its relation to knowledge creation will facilitate rather than overloaded both data collection and data analysis processes. While the researcher decided to analyse the organisational role of ACAP as extracting categories from participants, the researcher was not familiar with some parts of significant literature while starting the fieldwork. Naturally, this was done intentionally, as the researcher aimed not to undertake a full literature review of the ACAP capabilities and to leave this full understating to be revealed while undertaking the interviews, consequently this is one of the most important objectives in the GTM.

4.4 Pragmatic Research Design

In the current research, the research objectives led to the procedure of building the systematic pragmatic research design. Consequently, the design reflected the aim of the whole study. The purpose was to build a design that implements the processes of the qualitative strategy and quantitative strategy presented in two distinct stages related to what the researcher intends to achieve through the research. The pragmatic design also

indicated the clear steps that will be followed in both strategies including the initiation points such as the initiation point started with research questions or hypothesis, later the analysis process, finally the expected results from both strategies.

The built pragmatic research design assisted as being a tool used throughout the whole research stages and used to evaluate how the research objectives are being accomplished. Moreover, the design helped the researcher achieve the research objectives by configuring it into several systematic parts.

Finally, one of the purposes of the design was to build an empirical scheme to test a theory rather than to develop a theory, besides, the current research intended to deliver a rigorous representation of an organisational interaction between two organisational fields, and create a systematic relation based on exploration of the this proposed relation through interviews. The researcher tended to follow the school of Strauss and Corbin (1990) in GTM to create this systematic theory through following a set of design steps in GTM, as explained in the chart in 4.14. Later, the researcher was influenced by implementing the PLS-SEM method for the quantitative strategy for testing the hypothesis. However, the current study was so much influenced by Strauss and Corbin (1998) as they believe that researcher can also use GTM specifically in the data collection and analysis process for building a rigorous understanding of a certain phenomenon and not to use for creating a theory. The whole research design is presented in fig 4.13 next page.

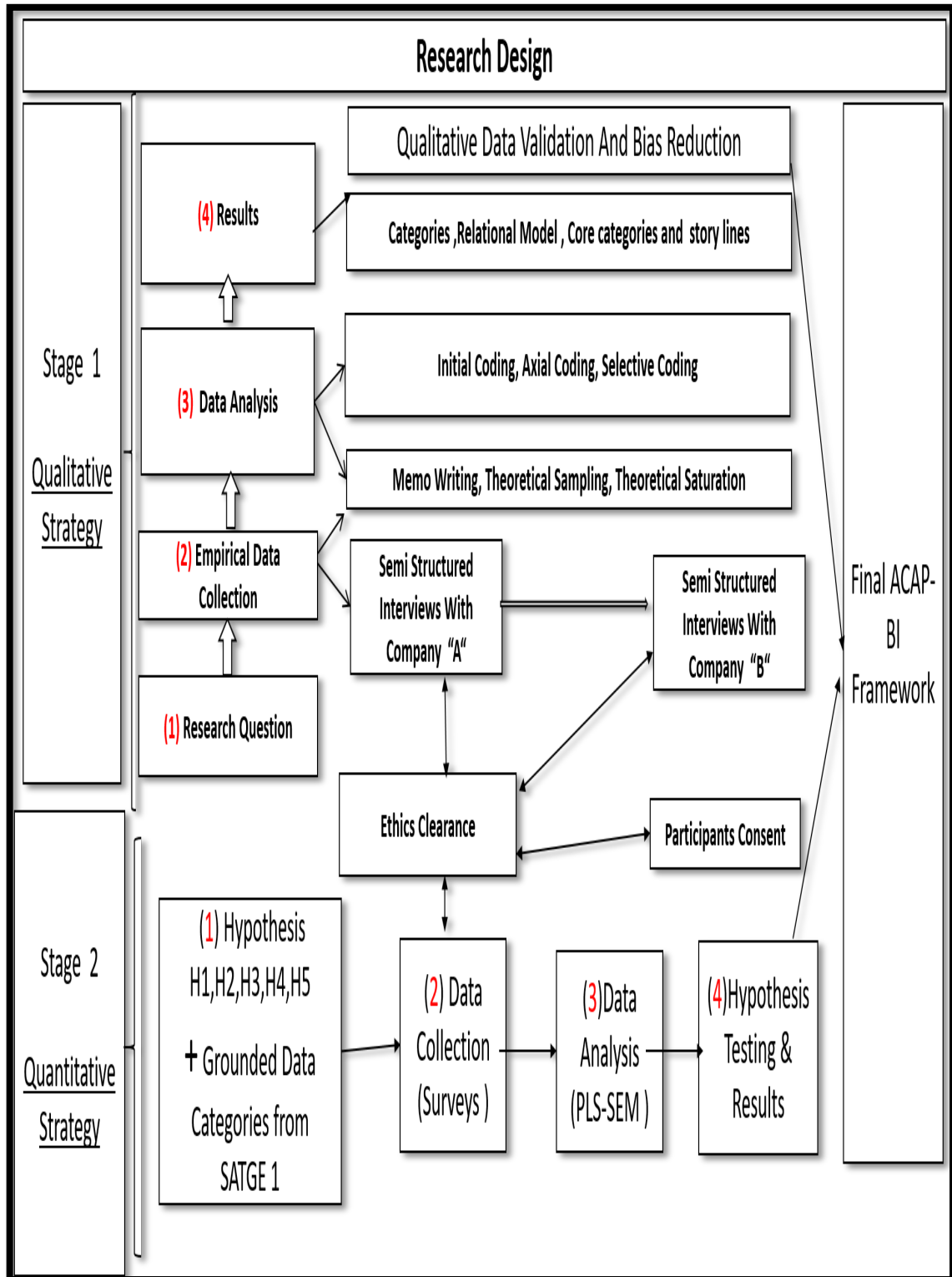


Fig 4.13: Pragmatic research design for the current research

4.4.1 Qualitative Research Design

The research question offered a broad perspective of the qualitative research scheme. Consequently, once a specific site for collecting data has been originated the process of the data collection was initiated accordingly (Bryant, 2011). GTM open and axial coding processes were employed in the analysis phase resulting in extracting ACAP categories and assigned to themes as a result of the axial coding process. Memo writing and theoretical saturation mentioned in the design made this approach dissimilar from other approaches. Memo writing is a process where the researcher writes notes throughout the research; memos might include events, categories, or relationships observed and written while initiating the collections and analysis phase (Gibbs, 2018).

The bellow design in figure 4.14 was directed by the following research question;

“What are the categories that determine organisational ACAP dimension in supporting potential creation of knowledge?”

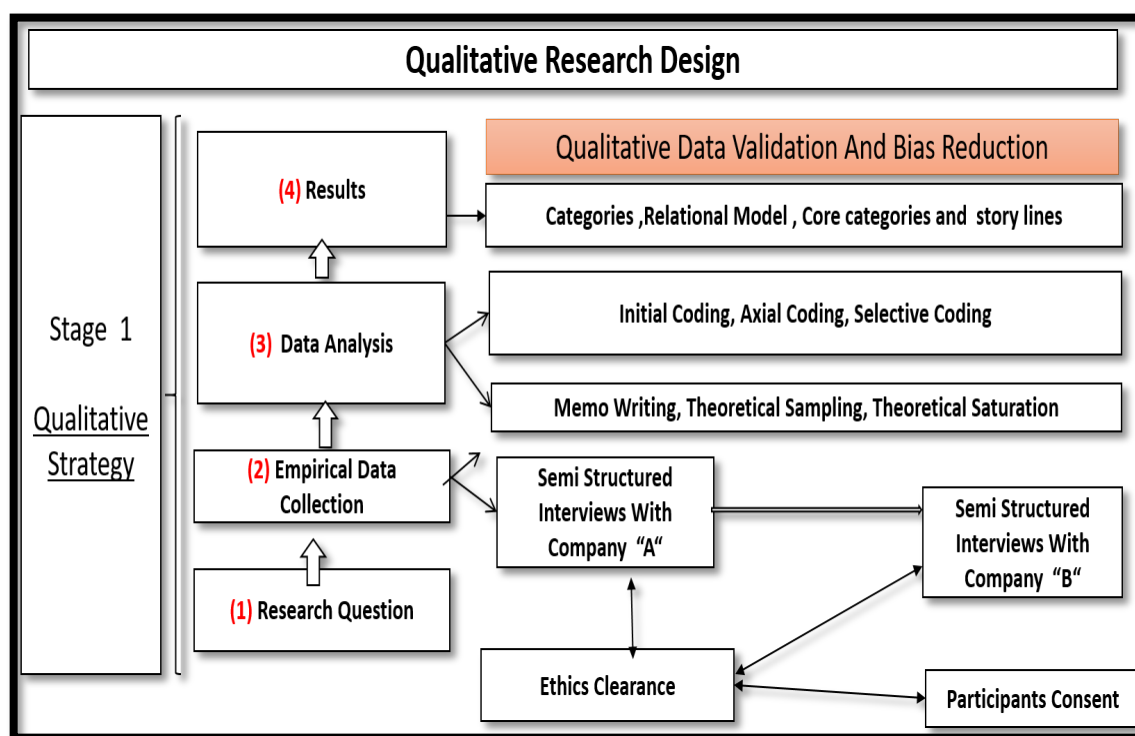


Fig 4.14: Qualitative research design for the current study

The above design in figure 4.14 presents an illustration of the inductive empirical data collection and qualitative analysis methods.

- **Semi-structured interviews design**

The questioners contained two essential stages; the first stage is assumed to be an icebreaker in which it helps both parts the researcher and interviewee to feel more comfortable and to collect the initial information about the participant as follows,

- First Part Interviews (Interview Protocol)
 1. Distributing a consent letter to be signed
 2. Opening comments
 3. Explain the study objectives and purpose of the interview
 4. Provide an overview of areas to be covered
 5. Questions or comments
 6. Background Information
- Introduction: Questions about yourself and your work
 1. What is your job title?
 2. What is your position?
 3. Are required as senior (managerial level) or (operational level)?
 4. How long have you been working for this organisation?
 5. Questions about your background?

- **Second Part of Interviews**

The second part of the interview is the most significant part; as it needs full concentration from the researcher to collect and ask the precise question, then document the most meaningful answers. Questions in this part designed according to the understanding emerged in the exploratory literature review phase of the study, and the interview questions aimed to test the four dimensions of ACAP and their impression on knowledge creation in top-level managers by answering the following research questions in table 4.4.

Measuring ACAP	
Semi-Structured Interviews Questions	Source
Q1) Please state to what extent your organisation uses external resources to obtain information (e.g., personal networks, consultants, concerning)?	(Auster and Choo, 1993), Liang and Liu, 2018 (Jansen et al. 2005)
Q2) Do you encourage employees to obtain information from other industries, and what are mechanisms used in doing this?	(Veugelers and Cassiman, 2000), (Liang and Liu, 2018)
Q3) Do you expect that the employees deal with information beyond your organisation's industry?	(Laursen and Salter, 2006)
Q4) Does your organisation uses tools (e.g., intranet, internal studies/reports) to spread knowledge in the entire organisation? Please explain how.	(Bontis, Crossan, and Hullan, 2002)
Q5) Do you have specific practices inside your organisation that reflects any degree of data sharing between departments or outside the organisation scope? Please provide examples	(Lu et al. 2006)
Q6) Does your organisation use any data analysis tools or systems for reducing data analysis effort? Please list and explain all available types of systems used.	Liang and Liu, 2018 (Hock-Hai et al. 2006)
Q7) Are your employees able to apply new knowledge in their daily operations? How?	(Hock-Hai et al., 2006)
Q8) Does your organisation have initiatives for launching innovative products or services concerning its research and development plan (i.e., R&D initiatives or department?	(Szulanski, 1996) (Liao, 2006)
Q9) How can managers benefit from the generated knowledge in terms of performance, or decision-making initiatives?	Liang and Liu, 2018, (Armstrong and Sambamurthy, 1999)
Q10) How can you evaluate the existence of general information technology components, and non-generic inside your organisation?	(Armstrong and Sambamurthy, 1999)

Table 4.4: Table Semi-structured interviews questions.

The interviews enclosed open questions given the fact that the research is mainly following GTM, questions also probed into how the research participant can use their pre-ACAP and knowledge improving the assimilation of data systems in their organisations, and how they went about exploiting such knowledge.

4.4.2 Quantitative Research Design

In this part of testing the study, the goal is to test what are the existing effects of ACAP categories, and that may enhance the readiness of organisational ACAP that supports BI successful adaptation efficiency.

The quantitative pragmatic design aims to answer the following question:

“Can ACAP dimensions affect the efficiency of BI systems, overall organisational efficiency? “

To test the proposed question and provide answers, it was imperative to set a total of five hypotheses. This part of testing emerges from research question mentioned above.

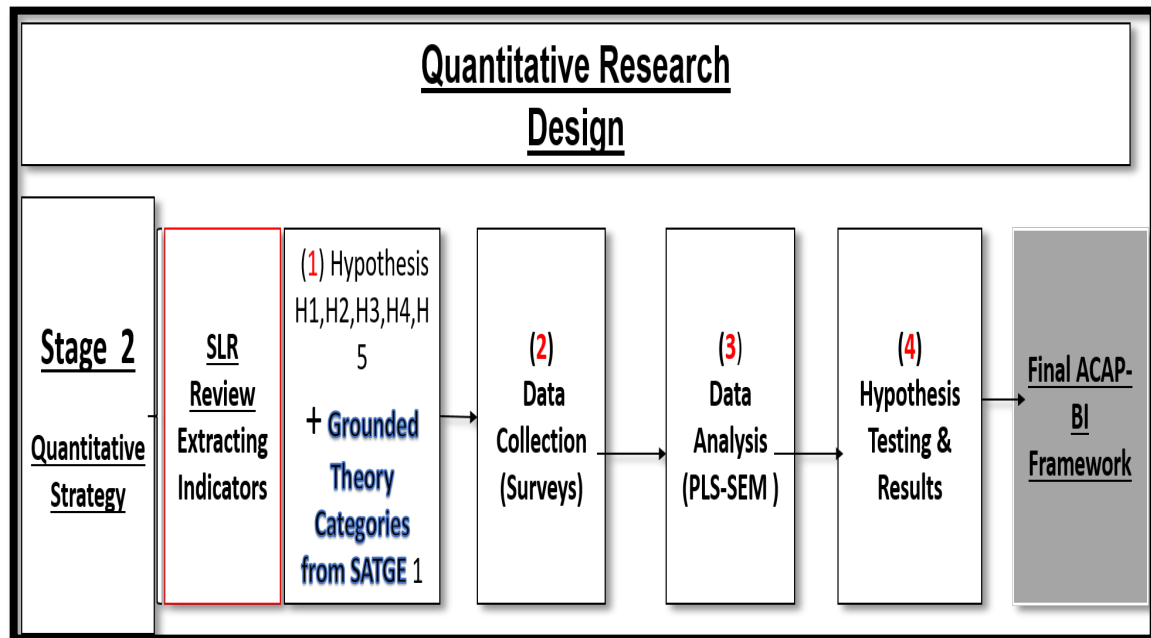


Fig 4.15: Quantitative research design for the current study

4.4.3 Quantitative Pilot study

The quantitative strategy conducted a phase of pre-testing to assess the quality of the questioner that will be used in the second stage of empirical data collection. In the initial pre-test, the questioners were conducted personally with five directors from top-level managers, and directors that were required to indicate if they have found any of the questions difficult to answer, or ambiguous in terms of technicalities. There was some flexibility during the first pre-test of the three surveys filling in terms of the order in which the questions in the agenda were asked: such as skipping some questions, and adjusting and refining others as they put some constraints on the interviews. This permitted the researcher to notice complications with the questions and to polish them consequently.

The feedback resulted in that the pilot study settled the need for modifying some questions in the surveys, and eliminating others according to the main ACAP extracted categories. As some managers felt that they are unfamiliar with terms in the questioner describing some ACAP dimensions, and after eliminating some ambiguous terms and questions, the surveys were conducted again with several approved top-level managers. The survey contained information regarding Business Intelligence - Information Technology infrastructure. The participants conducting the pretest survey were required to indicate if the items listed in the survey are available within their department, and to indicate if any of the items were missing or not needed to be within the choices.

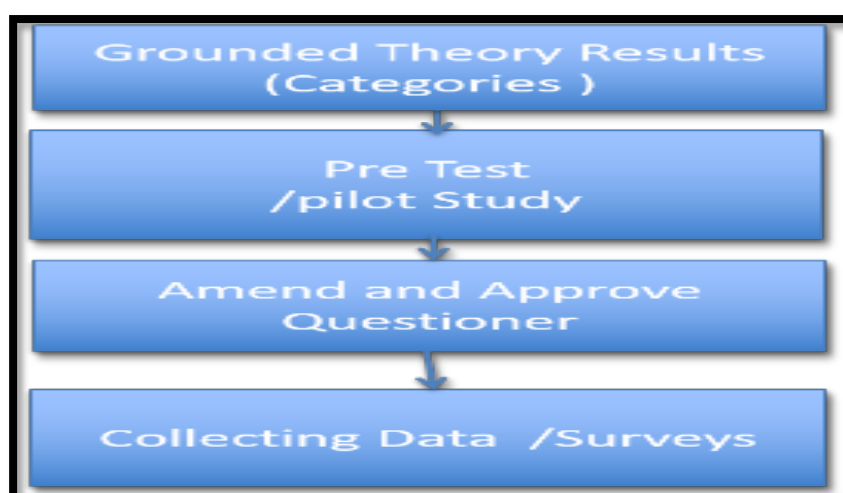


Fig 4.16: Quantitative survey input and pre-testing

Overall, the consequences of the pre-tests implied that the categories of ACAP measures should be slightly explained to the participant before initiating the interview, especially if the interview is with not a senior technical level manager.

4.5 Summary

The focal purpose of this chapter was to undertake an investigation that leads the formations of an extensive understanding of the qualitative GTM outset and its detailed background and roots, and the quantitative SEM-PLS method. Later, analyse their methodological positions presented in the shape of the methodological framework. The current methodological demonstration is expected to influence later adoption of these methods within the study treated as pivotal research methods that will play a primary role in directing the pragmatic data analysis process. A detailed description was structured around considering critical analyses of available potential methods. Disagreements and agreements between methods, views, and strands of the GTM schools were also presented. Finally, a well-structured pragmatic design was presented for both qualitative and quantitative research strategies.

CHAPTER 5: QUALITATIVE DATA ANALYSIS, RESULTS, AND DISCUSSION

5.1 Introduction

This chapter sets the perspective of implementing the qualitative research method used for uncovering methodological pragmatic categories of ACAP from organisational knowledge foundations. The goal of this chapter is to present the process of the qualitative data analysis and results undertaken from a systematic GTM approach, and how the coding process was executed in a systematic ordered technique.

The chapter elements are organised starting with section 5.2 the qualitative data sample and how it was calculated, section 5.3 presented core elements of GTM analytics as a qualitative data coding technique. Next, sections 5.4 commenced in introducing the coding process for the current research. Section 5.6, 5.7, and 5.8 all thoroughly conferred the detailed process of the three coding phases open, axial, and selective coding and how they were generated. Later section 5.9, and 5.10 illustrated how the current research applied a two-researcher routine as an attempt to reduce bias discovered in categorised data, and later reflect the reliability of coding techniques. Section 5.11 evaluated the GTM followed the method; finally, section 5.12 presented as a descriptive discussion of the qualitative data results.

5.2 The Qualitative Data Sample

The qualitative data relied on using semi-structured interviews as a means of collecting data. In each interview, a set of (10) questions was asked for each person participating in the study, as mentioned previously in the chapter (4). From a total of (50) clients, two organisations were selected for interviews based in Jordan. BI vendor provided the researcher with a contact list of clients. Multiple respondents from each organisation were selected from the vendor's contact list. The calculation for the sample size relied mainly on analysing previous research published studies that applied the GTM coding process. Consequently, extracting the number of interviews in each study and finally calculating

the median according to the studies. The final concluded number of the qualitative sample is 22 samples, as in the bellow table 5.1; and following used the formula for calculating the median: $N : (\text{Number of Studies}), N=7, \text{Odd number.}$

Extracting Average Sample size for the Qualitative Sample						
Journal Title	Article Name	Discipline	GTM approach followed	Data Collection method	Size	Median for Number of Interviews
European Journal of Information Systems (2001)	From contexts to constructs: the use of grounded theory in operationalising contingent process models	Information Systems	following Strauss and Corbin Paradigm Model, use of GTM to aid the evaluation of the informational artefact, or part of it, to support contingent process models.	Semi-Structured Interviews	10	1) N:(Number of Studies)
Journal of Information Systems and Technology Management (2012)	Using Grounded Theory for Systems Requirement analysis	Information Systems	Evolved Approach (Strauss and Corbin, 1990)	Case Study /Semi Structure Interviews	7	
Journal of Information Technology (2009)	Mobile word-of-mouth - A grounded theory of mobile viral marketing	Information Technology	The Study follows descriptions of how to generate a GTM set out by (Strauss and Corbin, 1990)	In-depth interview Focus Groups	50	
European Journal of Information Systems (2013)	Using a grounded theory approach to study online collaboration behaviours	Information Systems	Following mixed approaches mainly Glaserian (classic GTM approach	Semi Structure Interviews and Focus Groups	23	

Journal of Management Accounting Research (2006)	The Role of Information Systems in Supporting Exploitative and Exploratory Management Control Activities	Accounting /Management	A grounded theory for analysis analyse the study data (Glaser and Strauss 2001; Sunday 2006; Lee et al. 2006)	Semi-Structured Interviews	21	$), N=7, \text{ Odd Number}$ $2) N+1/2$ $7+1\sqrt{2}=(4)$ <p>The fourth element</p> $3) \text{ Fourth element } =22$
Journal Of Tourism Management	Exploring the adoption and processing of online holiday reviews: A grounded theory approach	Tourism Management	Following both Approaches of approach (Glaser, 1978, 1998; Glaser & Strauss, 1967; Strauss & Corbin, 1990). Using Grounded Theory as GT as more of a research paradigm than a prescribed methodology.	Personal Un-Structured Interviews	22	
Journal Of Social Science & Medicine (1990)	Discovering Chronic Illness Using Grounded Theory	Social Science &Medicine	Constructive Grounded Theory charmaaz (1990)	Semi Structure interviews and open ended questions	30	
MEDIAN = (22) INTERVIEWS						

Table 5.1: Calculating sample size

A total of (10) organisations were selected, and a total of (22) practitioners were chosen. Different levels such as IT officers, top level and middle managers, different languages mainly Arabic and English, different educational background, and different level of experience ranging from (4) to (20) years. This categorisation for practitioners went through lots of changes and re-interviewing process in the course of the interviews. The research followed the methodological guidance for Isabella (1990) for presenting and conducting the research interviews. In table 5.2 in the subsequent page displays detailed specification for interviewed clients according to their industry and position of the person that was engaged in the interview.

Perspective Category	Number of Interviewed Participants	Length of Work Experience	Managerial Level	Industry
Head of data analytics	2	10	Top Manager	Telecom
Chief information officer	1	9	Top Manager	Telecom
Marketing head	2	15	Top Manager	Telecom
Risk manager	2	8	Top Manager	Telecom
Product development manager	2	9	Top Manager	Telecom
Senior cost analyst	2	5	Top Manager	Telecom
Data Platform Engineer	2	10	Middle	Telecom
Technology leader global analytics	2	12	Top Manager	Telecom
Business intelligence analysis head	2	4	Middle Manager	Telecom
BI and data analytics Senior Consultant	3	5	Senior	Telecom
Director Of human resources reporting And analytics	2	14	Top Manager	Telecom

Table 5.2: Categorization for practitioners.

5.3 Qualitative Data Analysis Using GTM Coding

Data analysis in the current study relied primarily on two data coding techniques guided by GTM: open and axial coding. A code in GTM is a specific indication of the main issue or phenomenon that is going on in the text or collected data (Gibbs, 2018). Additionally, coding references a process of reducing the data without changing the meaning of the data starting with a large amount of data and ending with a grounded abstract view of the data. NVivo software was used to code the data by first uploading all interviews as one whole transcript and conducting a line by line coding to all answers of the participant's transcripts. In this phase, coding was required as a systematic automated technique for segmenting data into smaller units called sub-nodes, and categories in GTM. The configurations of categories enabled the researcher to gain a deeper rationale of the

knowledge creation potentials that were extracted from the interview answers. Mixed Methods were encapsulated within GTM such as theoretical saturation, memo writing, and finally mapping results with previous literature review for validation issues.

A code in grounded theory is a specific indication of the main issue or phenomenon that is going on in the text or collected data (Gibbs, 2018). Furthermore, coding references a process of reducing the data without changing the meaning of the data and having a very open mind while looking at the data, starting with a large amount of data ending with small abstraction view of the data. Reducing the size be can be performed by assigning a phrase to represent a certain aspect of a data, and the act of labelling this data, the essence is to reduce the amount of data and capturing important information to address the research question and deeply understand the phenomenon of the research. Consequently, coding in the current research was used for the following causes:

1. Reducing the amount of Data.
2. Understanding the phenomenon.
3. Developing constructs.
4. Developing theory.



Fig 5.1: Diagram showing coding phases in GTM

The coding procedure was conducted following Glaser (1978), and Strauss and Corbin (2001). Configurations of categories in which enabled the researcher of the current research to gain a deeper understanding of the data. Guided by GTM, three types of coding were used in this study: open, axial, and selective coding as the below diagram. Within the coding phases, mixed methods within grounded theory appeared such as constant comparison, theoretical saturation, and memo writing, and finally mapping results with previous literature review for validation issues.

5.4 Analytical Coding Approach

The choice of the current thesis to follow the analytical approach signified the pursuit of finding a method that is more likely to apply grounded theory typically for data analysis using coding. Likewise, this approach is influenced by both classical and evolved approach. In this approach the coding followed the paradigm model in coding data with three main levels, the research initiated the coding with a stage called open coding, then axial coding, ending with selective coding process as in fig 5.2.

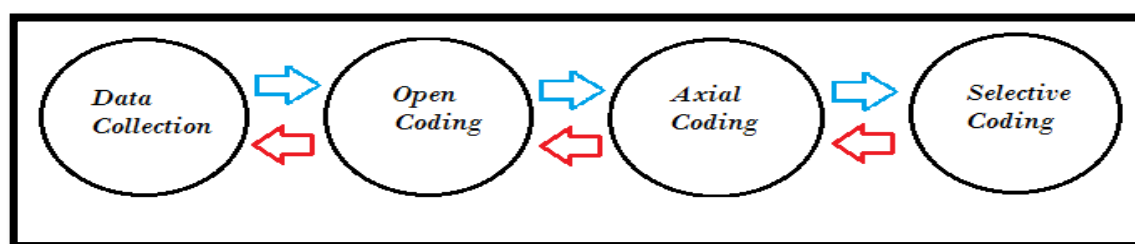


Fig 5.2: Phases of coding in GTM analytical approach.

While researching the different strands of GTM presented previously in chapter 4, the premier amount of research uncovered that there are three levels of coding performed, very little research included only two levels of coding. However, the three levels of coding occurred within two different main stages, initial stage of coding and developing of what so called as ‘categories’, the second stage is referred as the ‘emergent’ stage, it is the stage when the theories start to emerge while explaining the extracted categories through the use of memo writing (Walker and Myrick, 2006).

5.5 Amount and Hierarchy of Data in Coding Stages

As mentioned earlier that coding in the current research referenced a process of reducing the data without changing the meaning, and having a very open mind while looking at the data, starting with a large amount in (Open Coding) shown in diagram 5.3, in the open coding the data is required to be relatively big in terms of amount.

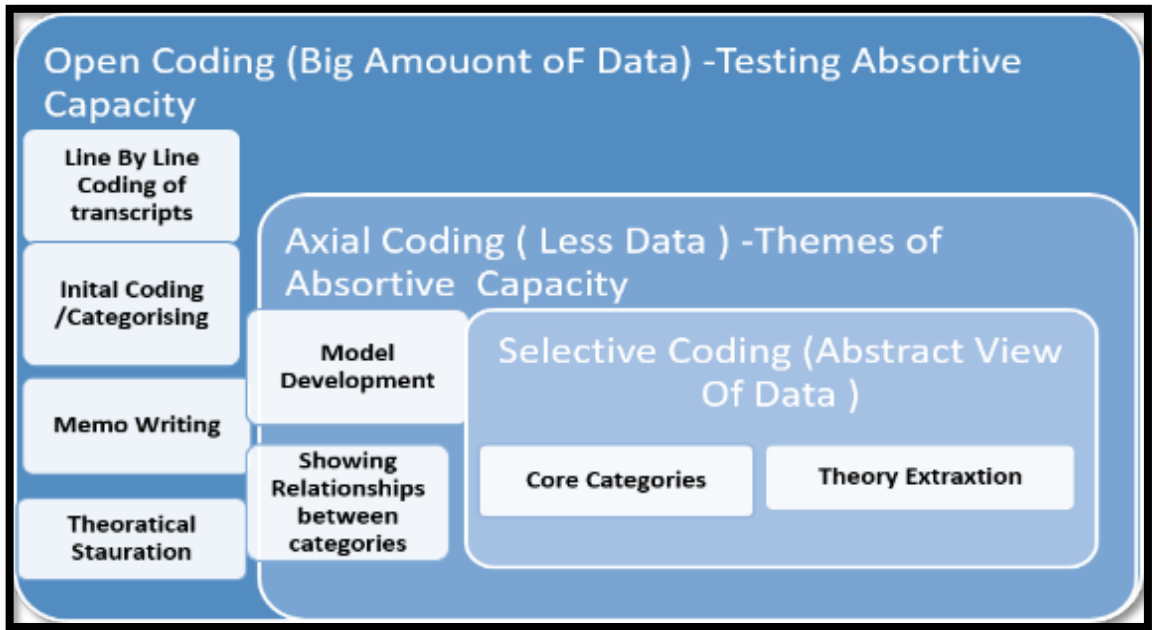


Fig 5.3: Data hierarchy model for the current research.

Later, in the Axial coding, the data starts to eliminate gradually as it is classified, so the researcher deals with themes or classification, rather than dealing with a long list of categories. Finally, in reaching the selective coding, the data is very abstracted into a few theories of text or storylines.

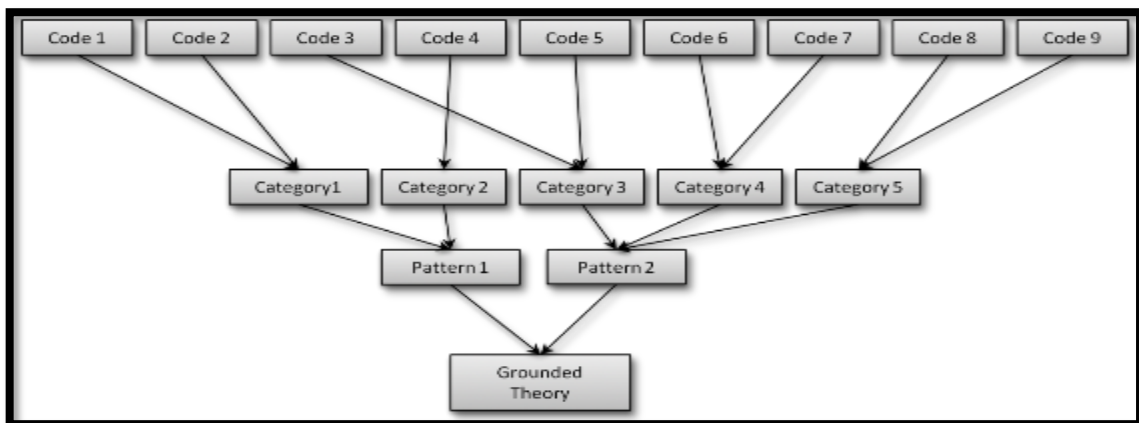


Fig 5.4: Hierarchy of data analysis in analytical GTM.

5.5.1 Inputs and Outputs in Coding Stages

This section visualises the key inputs and outputs required in the current research for the three phases of coding. However, each phase was explained individually in a separate section.

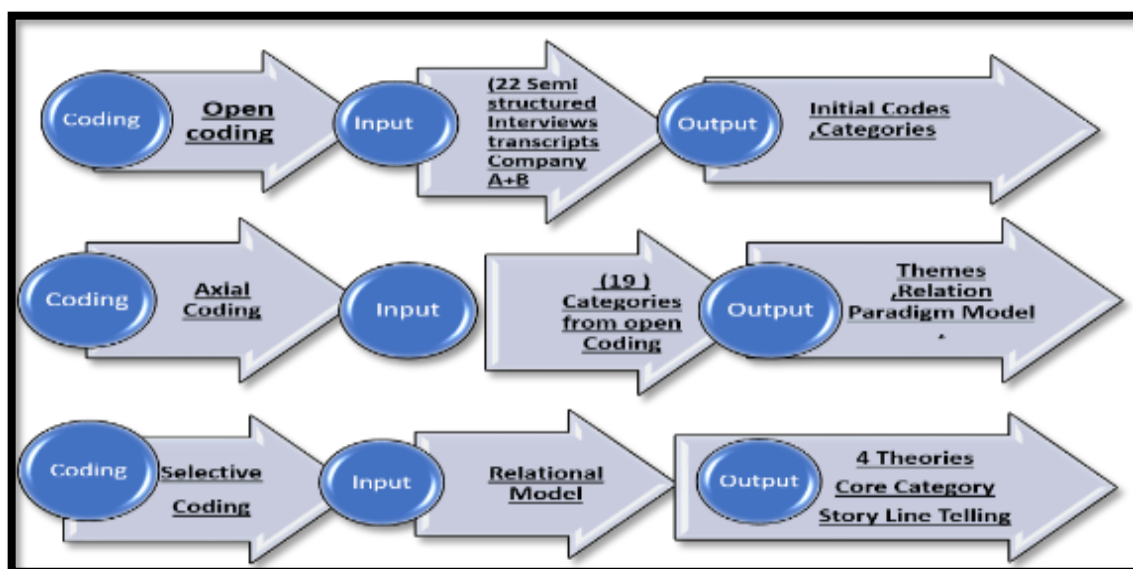


Fig 5.5: Input and output coding model for the current research.

Building on the above diagram illustration in figure 5.5, it is displayed that open coding input is the real text collected from participants in the interview, and the outputs are set of initial codes coded again into categories. Later, the axial coding in the current research was employed to build a relational model following Strauss and Corbin (2001) paradigm model as an output of this phase. Finally, selective coding required the paradigm model as an input to extract a final core category and document a storyline out of the main ideas of each collection of themes and categories.

5.6 Coding Phase One: Open Coding

Open coding refers to the key analysis process in this research; it is an unrestricted process of categories identification that is extracted from the transcribed interviews. Additionally, it is a set of techniques that engage initial labelling of all available data, and then segmenting data into chunks according to proposed classifications and themes (Glaser, 1978). The process of open coding as a process that engages categorising,

classifying categories into lines of text and groups that relates to a certain pattern, and that might be predefined earlier in the literature review stages. Moreover, engaging the use of memo writing until reaching theoretical saturation was an essential part of open coding.

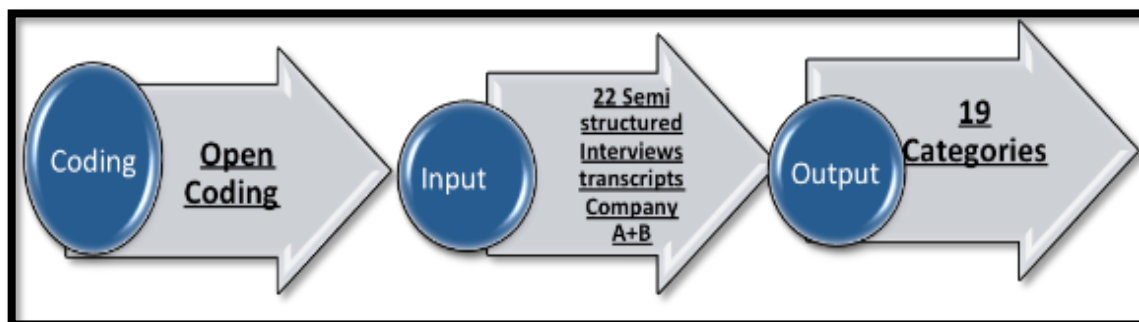


Fig 5.6: Open coding input and output for the current study.

The output was the extracted categories. Figure 5.6 illustrates the open coding input and output. Each category was coded as a sub-node in Nvivo, later was rationalised into the suitable main node that is referenced as a theme in the axial coding process. In open coding, the main input was the participant's transcripts, and the final output was the developed categories. Open codes were extracted by assigning a phrase to represent a certain chunk of a data performed open coding and then labelling this data according to respondents answering patterns; the essence was to reduce the amount of data (Glaser, 1978). Table 2 in the below section illustrates the total of 19 categories extracted through the open coding process.

5.6.1 Line by line Coding (Initial Codes)

In the current research reading each line of text, and labelling the text with a referencing phrase or set of phrases was required an important part within the open coding process. Following the method of line-by-line open coding of Strauss and Corbin (2001), lines were treated as bits of sentences. Using line-by-line coding was a way of breaking through things and forcing the researcher attention to know what the main phenomenon of each line of text is. The researcher of the current thesis went for a line at a time and coded this line. Initially, by assimilating the collected filtered data into transcripts, and one unit containing (5000) words and (20) pages of text using the qualitative data analysis software NVivo. Notes from each interview were reviewed. Alongside this process, many

forms of data such as notes or what is referred to as memos in Grounded theory, also handwritten correspondences, and relationships all were undertaken during the coding process. As mentioned earlier, that analysis and data collection in grounded theory analytical process are both processes that can interconnect. The researcher read the transcribed interviews carefully, figured out the main ideas realising the whole idea, and did a line-by-line coding of the transcripts, using phrases that best describe each dimension of absorptive capacity, and labelling each code from in a descriptive way. It is imperative to mention here, that the coding process sometimes needed more collected data, and other times, the researcher felt that data collected is enough to build categories. In this case, the researcher reached a point of theoretical saturation with available data; otherwise, seek to collect more data. A sample of how line-by-line coding from transcripts to extracting initial codes is illustrated in the table in the next page table 5.3.

<p style="text-align: center;">Coded to</p>	
<p style="text-align: center;"><i>" Text " from semi-structured interviews answers (Lines)</i></p>	<p style="text-align: center;"><i>Initial open codes</i></p>
<p>1. " actually, all in the team agrees that In our company Ideas and concepts are communicated cross-departmental, in essence, we are encouraged to have an open approach of exchanging our technical knowledge without any retractions.</p>	<p><i>Ideas and concepts are communicated cross-departmental</i></p>
<p>3. " as I understood the question I think yes, In the company where I work company 'x,' I feel, that there is a kind of communication protocol between my department and the R&D department "</p>	<p><i>Encouraged to have an open approach to exchanging our technical knowledge Communication protocol between my department and the R&D department "R&D department</i></p>
<p>1. "Well, I think, or no, I am quite sure that in our organisation, as I understand that the management develops annual or semi-annual workshop inviting experts to discuss potential technological issues, we always look forward to attending these workshops as we feel it is a kind of refreshment of our daily working routines.</p>	<p><i>The organisation encourages latest trends in the field of telecommunications management develops annual, or semi-annual workshop Inviting experts to discuss potential issues, technological issues. meet international speakers.</i></p>
<p>2. " yes, sure of what I continuously realise that our organisation encourages the latest trends in the field of telecommunications by allowing engagement with workshops that allows employees and managers to meet international speakers that can be both academic or professional from the industry</p>	
<p>Our management has special annual budgets for specialised telecommunication & projects. 2. " Our organisation can support financially any potential courses for employees that can lead to skills enhancement and enhancing the learning process."</p>	<p><i>Management has special annual budgets specialized telecommunications and projects, Support financially any potential course, skills enhancement, enhancing the learning process</i></p>
<p>1. " In most cases as I understand the case that the of 'y' management requires meetings/report that is called "awareness" meeting /reports summarizing progress, we are invited to a meeting that is circulated to us every month if anything came up urgently we are urged to document all reports and send it within no more than 7 working days.</p>	<p><i>Management requires meetings/report — awareness" meeting.</i></p>
<p>1. " As a manager, I can tell you that employee's demographic classification in our organisation can play a certain role in deciding efficiency knowledgeable environment efficiency as a telecommunication company, moreover, 2. " employees experience/domain, employees Educational backgrounds, employees Age are also taken into consideration as factors that can enhance the process data</p>	<p><i>Employee's demographic classification, Employees experience/domain. Employees educational backgrounds</i></p>

Table 5.3: Initial codes extracted from the text

5.6.2 Discovering Categories

In the categorising process, each researcher can categories the data in the transcript according to a particular assumption and interpret the text differently (Gibbs, 2018). Categorising was the act of coding the selected initial codes from phrases that were interpreted by the reader or researcher. The guideline presented in this section on how to extract categories were motivated by the seminal work of Birks et al. (2013) who tend to list a comprehensive and clear set of guidelines, focusing on the concepts and relations amongst them, moreover, these relations were discovered systematically in an iterative way, a guidelines.

Guideline	Main Activity	Comment
1	Develop categories	Using the initially collected data from interviews transcripts and labelling it into categories according to the research own understanding develop categories.
2	Saturate categories	Saturation refers to the continuation of the data gathering process thru interviews that relate to the same category until no more new information can add anything from the participant's answers.
3	Abstract definitions	Abstract definition refers to providing a summarised description for each category to keep in line with categories that relate to the same criteria.
4	Fully exploiting the category	Some categories might have subcategories; the researcher must keep talking memos to differentiate between any potential new categories emerging from the transcripts.
5	Build a connection between built categories	This refers to the second phase of coding called the axial coding when the researcher starts drawing relations between built categories of the research.
6	Keep comparing between categories to build a more comprehensive relational illustration between categories	Examine if the built relations can be illustrated as a more comprehensive model or can have a more relational association.

Table 5.4: Guidelines for extracting category adapted from Birks et al. (2013)

5.6.3 Naming Categories

Categories terms were employed to point out to certain processes rather than pointing to long clarifications Glaser (1978). For example, the category name '*well-established relations with data providers*' was selected over initial codes. The mentioned processes

explain the act of involvement with any data provider. Researcher of the current research was looking for a term that references the act of (connecting with providers, calling suppliers, or paying for data resources). Depleting participants' words in category names, famous as in Nvivo coding, is also encouraged as a method of remaining factual to the data (Glaser 1978). The categories naming, and explanation of the categories conveyed to one of the following behaviours to determine the final naming.

- Option 1: Some of the categories were extracted from terms and ideas learned from literature; however, in some cases, literature terms were found somehow limited, so the researcher used broader descriptive terms identify categories.
- Option 2: The use of a secondary researcher that provided a second opinion for the naming category, this process of naming and renaming categories had also assisted in the process of bias reduction in extracted categorised.
- Option 3: used informants' terms, the help of Nvivo automated words frequency extracted directly from the transcripts coded in the open coding process.

5.6.4 Identifying Hierarchical Structure of Categories

In GTM, when identifying categories, they may be treated as having properties, or dimensions just like colour specifications (shade, intensity). For example, when the current research used the phrase “Allocating financial budgets in category C6 in table 5.4. It was examined as follow in table 5.5.

Category	Intensity	Frequency	Extent
“Allocating Financial Budgets “	Highlow	Often... Never	Long...Short

Table 5.5: Example of hierarchical categories structure.

The current research aimed at creating a description of variance along with each category as much as possible, and in most categories.

5.6.5 Constant Comparisons

Constant comparison in GTM coding is defined as “*comparing incident against incident for similarities and difference* “ (Corbin and Strauss, 2008). In the current research

constant comparison was undertaken by reading the interviews transcript many times by more than one researcher, so as to reduce any kind preliminary bias, moreover achieving the constant comparison process is required as a way of comparative analysis that engaged a constant comparison between each response from a single participant of the semi-structured interviews with what was collected from all previous participants until reaching an ending point of categorizing. By constantly looking backwards and forwards and comparing the previously collected data with current data and documenting the relative differences and similarities using memos.

The constant comparison in the current research was critical to evaluate the impact of demographics on the responses for future research initiatives; as for the current research it was imperative for the process of extracting categories and constantly comparing new answers with extracted categories. Memo Writing

5.5.6 Memo Writing

In the current research memos were, created as written notes to get ideas and views concepts in the following key research stages,

1. Throughout the interviews.
2. While transcribing the interviews.
3. While coding the data.

Memos in this research were valuable instrument during data collection and data analysis, as they were required to be a tool in drawing and tracing the process until final codes were extracted. It should be mentioned here that memos are natural tools or notes that occurred from the data itself, in the bellow section an example explored how the software NVivo was used to assist the process of memo writing, it has a built-in tool for generating memos. The researcher initially used many codes to organise and assign empirical data logically until the coherent structure was achieved.

The researcher in the current research followed Glaser (1978) guidelines in documenting the memos. Generating effective memos helped in assisting the process of coding the data, extracting categories, extracting relation, and finally extracting theories. Moreover,

the use of memos was undertaken in the constant comparison process to document any similarities and differences that had appeared while collecting data and coding the data.

The subsequent guidelines in writing the memos were followed and exactly quoted by (Glaser, 1978);

1. *“Keep memos separate from data.*
2. *Stop coding when an idea for memo occurs, so as not to lose the thoughts.*
3. *A memo can be brought to you by literally forcing it, by beginning to write about the code.*
4. *When a lot of memos on different code appear similar; compare the codes for any differences*
5. *That may have been missed. If the codes still seem the same, collapse to codes into one code.”*

Interview Question	Answer	Memo	Memo Date /Time
<i>Do you have specific practices inside your organization that reflects any degree of data sharing between departments or outside the organization scope? Please provide examples?</i>	In our company there is a quick <u>information flow</u> , e.g., if a business unit obtains important information it communicates this information promptly to all <u>other business units or departments</u> . And Our management demands periodical <u>cross- departmental meetings</u> to interchange new developments, problems, and achievements.	Relate this when coding to " **Assimilation Node in Nvivo. SUGGESTED CODES in interview: Information flow, 2, Other business units or 3. Departments, 4, Interchange new developments. *** Saturation reached after this answer,	March 20/2018, Tuesday, 11 :00 Am. Zain Head office

Fig 5.7: Memo /open coding analysis for the current study.

Figure 5.7 exemplifies one of the memos used to document notes for one of the research categories. Conversely, Charmaz (1999) suggested that memos more likely to be used as a personal self-conversation by the researcher, and this conversation is not required to be shared publically unless to secondary researchers working on the same research.

5.5.7 Theoretical Saturation

Theoretical saturation in the current research demonstrated the process of knowing when exactly to stop with collected data, and also with coding the data needed for extracting new categories, seeking for variation or similarities. Data collection proceeded until reaching theoretical saturation; basically, the new data is not adding any significance to the existing data collected from the different participant. Therefore, it is important not to start theoretical sampling too early in the data collection process. Rather, the researcher should resume with sampling to exploit variations, and theoretical sampling should be used later in the process. A major problem faced in reaching theoretical saturation was the absence of a previous literature review that may be followed as a standardised technique in reaching theoretical saturation. Nevertheless, founders and scholars of GTM such as Charmaz (1999) suggested that reaching saturation is required to be personal opinion; mentioning that theoretical saturation is a very critical concept in GTM research, and is more or less based on a subjective decision of the researcher. For that reason, most GTM scholars suggested not starting theoretical sampling in the very early stages, as it may lead to biased theories. Likewise, they suggested waiting until a further reasonable amount of data is collected (Gibbs, 2018). In the current research, the challenge was to determine when to finish collecting data, and when to finish adding new data for the process of category extraction. Correspondingly, this led the researcher to conduct several interviews for extracting each category until getting saturated.

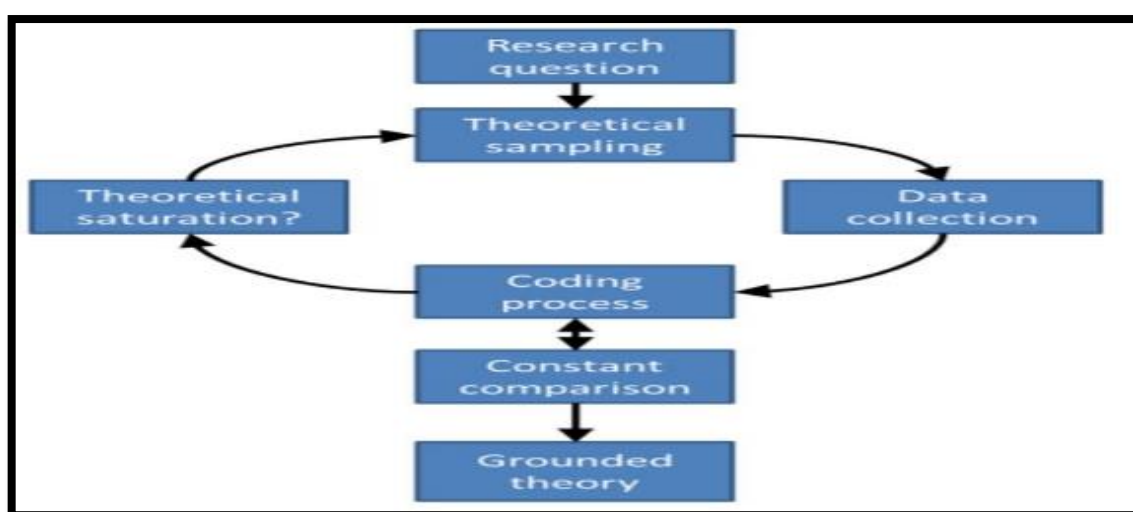


Fig 5.8: Process of theoretical saturation.

The main intention of this method was to promote a final refinement of certain categories and properties because it allows maintaining the balance between learning from empirical data and existing theories without diminishing the value of an inductive approach. The process of theoretical saturation was rather challenging as the researcher presumed it.

The bellow diagram illustrates the number of participants needed to extract each category.

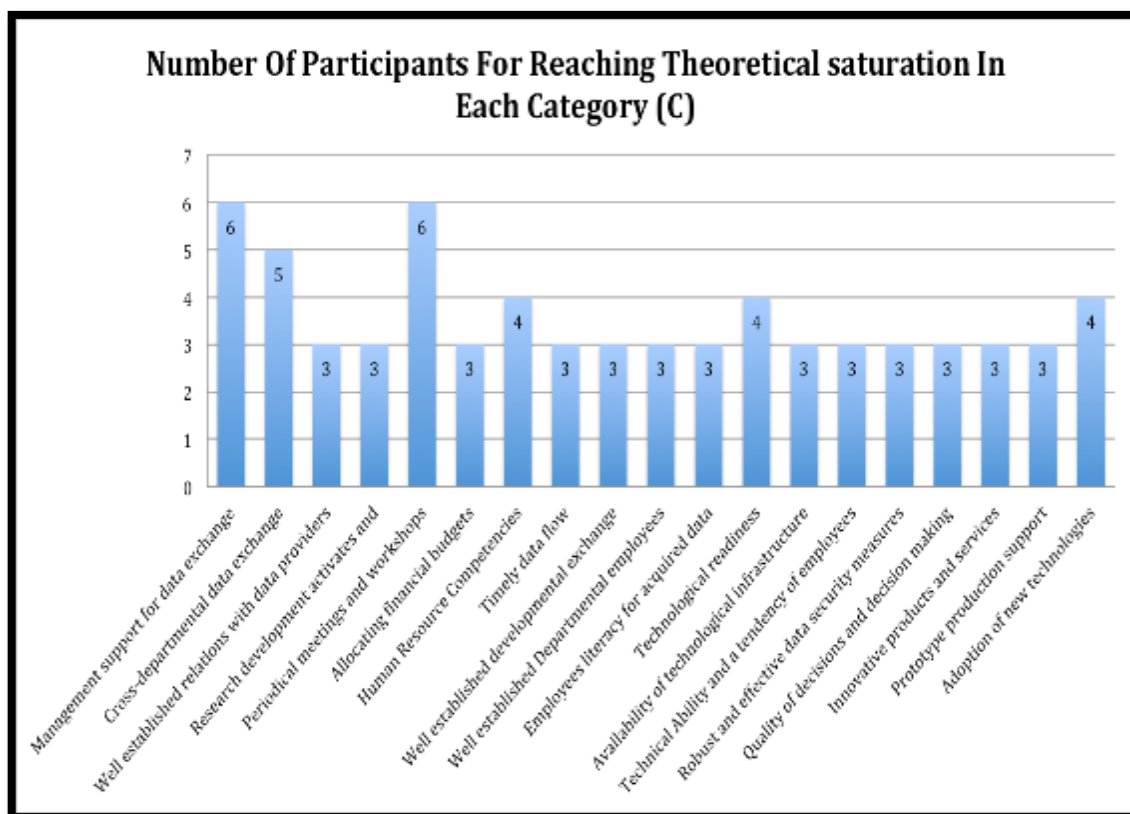


Fig 5.9: Number of participants reaching theoretical saturation.

A minimum number of (3) participants were used to reach the theoretical saturation, with no maximum limit as presented in figure (5.9). Theoretical saturation in the current research demonstrated the process of knowing when exactly to stop with collected data, and also when to stop with coding the data needed for extracting new categories, seeking for variation or similarities, in GTM there is no standardized way to reach saturation, it is according to the contents of the transcript (Gibbs, 2018). The main intention of this technique was to promote a final refinement of certain categories and properties, also allowing maintaining the balance between learning from empirical data and existing theories without diminishing the value of an inductive approach (Charmaz, 2012).

Appendices B reflect coding of each category in Nvivo, and how each category is linked to a specified number of participant and text needed to code the initial codes and create categories.

5.5.8 Results from Open Coding

The resulted number of categories appeared after conducting the process of open coding was (19) different categories; these were classified from a total of (57) codes also extracted from several lines and direct quotes from the lines of the transcript.

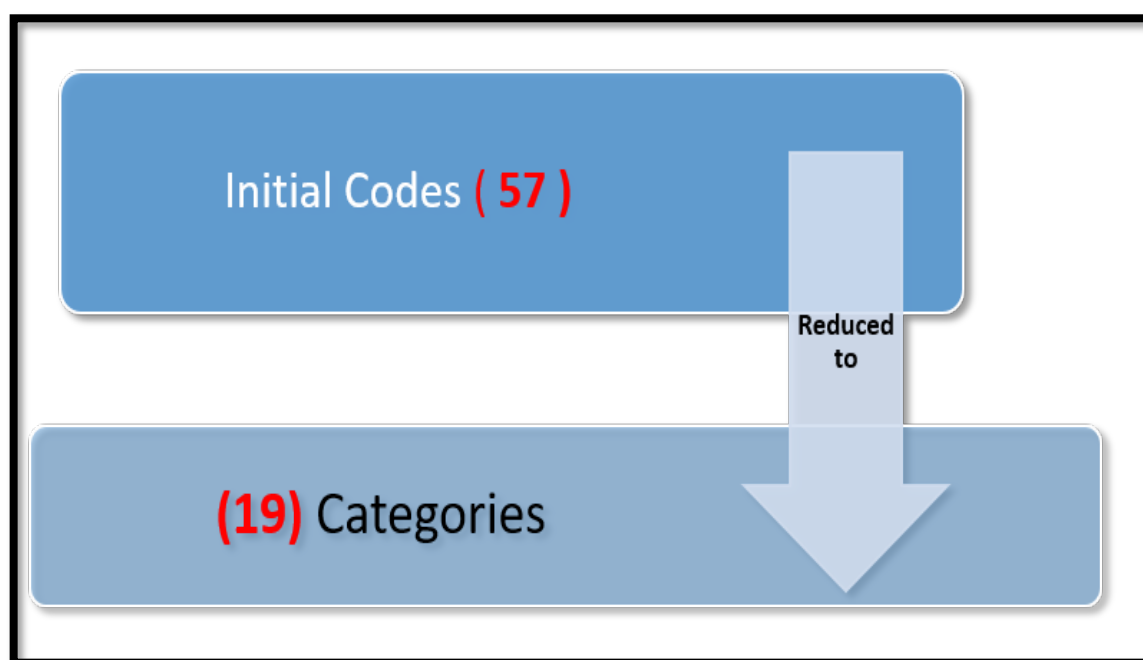


Fig 5.10: Open coding result diagram

Each category was coded as a sub-node in Nvivo, later rationalised into the suitable main node that is referenced as a theme in the axial coding process. In open coding, the main input was the participant's transcripts, and the final output was the developed categories. Assigning a phrase to represent a certain chunk of a data and then labelling this data according to respondents answering patterns extracted open codes; the essence was to reduce the amount of data (Glaser, 1978). Table 5.5 in the subsequent page illustrates the total of (19) categories extracted through the open coding process. Generating several (57) initial codes, reduced to (19) categories was both parts of the open coding process. The main categories included factors for assessing the organisational ACAP that had a certain

link with business intelligence components and that was directed throughout the research question and interview questions.

Category ID (C)	Coded Category
C1	Management support for data exchange
C2	Cross-departmental data exchange
C3	Well established relations with data providers
C4	Research development activates and investments
C5	Periodical meetings and workshops
C6	Allocating financial budgets
C7	Human resource competencies
C8	Timely data flow
C9	Well established development exchange meetings
C10	Departmental employees communication
C11	Employees literacy for acquired data
C12	Technological readiness
C13	Availability of technological infrastructure
C14	Technical ability and the tendency of employees
C15	Robust and effective data security measures
C16	Quality of decisions and decision making
C17	Innovative products and services
C18	Prototype production support
C19	New technologies adoption

Table 5.5: Final extracted open coding categories.

In each category (c) a specific number of participants were needed to reach theoretical saturation, some of the extracted categorised required the researcher to go back and collect more data to reach the theoretical saturation and to be sure of similarities and differences amongst the answers of the participants. Such as the category C12 and C14 is appearing as similar categories in technical availability and tendency with employees compared with technical readiness. Theoretical saturation also indicated that participant answers were most coded and covered in the selected data for the process of forming categories. The table in appendix F indicated the results for the categories organised according to participant's number and percentile coverage within the whole collected data.

5.5.9 Abstract Definitions and Description of Resulted Categories

The current section provides a theoretical explanation, and additional empirical verification from participant answers provided as an indication of each extracted category. Additionally, this section conveys certain examples from transcripts for each given category. As the table bellow in table 5.6:

Axial Coding /Theme /ACAP Dimension	Open coding /Category (C)	Abstract Definition/ Description	Sample from Participants answers
Acquisition	(C1) Management support For data exchange	This category was built upon codes from participants that described any managerial initiatives for encouraging data exchange or within the interviewed teams, departments, and individuals. (Flatten et al., 2011).	<i>"Yes, as a telecom company, we have formal managerial policies, procedures for allowing data exchange amongst different departments." "I feel that It is appreciated when employees in my department procure information from other industries as well" example: we do collaborate with the finance department and marketing for asking for certain data sets needed.</i>
Acquisition	(C3) Well-established relations with data providers	Referencing all codes that ascertained the obtainability of data sets from different providers, suppliers, or even competitors. Can be either commercial providers or others that can add value to the department's research	<i>"I am aware that our strategic management established strategies for good relations with data commercial providers such as data providers "x" and international company 'y', potential data providers, suppliers for our hardware equipment also sometimes provide us with specific data</i>

		and knowledge creation Zahra and George (2002).	<i>analytics if required</i> ".
Acquisition	(C4) Research development activates and investments	This category has directly designated an indication for the researcher to relate to the acquisition dimension in absorptive capacity, as most participants who indicated research and development presence for a department who supports this category, research and development initiatives were coded in this category (McGrath & MacMillan, 2000);(Chaudhary and Batra, 2018	<i>"Our department has allocated specialised personnel to deal with research and potential research but no formal department". However, we do have a special R&D department with six formal staff". "Our organisations have publications registered under its name".</i>
Acquisition	(C5) Periodical meetings and workshops	This category referenced all codes from participants that indicated that their organisation supports any kind of timely meetings either with external experts that can add more acquired knowledge to employees, or could be only periodical meetings between staff and management regularly. (Flatten et al., 2011)	<i>"Actually, we do develop annual or semi-annual workshop inviting experts to discuss potential technological issues; we even encourage latest trends in the field of telecommunications by allowing engagement with workshops that allows employees and managers to meet international speakers that can be both academic and professional from the industry".</i>
Acquisition	(C6) Allocating financial budgets	This category referenced any financial support from management to support any data acquisition activities (Elbashir, Collier and Sutton, 2011) ;(Silva et al. , 2014)	<i>"As far as I am concerned, We have special annual budgets for specialised telecommunication specific projects. Supporting financially any potential courses for employees that can lead to skills enchantment and enhancing the learning process".</i>
Acquisition	(C7) Human resource competencies	This category is defined as a combination of any determinate, considerable knowledge, skills or personal elements that were required as	<i>"A consideration as a department support financially any potential courses for employees that can lead to skills enhancement and enhancing the learning process.</i>

		enhancers to the employee performance in acquiring knowledge and contribution for organisational success in assimilating potential systems. (Robert et al., 2012)	
Assimilation Transformation	(C10) Departmental employee's communication. C (14) Technical ability of Employees	This category is different from the previous category that indicated cross-departmental data exchange. Most participants engaged in the subsequent data acquirement phase in both companies mentioned departmental employees communication. (Elbashir, Collier and Sutton, 2011; Dabic et al., 2019.) Also, the same answer was used to code c (14) technical ability of employees.	<i>"Informal/formal communication amongst employees is encouraged in our organisation to support data exchange following a formal hierarchy of positions and levelling for whom to report to". Also, our technological infrastructure available in the company enhances our communication abilities.</i>
Exploitation	(C16) Innovative products and services	This category was extracted with its high relevance to the telecom industry, referencing the number of new products, services they produce with the aid of all provided data acquisition, assimilation, and exploitation categories mentioned above (Flatten et al., 2011); (Harris and Yan, 2018).	<i>"However, we launched last year innovative products/services promptly about our outcome of the research, process, and analysis. Such as the latest mobile devices in the telecom and bids for offered lines." " Our company has a number of patents in regards to its announced products " .</i>

Table 5.6: Open coding extraction sample.

5.7 Computer-Assisted Qualitative Data Analysis Software (Nvivo)

This section demonstrates how the use of a computer-assisted qualitative data analysis software program (CAQDAS) was used in the first two coding phases. CAQDAS in the current research was treated as a set of tools for moving beyond the theoretical ACAP understating to a more descriptive model grounded in data. Recent research claimed that using NVivo software in their methodological approach would positively lead to more quality-based research comparing to other research that does not tend to use analytical software such as NVivo (Breckon and Jhonston, 2018). Nvivo was used to facilitate the analytical grounded theory extraction approach significantly in the coding process and extracting the final set of theories in the current research. The basis of grounded theory coding techniques is required by itself an iterative mixed method process that allowed the researcher to move amongst data collection and analysis, writing memos, coding and finally axial coding modelling. The choice of NVivo as (CAQDAS) in the current research enabled such iterative tactics to be implemented. The latest version of the software package NVivo version (12.0) was used for accelerating the coding process in the two phases of coding open, and axial. The full process of automated coding is illustrated in the flow chart below;

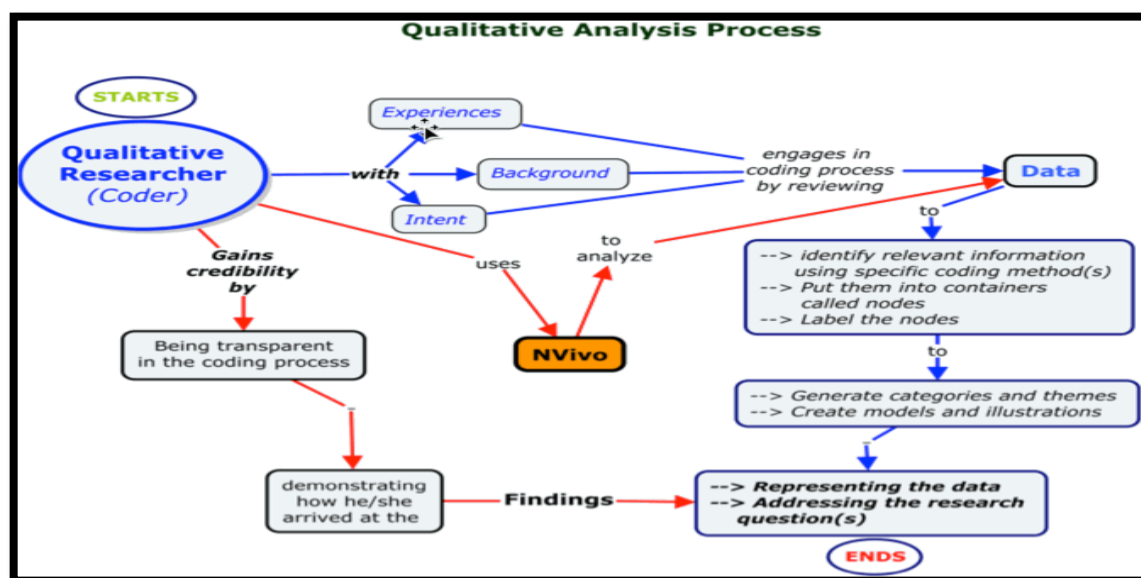


Fig 5.11: Flow Chart analysis with NVivo(Breckon and Jhonston, 2018)

5.7.1 Word Frequency and Word Cloud

The initial process of open coding using NVivo was important to attain a very open idea of all text within the interview transcripts', and give the researcher more confidence that some of the words are relevant. This allowed the researcher to have a tabular indication of the common phrases, and that helped the researcher to use some of the phrases in the coding process.

Initially, the researcher ran a word frequency query that excluded any stop words, the most frequently occurring words from the whole interview transcripts were automatically generated in a well-constructed table that includes table columns as in appendix s section for the full table of most frequent words, summarised as:

1. Column one: most frequent word phrases are organised alphabetically.
2. Column two: length of each phrase
3. Column three: count number of times each phrase occurred within the transcripts.
4. Column four: subjective Percentage: the frequency of the word comparative to the total words counted and presented in percentage compared to all the words.

The most frequent words appeared within the current data analysed using word cloud were (**organisation, employee, data, knowledge, management**). Furthermore, in order to have a very abstracted view of the word frequency, NVivo software was used to generate what is called by a word cloud, which is described as a visualized view of the big table containing frequent words, and that appeared within the transcripts using a visual image as bellow, the word cloud presents the most (100) frequent words.

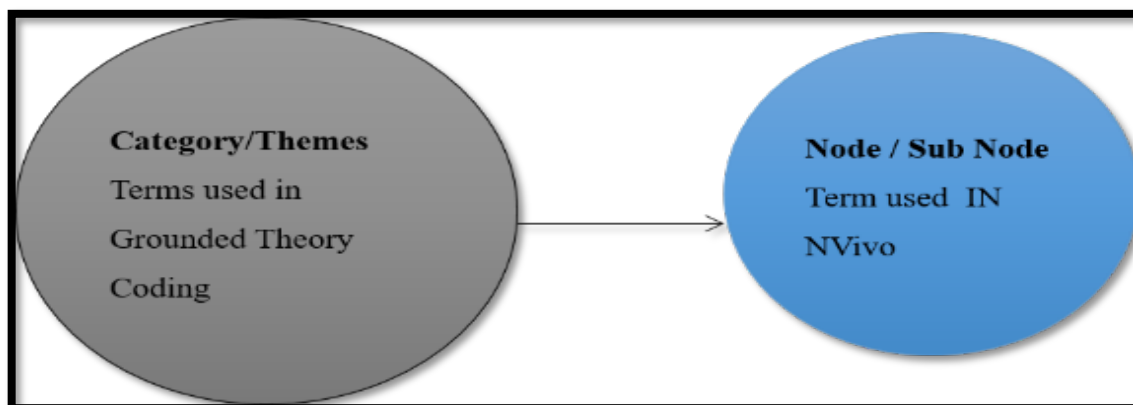


Fig 5.13: Node and category terms used in grounded theory and NVivo

Sustaining the categorised structure (node /sub node relationships) in ‘NVivo node explorer’ permits the researcher to discover associations below scarce settings. Additionally, this allows preserving the visualisation process, such as characteristics, the depiction of documents or memos to deliver circumstantial or implication to categories discovered.

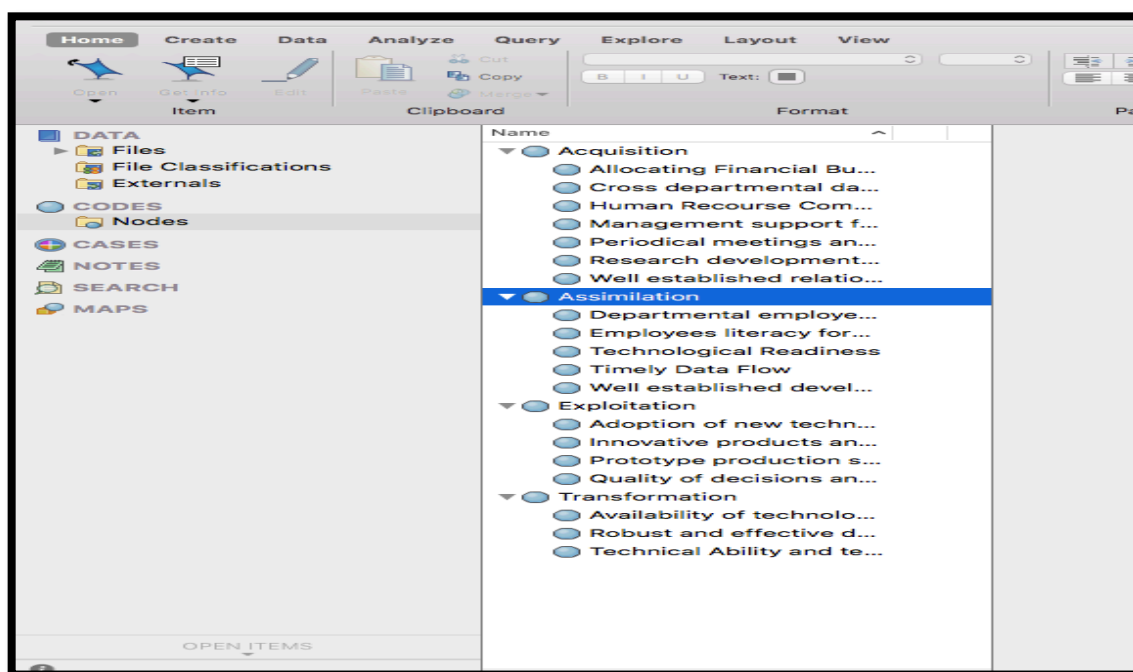


Fig 5.14: Screenshots categories Nodes /Sub Nodes Nvivo.

Sub nodes were sorted according to the most referenced sub-node in the transcripts, compared to all the other sub-nodes. Each sub-node can contain as many evidence of coded text as the researcher finds relevance.

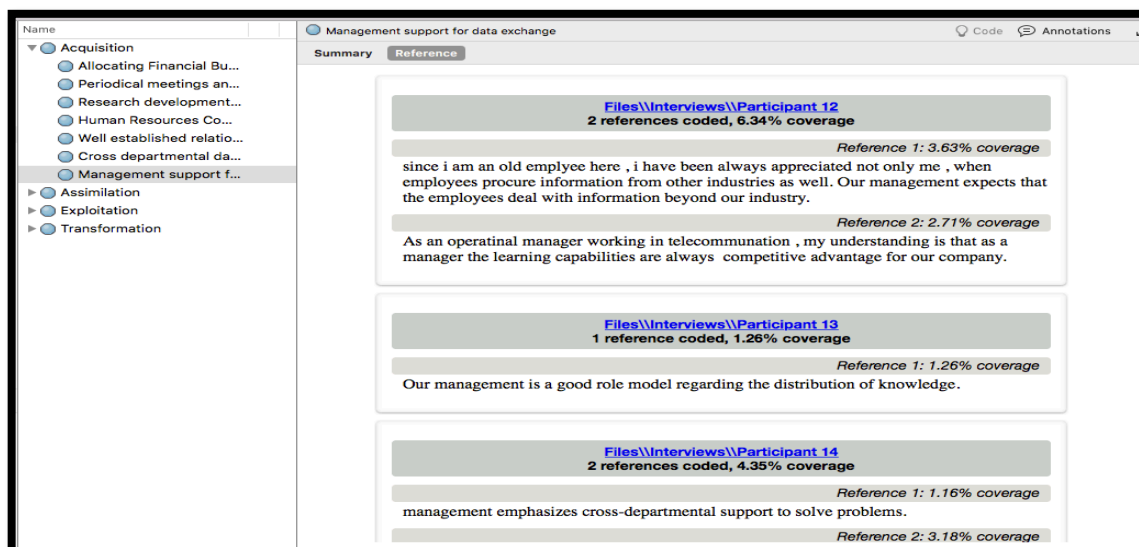


Fig 5.15: Screenshots from Nvivo for the nodes and their coded transcripts

As an example from the data coded in NVivo is the sub-node or category ‘Management Support for data exchange’. All categories participant and coverage results are attached in the appendices section E, F.

The screenshot shows the 'Summary' view for the 'Management support for data exchange' node. It displays a table with the following data:

File Name	In Folder	References	Coverage
Participant 12	Files\Interviews	2	6.34%
Participant 13	Files\Interviews	1	1.26%
Participant 14	Files\Interviews	2	4.35%
Participant 17	Files\Interviews	2	10.05%
Participant 3	Files\Interviews	1	1.26%
Participant 4	Files\Interviews	4	5.60%

Fig 5.16: Screenshot category referenced with participant and coverage

In open coding, each participant transcript was analysed according to how many nodes that participant was engaged in or (coded). Afterwards, a complete analysis of the

coverage of the participant's interviews answers also was calculated and referenced like the above table showing participant answers location, number of references and coverage.

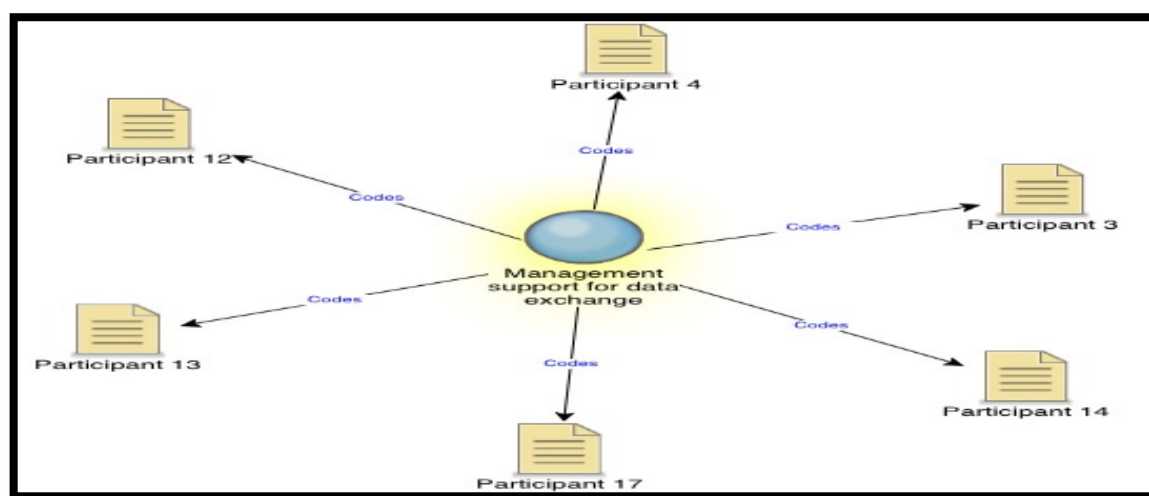


Fig 5.17: screenshot category with several participants

Similarly, the above diagram is a screenshot that depicts a plotted category “*management support for data exchange*” that was coded throughout the initial codes of participants 3, 4, 12, 13, and participant 17. This indicates that all the given five participants’ interview answers were coded into initial codes concerning the category management support for data exchange.

5.8 Coding Phase 2: Axial Coding

In this phase, the most critical goal was to derive a coding paradigm or theoretical model that links categories with relational themes. After having a complete set of coded categories, and everything has been looked at from the previous transcripts.

5.8.1 Axial Coding Results

The result from axial coding is (19) categories classified into (4) pre-defined themes: Acquisition, Assimilation, Transformation, and Exploitation. Classification process was based first on evaluating the categories logically into four main classes according to Strauss and Corbin(2001) ACAP model. The input to the axial coding was the extracted categories; the output is building a relational model that relates each theme of ACAP into its corresponding category as illustrated in figure 5.18.

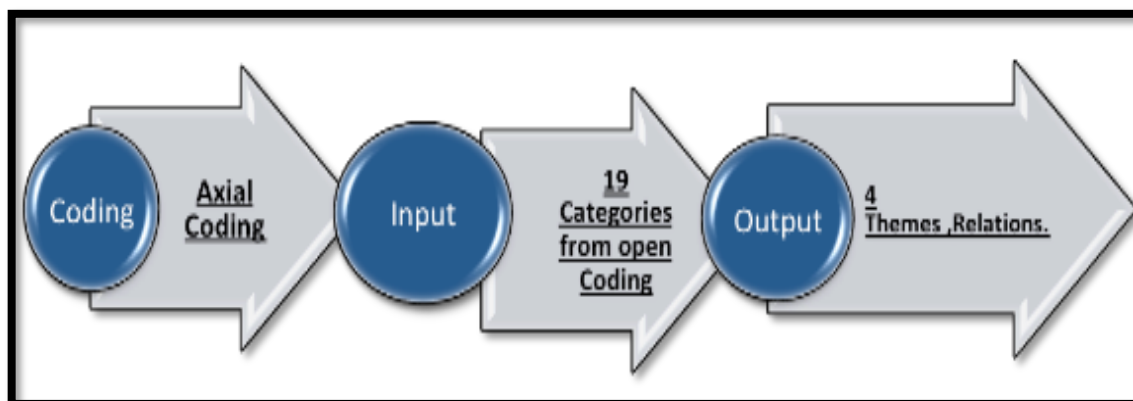


Fig 5.18: Axial coding input and output for the current study.

In axial coding, it was looked at the conceptual categories extracted from the open coding phase. Their interdependencies were examined for outlines that might explain the relationship between ACAP different dimensions. In line with the current research, the process of linking categories to fit each of the ACAP dimensions is referred to as axial coding (Strauss and Corbin, 2001). The results presented a total of (7) categories were found relevant to the dimension Acquisition, (5) categories for Assimilation, (3) categories for Transformation, and (4) categories for Exploitation. All explained in the bellow table number of categories related to each theme as an output of axial coding.

Categories to each Theme	Theme Name/ACAP Dimension
7	Acquisition
5	Assimilation
3	Transformation
4	Exploitation

Table 5.7: Extracted categories and themes.

It is imperative to mention here that axial coding was not grounded in extracting the selective themes. However, the purpose was to relate the grounded categories from open codes to the main dimensions of ACAP that references the model of George and Zahra (2012). A relational model was built subsequently to illustrate these relationships between each theme and its corresponding categories, as in figure 5.20.

Thematically and as recommended in GTM research, the current research applied Strauss and Corbin (2001) paradigm model components that guided the axial coding model creation to create themes in axial coding. Each component of the model allowed the reflection and creation of certain them of axial coding. Paradigm model theoretical component is as follows,

Casual conditions: selecting any categories that may have a cause that influenced the central phenomenon of the research - knowledge acquisition and knowledge assimilation were chosen as a causal condition of the central phenomenon of the research.

Phenomenon: a central phenomenon in the study by itself – (Absorptive Capacity effect on BI assimilation or after implementation.)

Actions /Strategies: researcher asked questions about people in the organisations.

Consequences: outcomes of results of actions, and results from the strategies.

The table below 5.8 illustrates the paradigm model components adapted from Strauss and Corbin (2001) view of GTM axial coding.

	Model Component	Description	Theme	Example from the current research Model
1	Causal Conditions	What categories that are required as conditions that lead to the central idea	Acquisition and Assimilation Tasks and Categories that point out when, while, since, because, due to, on account of.	Allocating financial budgets, cross-departmental communication
2	Phenomenon	Central idea	It was identified earlier in the literature review phase	Absorptive Capacity effect on business intelligence assimilation
3	Actions/ Strategies	What strategies engaged in influencing that situation, goal-oriented?	Assimilation and Transformation categories included that led to achieving the final result and goal	Technical Ability and the tendency of employees Robust and effective data security measures
4	Consequences	Outcomes of results of actions, and results from the strategies.	Exploitations Categories that point to outcomes and results	Innovative products and services

Table 5.8 Paradigm model components adapted from Strauss and Corbin (2001)

The process of axial coding mostly referred to the act of taking the refined core categories extracted in the open coding phase, and carefully assigning each code to a predefined theme of ACAP that was all defined and described within the early exploratory phase of literature review. Also in figure 5.19 illustrates how each dimension of ACAP was associated with each of the paradigm model components.

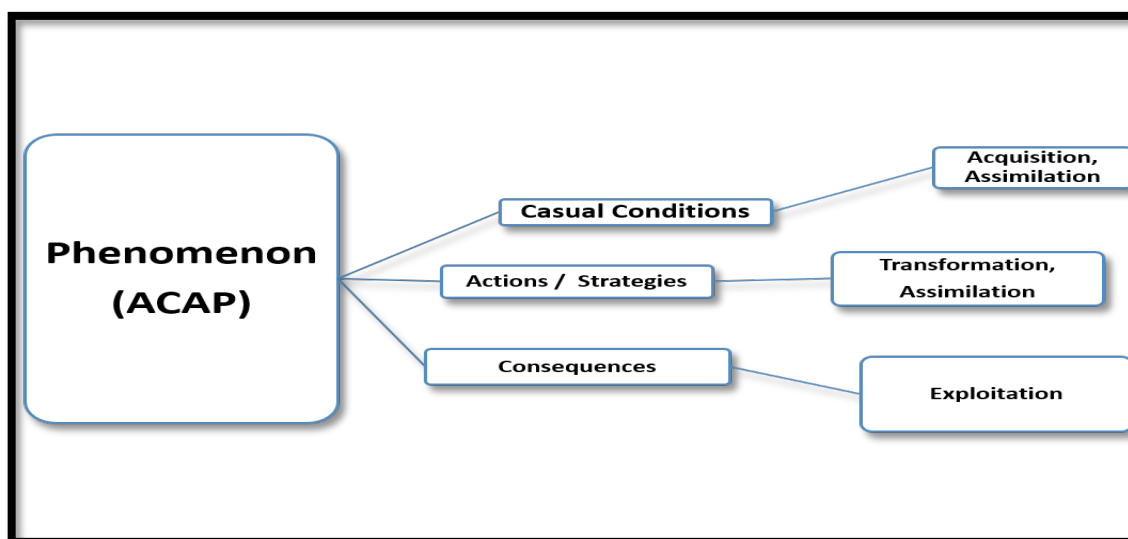


Fig 5.19 Paradigm model resulted from initial Axial Coding

The given themes were extracted earlier in the previous chapters. Building on the above components of the paradigm model, the bellow initial paradigm models was created before assigning categories to the themes.

Extracting Codes		
Themes/Axial	Classifications /Open Codes	Codes /Initial Codes
Acquisition	Management Emphasis Data Exchange	<i>“Management encourages employees to use information sources within and outside industry “</i>
		<i>“Manage expects that employees deal with information beyond their industry</i>
		<i>“It is appreciated when employees procure information from other industries as well.”</i>
	Research And development initiatives	<i>“Joint Research Projects within the company “</i>
		<i>“Joint Research Projects within the outside company “</i>

		<i>"Availability of R&D departments "</i>
	Timely meetings with experts	<i>"Periodical meetings with external experts "</i>
Assimilation	Cross departmental data exchange	<i>"Concept exchange is cross departmental"</i>
		<i>"Cross Departmental Support to solve problems "</i>
		<i>"Personnel exchange for employees for certain projects amongst departments "</i>
		<i>"Management Team sharing knowledge "</i>
	Management emphasis for data distribution	<i>Employees are conscious about who Possesses special skills and knowledge and for who Certain information is of interest.</i>
		<i>" Management is a good role model regarding knowledge distribution."</i>
		<i>"Management demands periodical cross-departmental meetings to interchange new developments, and achievements."</i>
Transformation	Employees tendency for Data Transformation	<i>"Our employees successfully link existing knowledge with new insights."</i>
		<i>"Our employees can apply new knowledge in their practical work. "</i>
		<i>"Our employees can structure and use collected knowledge."</i>
	Organisational Policy for Data Transformation	<i>"Company policy encourages our employees to engage in further training and continuous learning."</i>
		<i>"Technological training for data transformation tools periodically "</i>
	Exploitation	Innovative products services
Prototypes support		<i>"Management supports the development of prototypes."</i>
Adopting new technologies		<i>"Company can work more effectively by adopting new technologies."</i>
		<i>"Management encourages employees to combine ideas cross-departmentally using analytical technologies. "</i>

Table 5.9: Initial, open, and axial codes

Subsequently, the following figure 5.20 represents a diagram that links each theme with its categories, and which demonstrates the final relational model for extracting the ACAP qualitative categories as a result of both open and axial coding techniques. The relational model encapsulates the (19) categories extracted in the open coding phase; later each category was referred to the corresponding ACAP theme.

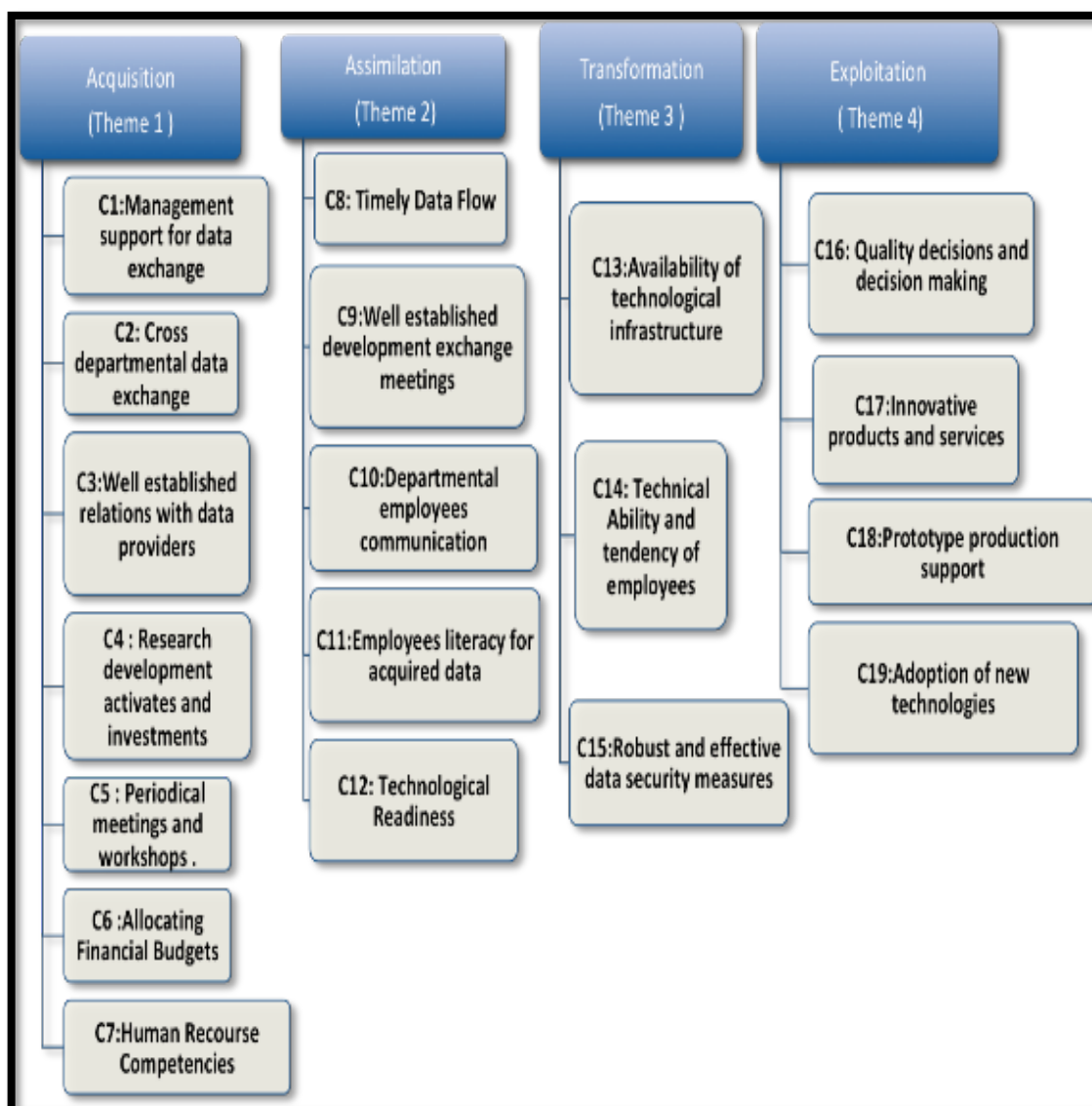


Fig 5.20: Final grounded relational model ACAP qualitative categories.

Drawing on the extracted model, the proposed categories were coded according to the answering patterns established within the number of participants through an open coding process. Later, these categories were assigned to the dimensions of ACAP referenced as themes within the GTM reflection

5.8.2 Automated Axial Coding

Axial coding in automated grounded theory is roughly presented as illustrating models that are able to represent a building visualizations called hierarchy models, and hierarchy sunburst chart, these diagrams were generated to visualize the relations between ACAP linked themes, and that were rationally created through the paradigm model following the Strauss and Corbin (1990) paradigm model elements discussed in the previous sections.

5.8.3 Hierarchy Chart for Coded Categories

Hierarchy chart models were both generated and required to be a useful visualisation technique for exploring and illuminating the relationships between various nodes (themes), sub-nodes (categories), documents, and memos. The hierarchy chart revealed that the dimension/node acquisition had the most referenced categories coverage; this indicates that assimilation and transformation came next in regards to their categorisations. A numerical verification for each theme/node and number or categories referred to the table in appendix F, all needed evidence needed are linked them with participants.

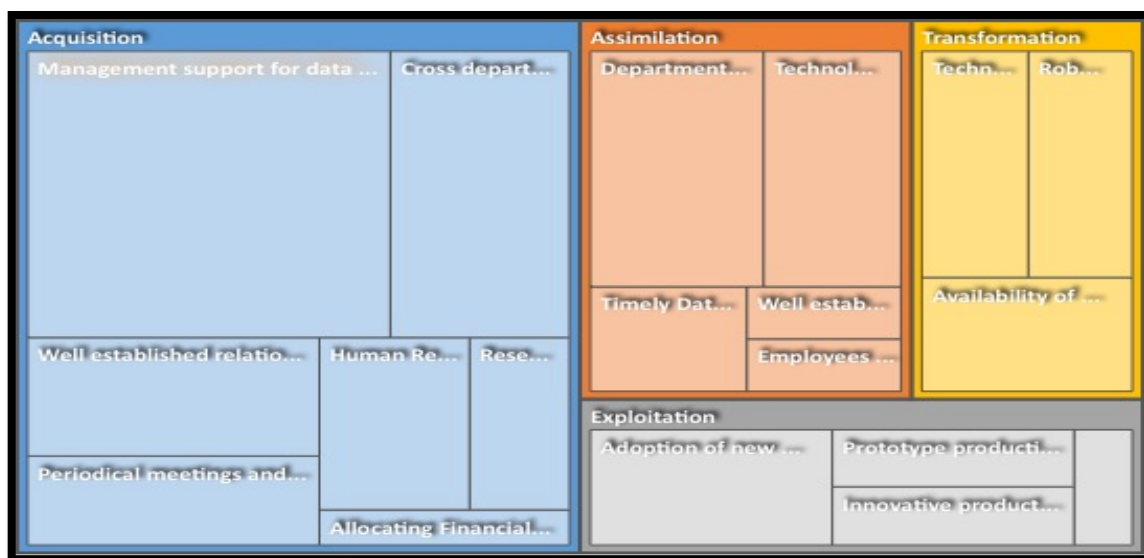


Fig 5.21 Hierarchy chart showing same results of axial codesthe.

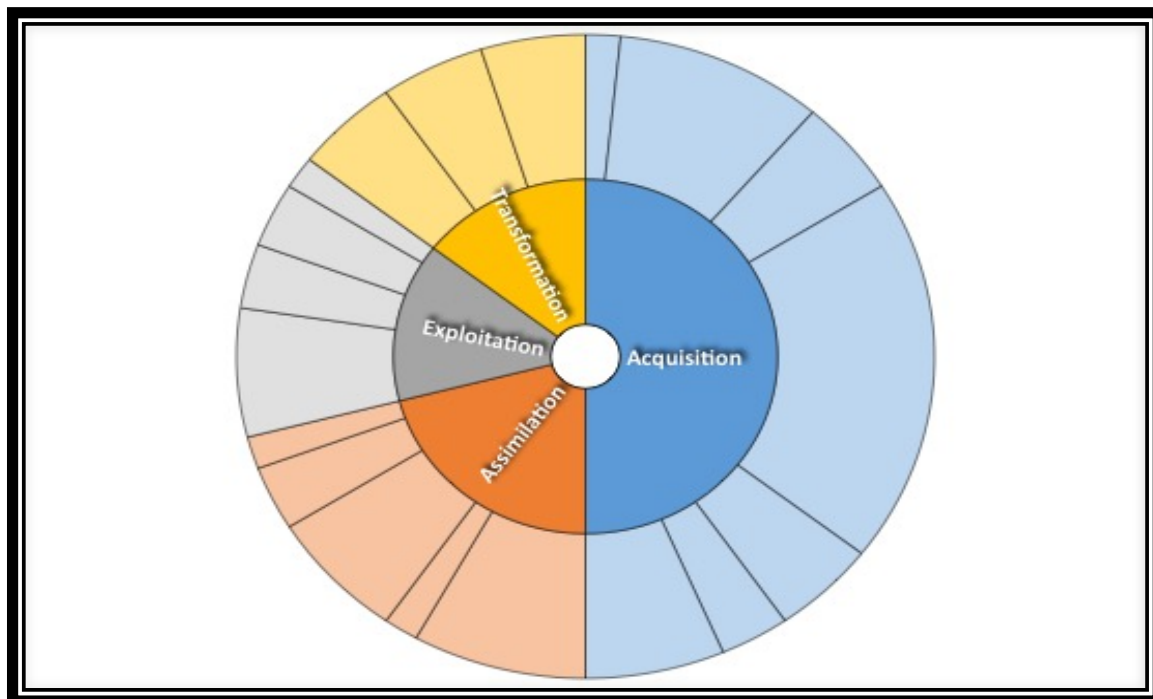


Fig 5.22 Sunburst showing same results of axial codes

5.9 Coding Phase Three: Selective Coding

Glazer (1990) described the selective coding as systematically selecting the core category to other categories and filling in categories that need further refinement. Selective coding is the final coding phase in GTM extraction. The process of selective coding in the current research primarily involved storytelling of the main ideas extracted from undertaking open and axial coding. Likewise, input to the selective coding is the paradigm model from axial coding, and the output is storylines explaining theories derived from the given model as in fig 5.23.

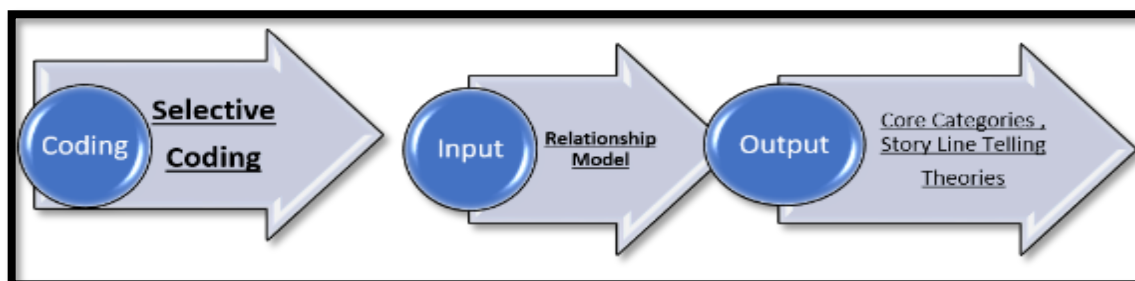


Fig 5.23: input and output of selective coding

The process of selective coding went through the following steps according to Strauss and Corbin (2001),

1. Initially, select one core category, which is required as a central idea around the main phenomenon.
2. Afterwards, constructing a story line around what was selected.

In the current research, the main goal of undertaking the grounded theory approach is to construct categories that relate to the four dimensions of ACAP; selective coding was undertaken as a step further to explain the core categories.

5.9.1 Results from Selective Coding (Theories)

The results indicated the extraction of four main theories proposed by the GTM scheme suggested in the Strauss and Corbin (1999) methods of extraction. However, as mentioned in the above section that extracting theories was not a primary objective in using the GTM method in the current research. Nevertheless, the main goal was to use the categories extracted in the axial and open coding phase and later deploy them in building the ACAP – BI relational model. (Gibbs, 2011) indicated that a genuine grounded theorist should extract only one grounded theory for the whole research phenomenon. This can be a very challenging procedure for the researcher to extract only one core category and draw a storyline around it. Selecting only one core category was a very complex approach to be achieved in the current research due to the number of categories extracted for each theme. The proposed theories are as described as the following,

- **Proposed Grounded Theory (1)**

The first resulting theory was regarding the initial dimension of ACAP knowledge ‘acquisition’. The theory was extracted by concluding a unified category from the set of categories that fulfilled a theme in the axial coding phase. After going through the categories and mapping them to the previous understanding of the theme ‘acquisition’ gained through both data analysis and literature review.

The resulted core category was ‘collaborative data interchange and research support’.

Core Category: collaborative data interchange and research support.

Story Line: organisational knowledge acquisition dimension can be positively measured by the amount of collaborative data interchange and amount of research and development support appearing in a certain organisation.

- **Proposed Grounded Theory (2)**

The researcher faced a major dilemma in extracting a core category in the current theory. Reasons behind this dilemma were that the dimension 'assimilation' was found to a certain extent to be misleading in regards to its organisational elements, this was noticed in both stages of literature review and data analysis. The understanding of assimilation is placed between two dimensions that are acquisition, and transformation and can occasionally incorporate mixed annotations from both. However, eventually, the researcher in the current research managed to compromise by accumulating all collected information from different sources and relying on the secondary researcher to reduce any biased conclusion. The resulting core category was "**Readiness for data Obtainability.**"

Core Category: Readiness for data Obtainability.

Story Line: Organisational knowledge assimilation dimension can be measured by the organisational readiness for data obtainability in a certain organisation.

- **Proposed Grounded Theory (3)**

Extracting the third category was relatively considered simpler compared to theory 1 and theory 2.

The third theory involved knowledge transformation dimension of ACAP. Furthermore, concerning the process of relating all categories to technical and technological data proceeding initiatives in the interviewed organisations. Core category and the storyline for the third theory is as follows,

Core Category: Technical and Technological Data Handling Potential.

Story Line: organisational knowledge transformation dimension can be positively measured by the amount of technical and technological data handling potential within a certain organisation.

- **Proposed Grounded Theory (4)**

The final and fourth theory was concerning the last dimension of ACAP knowledge of 'exploitation. 'The extracted core category accumulated understating from all categories in this theme. Here all categories encompassed of outputs and productions resulting from previous absorptive capacity dimensions initiatives.

Resulting core category and storyline are as follows,

Core Category: Significant products and decisions.

Story Line: organisational knowledge exploitation dimension can be measured by the existence of significant products and decisions that are key categories of the overall organisational performance.

5.10 Qualitative Bias and Bias Reduction

In some qualitative research, the purpose of coding data is to arrange and systemize the overall ideas, concepts, and generate categories similar to ones generated the current research. The resolution of the coding process is to uncover the data through codes and categories (Gasson, 2009). However, the important challenge is to assess the quality of extracted categories and find ways for evaluating them depending on the researcher philosophical standpoint (Mays and Pope, 2000).

In the current research developing a valid theory or set of theories was not the main goal of the research. For that reason, it was imperative to assess the quality of extracted categories that were required as key components used later in extracting the Business Intelligence – ACAP model. An approach suggested by Mays and Pope (2000) in qualitative research provides more richness to coded results by reducing bias shaped throughout a single researcher analysis. They suggested the use of the second researcher as an instrumental approach to reduce bias and protect a single individual interpretation of data. The current research examined the extracted categories that might affect the existence of ACAP within interviewed organisations.

Significant propositions observed while undertaking the bias reduction in the current research process are justified throughout the following perceptive,

1. The dissimilarities and similarities between two researchers or more in (professional experience, personal characteristics, and perspective) can somehow result in variations when interpreting the same data.
2. Variances in researchers' analysis of data or some part of the data might be resolved, and a mutual set of findings can be extracted from both researchers to come out with a synthesised set of categories, or final theory in grounded theory.
3. Finally, and upon the final results extraction, the combined view of two researchers might enrich the credibility of the findings. The procedure of Bias reduction went across two main phases illustrated in diagram fig (5.24).

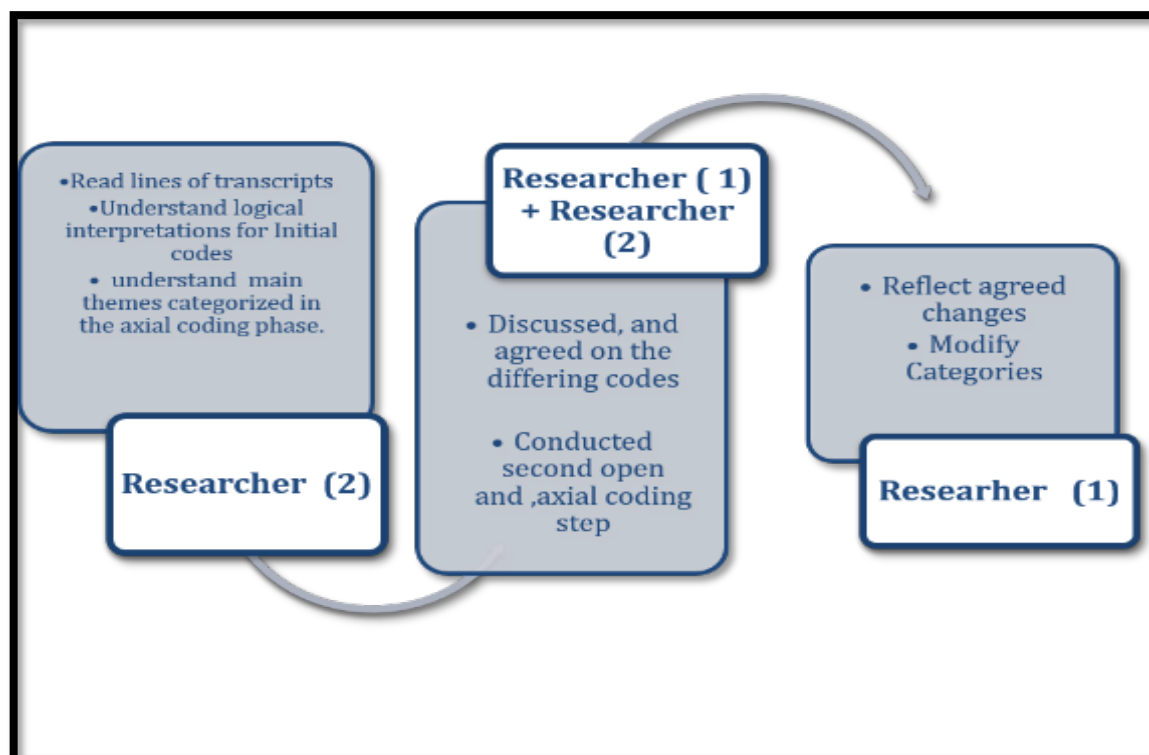


Fig 5.24: Bias Reduction process for the current research.

• **Qualitative Bias Reduction - Phase One**

Initially, in phase one, the second researcher who is senior researcher specialised in information systems and qualitative research, but not very familiar with ACAP to reduce any bias that can affect categories extraction. The second researcher recited the lines of

transcripts of the interviews aiming to understand the open view of the answers, and the logical interpretations of how the lines of text were coded to initial codes by the first researcher. Consequently, understanding the main themes of ACAP categorised in the axial coding phase. These processes of enlightening the second researcher viewpoints were a key driver in preceding with phase two of bias reduction, as phase two, was the actual execution required by the second researcher. The objective from the whole process of bias reduction was to establish a valid unified set of new categories that will be used in extracting the final model of the current thesis.

- **Qualitative Bias Reduction- Phase Two**

In this phase, both researchers discussed and agreed on the contradictory ACAP codes. They then conducted a second open-coding step to combine the recognised conceptual categories. Additionally, the second researcher commenced an independent classification session attempting to map categories to their corresponding themes according to the second researcher own perception. Once this was done, the second researcher referred to the first researcher to discuss similarities and dissimilarities. The different results were displayed using a comprehensive table shown in table 5.10. The table revealed the original categories/themes interviews and the changes reflected by the second researcher. The finalised changes were exposed in the results section coding phases mentioned in the above coding description section. As a Bias reduction process; the second researcher correspondingly made an additional attempt of coding, this coding was undertaken in phase two of grounded theory axial coding that engaged the second researcher efforts in matching the extracted themes into their joint theme of ACAP. The bellow table in the next page exemplifies phase two of bias reduction that compared results of mapping themes and categories from researcher a paralleled to research B.

Bias Reduction /Researcher A and B				
Researcher A (Author) (Before refining to final results)			Researcher B (Senior qualitative Researcher in the same institution)	
The me	Category	Theme	Major changes Suggested By Researcher B	Category
Acquisition	Management emphasis Joint projects cross- departmental exchange Years of prior employees Experience Financial Resources (Merge) Human Resources Capabilities Management encouragement for possessing new special skills Demanding cross- departmental meetings	Acquisition	Reduce the number of categories. Redundant categories to be joint in one category approved as by both researchers) Some categories are confused with another absorptive capacity dimension such as 'Demanding cross- departmental meetings'	Management emphasis (X) Joint projects (X) Cross departmental exchange Merge Years of prior employees Experience (X) Financial Resources (Merge) Human Resources Capabilities Management encouragement for possessing new special skills (merge) Demanding cross- departmental meetings (Move to assimilation).

Assimilation	<p>Using tools to support data exchange</p> <p>Management classifications of employees skills</p> <p>Management encouragement for attaining new skills</p> <p>Availability of tools) intranet, Internet).</p> <p>Processing recourses</p>	Assimilation	<p>Change some Terms used in naming categories</p> <p>Sometimes found misleading categories that don't relate to assimilation and is mixed with the acquisition.</p>	<p>Using tools to support data exchange</p> <p>Management classifications of employees skills (Merge)</p> <p>Management encouragement for attaining new skills (Merge)</p> <p>Availability of tools) intranet, Internet). (Merge with 1)</p> <p>Processing recourses. (x)</p>
Transformation	<p>Employee's literacy for data transformation.</p> <p>Technological processing compatibility</p> <p>Organisational policy for data</p>	Transformation	<p>Minor changes /add different category</p>	<p>Employee's literacy for data transformation.</p> <p>Technological processing Compatibility</p> <p>Organisational policy for data (x)</p> <p>And add:</p> <p>Robust and effective data security measures</p> <p>Technological reediness</p>
Exploitation	<p>Innovative products and services.</p> <p>Prototype Support</p> <p>Adopting new technologies</p>	Exploitation	<p>No change</p>	<p>Innovative products and services</p> <p>Prototype Support</p> <p>Adopting new technologies</p>

Table 5.10: Bias reduction process.

5.11 Reliability of GTM Coding

The current research overall evaluation from applying analytical coding approach was that GTM is seen as a package of multi-research methods in one. The method was engaged in the application of different techniques such as simultaneous data collection, constant comparison, memo writing, and coding until reaching theoretical saturation. All these techniques created a consciousness of the scientific significance necessary for any grounded theory research. Furthermore, the implementation of GTM promoted the features of the current research as being treated as qualitative research. The main purpose was to construct a descriptive, multi-dimensional introductory framework that will be treated as the main stage in the later comprehensive ACAP-BI model. The model was built from raw data that added more validity to the process. However, coding was an important process in extracting results; nonetheless, it was a very time consuming and draining process for the researcher. The process of coding line-by-line and looking at each line made the process rather time consuming. Besides, the process of theoretical saturation, and when to stop coding was a challenging process in the overall data analysis procedure. The bellow table describes the time in days for completing the three coding phases.

Coding	Number of days required to complete phase
Open Coding	120 Days
Axial Coding	40 Days
Bias Reduction	5 Days
Selective coding	20 Days

Table 5.11: Time required for completing each coding phase.

5.12 Discussion of the Qualitative Results

The extracted categories are proposed to offer foundations for shaping where and how further potential organisational assets can be leveraged. While viewing the extracted categories, managers can consider what they already have from these sets, and what is missing or needs to be further discovered. The current study main contribution in term of

the resulted qualitative analysis lies in proposing categories that found to be linked to one or more of areas described as : (1) organisational human recourse abilities, (2) organisational financial abilities, (3) organisational relational and interpersonal abilities, (4) organisational technical and technological capabilities, and (5) decision making outcomes and innovation outcomes. All extracted categories are linked to one or more of the given propositions areas. By settling these concentrations, the presented managerial implication reinforced the fact the four dimensions of ACAP were strongly supported empirically within in our study resulting from consistent managerial implications for each ACAP dimension as the following;

- **Acquisition:** the developed categories that signified the acquisition dimension are harmonised with the definition proposed by Cooper and Molla (2016) as the ability to recognise, obtain, and grasp external knowledge required for organisational processes and growth. Categories such as management support for data exchange, research development activates and investments, periodical meetings, and workshops found to be supported in terms of acquisition capabilities within the organisation. To be more specific in describing acquisition categories and basis for extracting them; a good number of managers stressed the idea of having in their department's external resources they can assist in obtaining information (e.g., personal networks, consultants, seminars, internet, database, professional journals, academic publications, market research). However, others stressed that they require these components and they are misplaced in their company. Consequently, the researcher considered this as an essential measure to be coded as a category in the open coding phase. While others managers stressed that as managers they do assign financial budgets, or at least they are aware of organisational pre-setting for budgets that support any data obtainability initiatives, such as paying for external data providers, which revealed the category (well-established relations with data providers). Also allocating budgets for workshops, and seminars that can provide better data accessibility and knowledge controls for employees within their departments (Abdelrahman et al., 2016).

- **Assimilation:** was measured in regards to categorisation that emphasised the importance of achieving timely data flows within departments, employee's literacy for

acquired data, departmental employee's communication, and technological readiness. All these categories found to be in line with the cited understanding of assimilation proposed by Zahra and George (2002), which refers the firm's routines, and processes that allow it to interpret and understand the information obtained from external sources. The extracted categories were treated as routines for encouraging the understanding of the acquired information.

- **Transformation:** resulted in categories that stressed the importance of contemporary information technologies that can play a very important role in the development and growth of a firm's ACAP. By recognising the importance of information technologies and treating information technologies as a strategic source that can provide ACAP transformation (Wade and Hulland, 2004). Managers are encouraged to identify and invest in technical requirements such as robust and effective data security measures, open architectures, infrastructural technologies, and data repositories. Consequently, building and investing modern digital technologies facilitate what so-called 'learning-by-doing' which by itself is considered a transformations attribute that helps in recognising new data and responding to any novel information technologies that support ACAP (Sambamurthy et al., 2003).
- **Exploitation:** the resulted measures reflected the dimension exploitation as an integral output and realised dimensions of ACAP, opposing the proposal of Todorova and Durisin (2007) that suggested that both transformation and exploitation are not required to be substantial aspects of ACAP comparing to assimilation and acquisition dimensions. Acknowledging exploitation when measuring ACAP facilitated in highlighting the potential outcomes resulting from implementing the potential ACAP dimensions mentioned above (Flatten et al., 2011). Exploitation dimensions in the line of the current research categories proposed significant constructions such as that quality decision-making initiative, innovative products and services, and the ability to adopt new technologies are required to realise sets of outputs attained from employing the previous potential ACAP dimension.

5.13 Summary

Main purpose of chapter five was to offer a detailed exploration of the analysis process of the qualitative collected data engaged in the involvement of the interpretation of the data gathered analytically using semi-structured interviews. Moreover, to determine initial codes, and categories that were required as important building blocks of the GTM extraction process following the process and paradigm modelling of Corbin and Strauss (1999). Additionally, the chapter presented the description of detailed GTM inspired and portrayed by Strauss and Corbin (1999) to generate codes, and integrate the final conceptual model that encapsulates extracted grounded theories. The GTM followed three phases of coding levels: open, axial, and selective coding process. Codes were generated with the assistance of the automated Nvivo software.

CHAPTER 6: QUANTITATIVE DATA ANALYSIS, RESULTS, AND DISCUSSION

6.1 Introduction

This chapter key determination is to uncover the second research question that supported the process of extracting the final model using a quantitative approach. The quantitative approach is required to be a final validation stage for checking the validity of extracted categories in relevance to BI systems efficiency. The goal of the current chapter is to answer the following research question:

RQ2: Can ACAP dimensions influence the efficiency of BI systems? Consequently, influencing overall organisational efficiency and performance? .

The chapter is organised starting from section 6.2 that provides a quantitative survey direction accounting the sample size, respondent demographics. Then in section 6.3, the measurement items included in the hypothetical proposed model are all presented according to the measurements items. Consequently, sections 6.4, 6.5, and 6.6 respectively revealed the results from PLS-SEM research method in terms of calculating reliability, validity, and statistically assessing the structural model. Finally, section 6.7 presented a discussion of the results describing the subsequently supported hypothesis and how they are related to the research settings.

6.2 Quantitative Survey Direction and administration

As mentioned earlier in Chapter 4, the quantitative data collection relied on the use of online surveys. Most respondents were senior managers provided to the researcher by the BI system supplier that supported the recommendations of a list of telecommunication organisations using their implemented BI systems and tools. The first part of the survey captured the demographic details of the respondents (Table 6.1). As for the second part it was concerned with measuring the variables and constructs under study, and following a scale based on a scale from 1=strongly disagree to 5=strongly agree). Surveys are displayed in Appendix B.

6.2.1 Quantitative Sample Size

The current research relied on structural modelling for analysing the theoretical model, specifically the use of Partial Least Squares (PLS-SEM), the chosen method thought to be suitable due to its significant flexible advantage in dealing with relatively small sample size. According to chin (1997), the required sample is much lower than what is required in other SEM techniques. Chin (1997) suggested that the sample size should be larger or equal to one of the following;

(1) Ten times the largest number of formative indicators loading on one scale or , (2) ten times the largest number of paths directed at a particular construct in the model.

Since all the indicators in the current research are required to be reflective and non-formative, the researcher followed the second rule of thumb proposed by Chin (2017), in which the sample size was ten times more than the largest number of paths directed at a particular construct in the theoretical model. The most substantial paths were directed to the construct ' organisational efficiency' coming from the four constructs of ACAP, and BI systems efficiency construct. This indicated that the largest number of paths is the summation of both:

(1) Paths coming from the proposed relation ACAP dimension to BI systems efficiency.

(2) Paths coming from the proposed relation BI efficiency to organisational efficiency.

The indication also reflects that a total of five paths calculated as the maximum number of paths, so the sample size should be at least ten times more than 5, ($5 \times 10 = 50$) samples as minimum size accepted. According to the research proposed model, any sample size, more than 50 is acceptable.

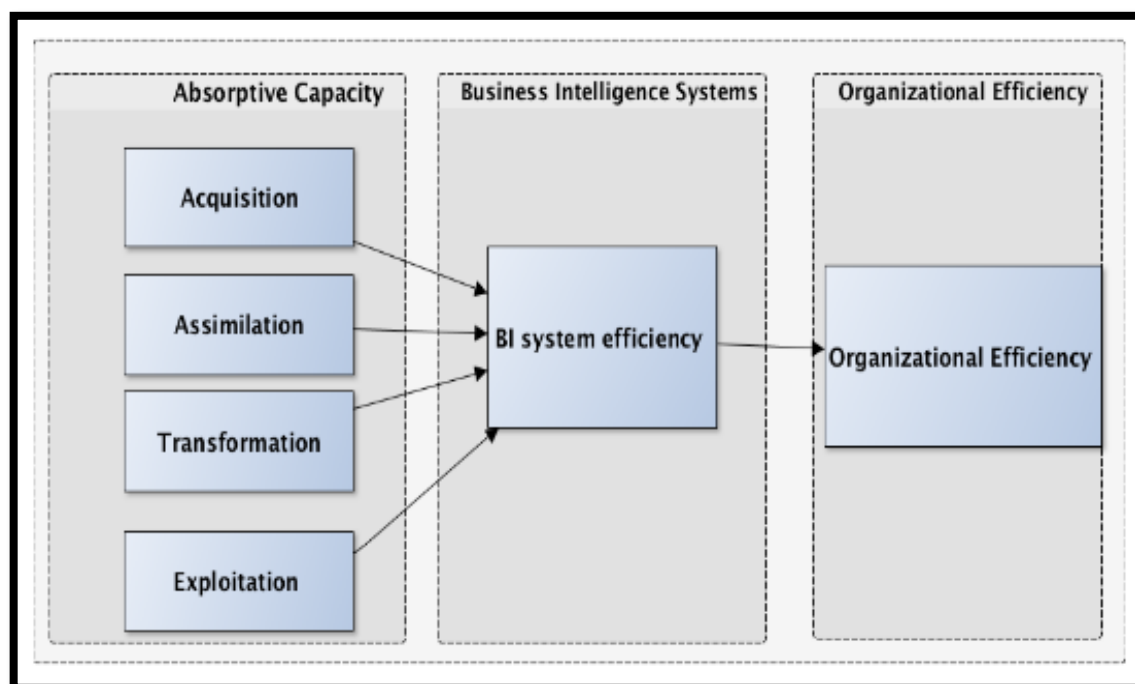


Fig 6.1: Theoretical model and Number of relations.

The theoretical model above in fig 6.1 indicates that calculation of the current quantitative research sample size is even larger than the minimum acceptable, and is (150) samples. However, in PLS based analysis the more variables available, the higher sample size is needed; the current research required (6) latent variables that are (ACAP four dimensions, BI systems efficiency, and organisational efficiency). The second order confirmatory factor analysis is a statistical method employed by the researcher to confirm that the theorised construct in a study loads into a certain number of underlying sub-constructs or components. It should also be noted that the more "arrows" that points to the variable, the more sample size needed.

6.2.2 Respondent Profile and Demographics

A total of (150) responses received through the use of online surveys. Moreover, a screening question was enclosed within the online survey to confirm the availability of BI systems within the interviewed organisations that support of the consistency between multiple respondents of each organisation. On the other hand, a single informant from an organisation treated as the representative of the organisation. Moreover, no significant was found as a difference between individual and average responses. Demographic classifications for quantitative sample are provided in the table 6.1.

	Number of received surveys	Length of Work Experience	Managerial Level (Top or Operational)	Industry
Total N = 150				
BI Data Platform Engineer	3	10	Middle	Telecom
Risk Manager	5	8	Top Manager	Telecom
BI and Data Analytics Senior Consultant	5	5	Senior Manager	Telecom
Business Intelligence Manager	6	8	Top Manager	Telecom
Technology Leader Global Analytics	7	12	Top Manager	Telecom
Business Intelligence analysis Head	10	4	Middle Manager	Telecom
Chief financial officer	10	12	Top Manager	Telecom
Director Reporting And Analytics	10	14	Top Manager	Telecom
Chief Information Officer	14	9	Top Manager	Telecom
Head of BI	15	10	Top Manager	Telecom
Senior cost Analyst	15	5	Top Manager	Telecom
Head of Data Analysis	20	15	Top Manager	Telecom
Product Development Manager	30	9	Top Manager	Telecom

Table 6.1: Demographic classification.

While looking at the demographic description, it indicates that the current research mostly concentrated on knowing the number of work experience, and the position of each respondent. Since the study is concentrating on managerial aspects, the goal was to collect data from senior managers with satisfactory years of experience. The demographic analysis shows that all surveys targeted seniors and managers with most (20 %) working as product development Manager, (13%) Head of Data Analysis, others representing (21%) targeted in the surveys work as chief information officer, director of human recourses, senior consultants, head of data acquisition, risk managers, technology led leaders, and senior cost analysts. The mentioned experts were chosen as main targeted respondents due to enormous potential knowledge of organisational features such as

ACAP dimensions, systems, and how this impact will be reflected in the organisational efficiency. The average size of the firms is large with an average of (600) employees.

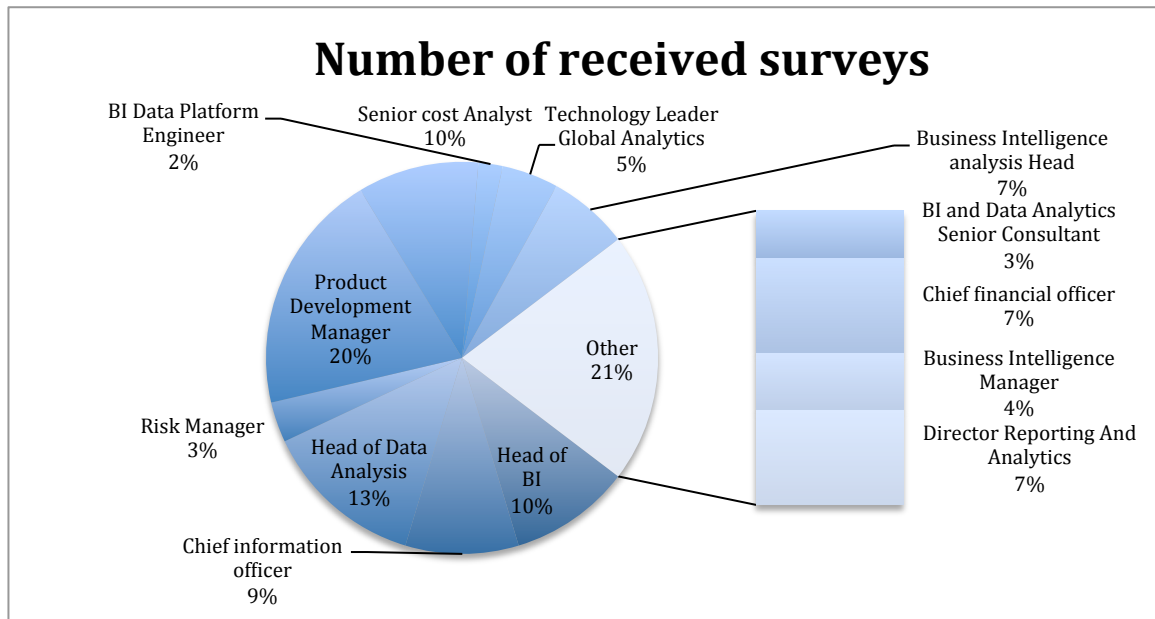


Fig 6.2: Demographic classification chart.

6.2.3 Testing Quantitative Non-response Bias

According to Cascio (2012) the non-response bias references the discrepancy that appeared between the results of survey respondents and non-respondents. Lambart and Harrington (1990) proposed a process for testing the non-response. The process mainly compares the respondents who completed the survey at an early stage to those who were relatively late to complete. In the current study testing for non-bias was conducted by comparing responses received immediately within the first two weeks of sending the online surveys, to those who responded after a reminder email was sent them to remind as a kindly reminder to answer the survey. The early patch of responses reached a total number of an n= 95 (including 85 valid responses), other responses who were received after the kindly reminder (n=65) and which (included 55 valid responses). A number of (12) of the randomly selected survey questions associated with the research model were used as a measure to compare responses and late response data. The test compared the mean of the responses and later comparing the two data sets after applying a simple t-test on both sets. Furthermore, a null hypothesis was propositioned and which proposed that the mean of the two data sets was equal. Otherwise, consider another hypothesis

suggesting that the means are not equal as bellow; H0: $M1 = M2$ (equal means), H1: $M1 \neq M2$ (non-equal means). The conducted t-test to calculate significance is required to be a test that ran on unpaired data, meaning that the means are coming from different two sets comparing different people. The results to figure the non-respondent bias using the t-test for the two sets of respondents indicated accepted minimal differences when looking at the two sets. Consequently, hypothesis H0: $M1 = M2$ (equal means) hypothesis was accepted; indicating that (late response) did not cause bias in the current research.

Arbitrarily survey question is chosen	MEAN Early patch N=85	MEAN The second patch answered after a reminder email N=65	Statistical Significance/Differen ce between two means/Alpha = >0.05 otherwise no difference
Q9) Well-established development exchange meetings occur in my organisation	1.73	1.66	0.98
Q3) There is support for well-established relations with data providers	2.00	2.44	0.92
Q13) In my organisation there is an acceptable availability of technological infrastructure	1.30	1.31	0.99
Q22) BI system improved data collection from different systems resources using BI technical tools.	2.11	2.78	0.88
Q21) In my organisation using BI System and BI technical tools increased employee productivity.	2.90	2.40	0.91
Q28) BI systems reduced the time and cost-to-market products/services.	1.51	1.78	0.95
Q33) We have Increasing organisational profit comparing with key competitors in the same industry.	2.66	2.71	0.99
Q32) Organisational development in our organisations is at a quicker pace compared with key competitors in the same industry.	1.54	1.00	0.90
Q27) BI systems in my organisation lowered operational costs	1.48	2.43	0.83
Q17) In my organisation exists apparent innovative products and services production	2.00	2.89	0.84
Q19) my organisation always seeks the adoption of new technologies	1.32	1.31	0.99
Q26) BI systems improved the efficiency of internal operations.	4.00	4.33	0.94

Table 6.2: Nonresponse bias test.

6.3 Measurement Items

A set of measurements items with respect to ACAP, BI systems efficiency, and organisational efficiency were relatively modified to the precise setting of this study. There are in total (5) constructs. The constructs are; acquisition including (7) items, assimilation including (5) items, transformation including (3) items, exploitation (4) items, BI systems including (10) items, and organisational efficiency (5 items).

The current study relied on the results extracted from the literature review to test the validation of ACAP categories as a construct. The categories indicated (19) categories extracted using the open coding technique from the GTM coding process, in addition to using previous studies to reinforce the validity of extracted measures. For the business intelligence systems efficiency and organisation efficiency, a total of (15) categories were extracted from previous studies and literature. All measurements tested using collecting data with a Likert scale for the respondent of the quantitative survey. Later, analysed using Partial Least Squares quantitative method to test the validity of the measures, and relevance of each construct with its corresponding measuring items.

6.3.1 Absorptive Capacity Construct

The ACAP construct adopted Zahra and George (2012) model to determine the ACAP main four dimensions acquisition, assimilation, transformation, and exploitation. Later, a GTM open coding was conducted to extract categories that better describe each dimension of ACAP. The items were validated through the Partial least squares analysis algorithm (PLS) to determine each loading of the given categories treated as indicators for the construct ACAP as in table 6.3 in the following page.

Construct	Indicators	Item	Source/ Results from qualitative Open coding Categories and literature review
Acquisition	AQUI1	Management support for data exchange exists in organisations	Elbashir et al. (2008)
	AQUI2	Departmental data management	(Silva et al., 2014)
	AQUI3	Well-established relations with data providers	(Pittz et al., 2018)
	AQUI4	Research development activates and investments	(Floor, Cooper and Oltra, 2018)
	AQUI5	Periodical Meetings and workshops with experts	(Cooper and Molla, 2016)
	AQUI6	Human Resource Competencies	(Silva et al., 2014)
	AQUI7	Allocating Financial Budgets	(Elbashir et al. 2008)
Assimilation	ASSIM1	Timely Data Flow	
	ASSIM2	Well-established development exchange meetings	(Popovič, Puklavec, and Oliveira, 2019)
	ASSIM3	Departmental employees communication	(Elbashir et al. 2008)
	ASSIM4	Employee's literacy for acquired data	(Kostopoulos et al., 2011)
	ASSIM5	Technological Readiness	(Pittz et al., 2018)
Transformation	TRANS1	Availability of technological infrastructure	(Popovič, Puklavec, and Oliveira, 2019)
	TRANS2	Technical ability and the tendency of employees	(Pittz et al., 2018)
	TRANS3	Robust and effective data security measures	(Kostopoulos et al., 2011)
Exploitation	EXP1	Quality decisions and decision-making	(Elbashir et al. 2008)
	EXP2	Innovative products and service	(Liang and Liu, 2018)
	EXP3	Prototype production support	(Laursen and Salter, 2006)
	EXP4	Adoption of new technologies	(Elbashir et al. 2008)

Table 6.3: Absorptive capacity indicators

The presented constructs and items propositions, it was hypothesized that the four dimensions of ACAP can have a positive influence on BI systems efficiency as in the

bellow four hypotheses:

Hypothesis **H1**: There is a positive relation between Acquisition dimension of ACAP and BI systems efficiency.

Hypothesis **H2**: There is a positive relation between Assimilation dimension of ACAP and BI systems efficiency.

Hypothesis **H3**: There is a positive relation between Transformation dimension of ACAP and BI systems efficiency

Hypothesis **H4**: There is a positive relation between Exploitation dimension of ACAP and BI systems efficiency.

6.3.2 Business Intelligence Systems Efficiency Construct

The current research followed the considerations of Olaru (2014), Elbashir et al. (2008), and others to extract (10) measurement items used to test the research hypothesis. The measurement mentioned in table 6.4 tested if BI systems enhanced benefits related to BI system potential in improving adequate data collection from different systems resources using BI technical tools. Moreover, improving internal and external communication with partners, suppliers, and departments. Other measurements focused on testing BI systems efficiency in enhancing the processing of data in timely and efficient manners. Finally, measurements were related to examining the output of BI systems in producing quality decisions and providing enhanced products marketing and creation. As mentioned previously in the theoretical model that the current thesis proposed a hypothesis for the positive relation between ACAP dimensions and BI systems, the other hypothesis suggests a positive relationship between BI systems and organisational efficiency.

Construct	Indicators	Items	Source
Business Intelligence System efficiency	BI1	BI system improved data collection from different systems resources using BI technical tools.	(Wixom and Watson, 2010)
	BI2	BI System increased employee's productivity	(Foley and Guillemette, 2010)
	BI3	BI systems added enhanced coordination between partners, suppliers, and our organisation.	(Liang and Liu, 2018)
	BI4	BI systems enhanced the coordination between employees and management	(Wang and Byrd, 2017)
	BI5	BI systems lowered the cost of transactions with business	(Watson, 2009)

		partners/suppliers, data providers	
	BI6	BI system improved data processing and storage using data warehouse and OLAP online analytical processing tools	(Elbashir et al. (2008)
	BI7	BI system improved the efficiency of internal processes	(Olaru, 2014)
	BI8	BI system lowered operational cost	(Wang and Byrd, 2017)
	BI9	BI system reduced the time and cost-to-market products/services	(Watson, 2009)
	BI10	BI system reduced the cost of effective decision-making	(Wixom and Watson, 2010)

Table 6.4: BI system efficiency indicators.

6.3.3 Organisational Efficiency Construct

Organisations efficiency construct used a total of (5) categories extracted to test the construct. Measures relied on previous studies and literature. Furthermore, categories were slightly altered to fit the current study requirement. Organisations efficiency is perceived to be improved by BI systems, according to Turban et al. (2007). Moreover, researchers revealed that the existence of BI within organisations could provide significant members of organisations such as employees, partners, and suppliers with relaxed access and acquisition to information, and the ability of effective data analysis and sharing. Consequently, this can reflect on organisational efficiency compared with other competitors, also can increase profit and productivity. Based on these propositions, it was hypothesised that:

H5: A positive relationship between BI systems and organisational efficiency exist in companies using BI systems.

A total of (5) categories extracted from literature as the bellow table. Table 6.5 Indicators for organisational efficiency construct

Construct	Construct	Items	Source
Organisational Efficiency	ORG1	Organisational success comparing with key competitors in the same industry.	(Watson, 2009)
	ORG2	Organisational ownership of market share compared with key competitors in the same industry	(Elbashir et al. 2008)
	ORG3	Organisational development at a quicker	

		pace compared with key competitors in the same industry	(Foley&Guillemette, 2010)
	ORG4	Increasing Organisational profit comparing with key competitors in the same industry	(Turban et al. 2007)
	ORG5	Organisational products and services innovation comparing with key competitors in the same industry.	(Pittz et al., 2018)

Table 6.5: Organisational efficiency indicators

6.4 Data Analysis Partial Least Squares (PLS)

The quantitative data was initially analysed and collected using SPSS; the data entry was undertaken using SPSS, later all data was uploaded to Smart PLS. The current research relied on using Structural Equation Modeling (SEM). Specifically, SEM using Partial Least Squares (PLS). SEM-PLS was required to be as a critical statistical instrument that integrated both factor analysis for testing the reliability of indicators and constructs, and path analysis for testing relationships and hypothesis. Moreover, PLS was used to analyse the relationship between multiple independent and multiple dependent variables in the research model. SmartPLS version 3.0 initially was used to present the proposed model, the main constructs, indicators for each construct, and the hypothesised relationships as the following figure in 6.3 in the subsequent page.

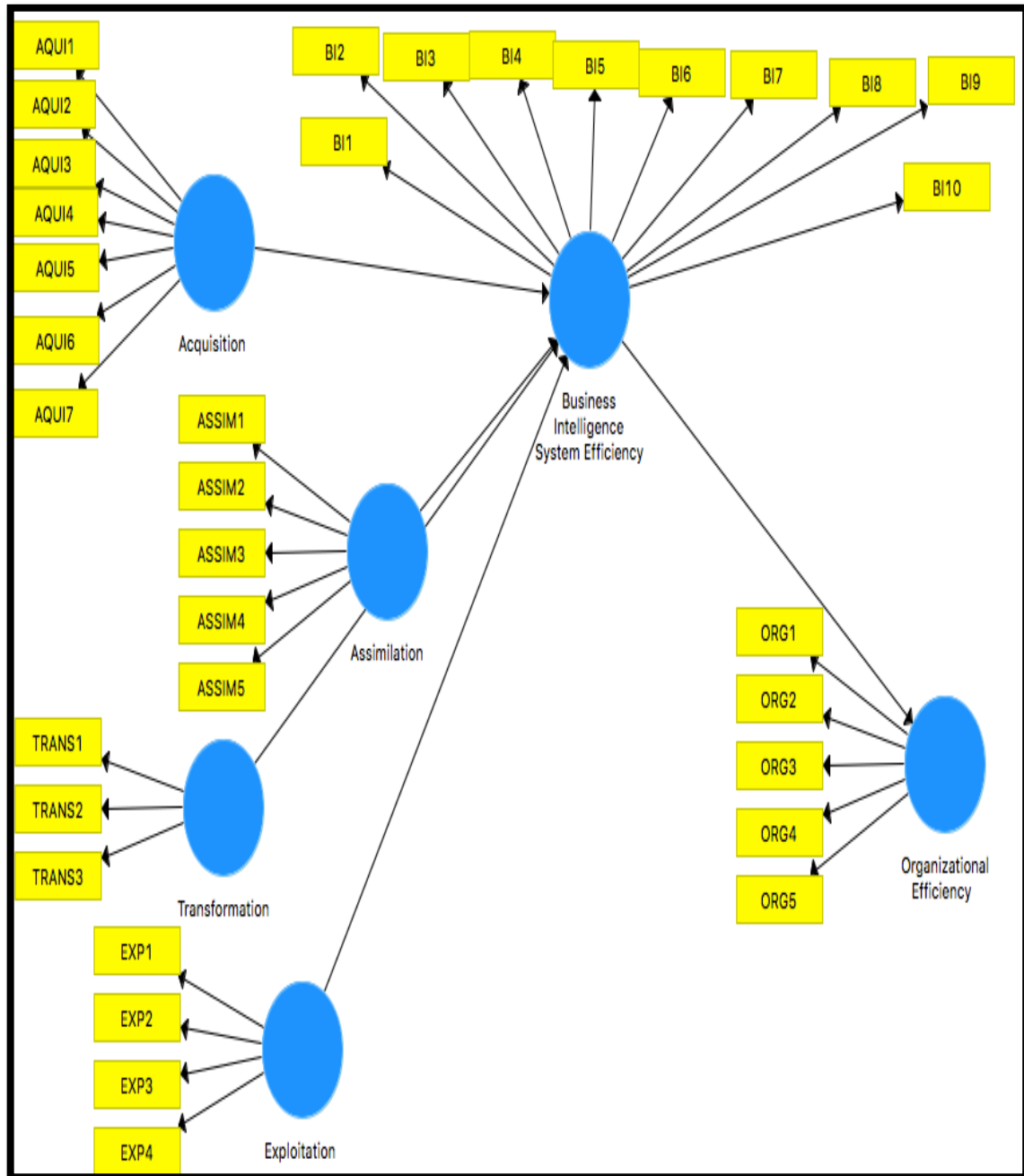


Fig 6.3: ACAP-BI measurement model using SmartPLS 3.0.

In PLS, the measurement item is referred to as an (indicator), and the construct is called (latent variable). Figure 6.3 clarifies that all indicators in the current study are required to be reflective measures, a reflective measure implies that if that indicator was removed from the set of indicators representing a certain construct, the construct will remain the same meaning assuming that there are adequate and related effective indicators to signify the latent variable. The direction of interconnection in reflective indicators is always

directed from construct to the indicator. Since most indicators are the consequences of the same latent variable they are anticipated to be extremely correlated, referred to as internal consistency reliability according to Bollen (1984).

6.5 Reliability and Validity of the Constructs, Indicators and Measurement Model

The test for the validity of each of the (6) constructs variables was undertaken, also comparing each construct for its given indicators was also tested for validity generated within the consistent PLS algorithm running. Individual item reliability represents the loadings of items on their designated construct. Correlations are measured using loadings, indicating the extent an item loads onto a construct. Hulland (1999) suggested that a minimum loading of 0.4 is acceptable. For this study, all items achieved the minimum loading and were determined to be reliable enough about the measurement of the construct assigned to them. SEM-PLS uses the term “latent “variable for each construct engaged in the study. A latent variable is defined as a hypothetical construct that is invoked to explain the observed variation in behaviour. The results in this section and sections 6.5.1, 6.5.2, and 6.5.3 are all based on the calculation of the analysis tool SmartPLS 3.0 that used a consistent PLS algorithm as bellow in figure 6.4. The tool allows the process of analysing the interactions between different indicators of each construct.

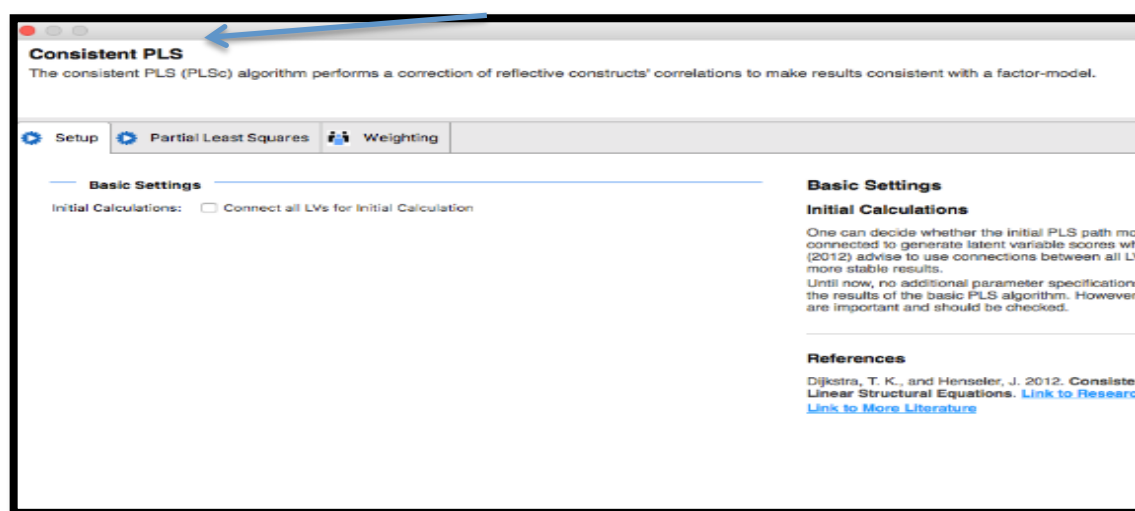


Fig 6.4: Screenshot of the PLS algorithm SmartPLS.

6.5.1 Assessment of the Measurement Model

The internal consistency was measured using a consistent PLS algorithm for assessing indicators and constructs, applying analysis between indicators was required as a factor analysis process. Resulting statistics were calculated to indicate the “outer loadings “of each indicator, “average variance” extracted (AVE) that shows the ratio of the sum of the variance by measuring the percentage of the variance of a construct. Also, composite reliability (CR). Results are represented in table (6.6). The results from analysing the validity of the measurement model indicators implied that the CR values ranged from 0.70 to 1.000, and most of the constructs were above the threshold of 0.7, according to Gefen et al. (2011), Gefen, et al. (2000); and Nunnally and Bernstein (1994) reliability scale. Therefore, all the indicators used in this study were found reliable. Later, the construct validity was also tested by measuring (AVE), table 6.6 illustrates that all (6) constructs scored a value greater than the threshold of 0.5 according to Yoo and Alavi (200) scale.

Constructs	Outer Loadings	AVE (Average Variance)	CR (Composite Reliability)
Acquisition	0.8051	0.5679	0.9211
	0.8746		
	0.8968		
	0.7263		
	0.6981		
	0.8728		
Assimilation	0.7937	0.7856	0.8903
	0.7961		
	0.7863		
	0.8677		
	0.7622		
Transformation	0.7161	0.7649	0.8089
	0.7397		
	0.7715		
Exploitation	0.7837	0.8042	0.8806
	0.8227		
	0.8107		
	0.8616		
BI Systems Efficiency	0.7218	0.8422	0.9609
	0.7061		
	0.8941		

	0.8164		
	0.8609		
	0.8903		
	0.8595		
	0.8404		
	0.8715		
	0.8627		
	0.8205		
Organisational Efficiency	0.8043	0.8257	0.9148
	0.8808		
	0.8112		
	0.8012		
	0.8313		

Table 6.6: Assessment of the measurement model.

6.5.2 Discriminate Validity

Discriminant validity likewise was tested within the context of the consistent PLS algorithm process. Discriminate validity was tested to examine if a construct better clarifies the variance of its indicators compared with the other constructs indicators variance (Fornell and Larcker, 1981). In other words, and line with the PLS setting; the discriminant validity indicates that particular construct shares added variance with its indicators than what it shares with the other constructs indicators within the same model (Hulland, 1999). Discernment validity also indicates that the correlation between any two constructs is recommended to be greater than 0.7. The correlation between the two constructs must be not less than the recommended value of 0.60. Subsequently, discriminate validity indicates that the square root of the AVE for each construct is recommended to be greater than all the other cross-correlations between the two constructs (Fornell and Larcker, 1981). Consequently, the results presented in table 6.7 are in line with the discriminant validity categories of all constructs assumed in the hypothesised model.

Construct	Acquisition	Assimilation	Transformation	Exploitation	BI Systems efficiency	Organisational Efficiency
Acquisition	0.8274					
Assimilation	0.2483	0.7565				
Transformation	0.2775	0.3183	0.8714			
Exploitation	0.3483	0.2483	0.1483	0.8645		
Business Intelligence systems efficiency	0.1483	0.3183	0.1453	0.2483	0.8405	
Organisational Efficiency	0.2775	0.3048	0.2507	0.1569	0.1483	0.8600

Table 6.7: Discriminant Validity for constructs diagonal square root results.

To sum up, the resulted statistics indicated that discriminant validity was exhibited in this study.

6.5.3 Convergent Validity

Convergent validity was tested to denote the validity of the indicators in the measurement model. Since the current research model involves reflective measurement, the convergent indication, in this case, is conveyed when dissimilar indicators of theoretically alike or overlapping constructs that are strongly connected (Brown, 2006). According to Chin et al., (2003), each indicator loading on its original construct must be above than 0.70. Likewise, the (AVE) for each construct must be above the lowest suggested value of 0.50 (Bagozzi and Yi, 1988) and (Dillon, Goldstein and Schiffman, 1978).

Item	Acquisition	Assimilation	Transformation	Exploitation	BI System Efficiency	Organisational Efficiency
AQUI1	0.8051	0.2857	0.5373	0.3699	0.4244	0.2973
AQUI2	0.8746	0.2480	0.322	0.015	0.4292	0.2561
AQUI3	0.8968	0.3309	0.4768	0.3192	0.3547	0.2415

AQUI4	0.7263	0.3655	0.2371	0.3320	0.3442	0.2962
AQUI5	0.6981	0.3646	0.4479	0.3475	0.2928	0.2594
AQUI6	0.8728	0.2732	0.3866	0.3179	0.3143	0.2921
AQUI7	0.7937	0.2839	0.4514	0.2337	0.3371	0.4371
ASSIM1	0.3455	0.7960	0.2179	0.2143	0.4234	0.4381
ASSIM2	0.3188	0.7863	0.3468	0.3224	0.3225	0.4324
ASSIM3	0.3771	0.8677	0.4263	0.3004	0.3416	0.2649
ASSIM4	0.2727	0.7622	0.125	0.2249	0.2299	0.3016
ASSIM5	0.2677	0.7161	0.3416	0.3263	0.3656	0.2416
TRANS1	0.3981	0.3270	0.7397	0.3719	0.3686	0.2744
TRANS2	0.3025	0.3293	0.7715	0.2492	0.3121	0.3057
TRANS3	0.2528	0.2839	0.7837	0.3839	0.2172	0.2984
EXP1	0.2212	0.2173	0.1632	0.8227	0.2540	0.2056
EXP2	0.3671	0.3391	0.5013	0.8107	0.4002	0.3692
EXP3	0.3092	0.3182	0.2933	0.8616	0.347	0.068
EXP4	0.3796	0.226	0.4995	0.7218	0.3545	0.2407
B11	0.2180	0.1689	0.1973	0.1704	0.7061	0.3135
B12	0.4712	0.2031	0.4514	0.3286	0.8941	0.5782
B13	0.3436	0.2486	0.3182	0.3012	0.8164	0.3021
B14	0.2661	0.2844	0.1676	0.2357	0.8609	0.2883
B15	0.4024	0.3170	0.3689	0.2675	0.8903	0.2084
B16	0.3355	0.8877	0.3617	0.2632	0.8595	0.3664
B17	0.5325	0.024	0.4129	0.3335	0.8404	0.4570

BI8	0.3188	0.3112	0.3866	0.2741	0.8715	0.2888
BI9	0.3016	0.3135	0.3757	0.3621	0.8627	0.3788
BI10	0.2771	0.1832	0.3623	0.1960	0.8205	0.1287
ORG1	0.3207	0.3021	0.4356	0.3084	0.3122	0.8043
ORG2	0.2671	0.2728	0.3594	0.2181	0.2364	0.8808
ORG3	0.3065	0.2084	0.2968	0.2970	0.1948	0.8112
ORG4	0.3198	0.2022	0.3794	0.3843	0.2691	0.8012
ORG5	0.3689	0.3370	0.2924	0.3561	0.2272	0.8313

Table 6.8: Cross loading matrix

Hair, Ringle, and Sarsted (2011) suggested that any items with loading below 0.4 should be disregarded. Factor and cross-loadings were used to examine convergent validity, as shown in the cross loading matrix in the above table 6.8. All of the displayed measurement items loaded relatively high on their original constructs and not relatively high on other constructs. Consequently, these results confirm that indicated measurement indicators precisely exemplify clear latent constructs.

6.6 Assessment of the Structural Model

The whole proposed model in the current study was assessed using SmartPLS (Ringle et al., 2005). Assessment of the model in PLS-SEM engaged the process of a bootstrapping of the samples to measure the effects between latent variables, and show significant paths between each two proposed constructs or latent variables. This engaged a path analysis. Consequently, this illustrated categories for the hypothesised effects for ACAP on BI system efficiency, and BI system efficiency on organisational efficiency.

6.6.1 Bootstrapping and Hypothesis Testing

The result from performing a bootstrapping test in SmartPls software examined the data concerning the hypotheses previously reviewed in Chapter 3. In PLS-SEM, bootstrapping

is required to be a type of statistical inference that occupies the heart of the development process required for building the rigorous theory, and affirm the hypothesised model. It is a non-parametric resampling process that relies on evaluating the adaptability of the data by testing the variability of the collected sample without the use of parametric suppositions (Efron and Tibshirani, 1994). The current research conducted a bootstrapping process within SmartPLS, as shown in the screenshot provided in figure 6.5 (Ringle et al. 2005).

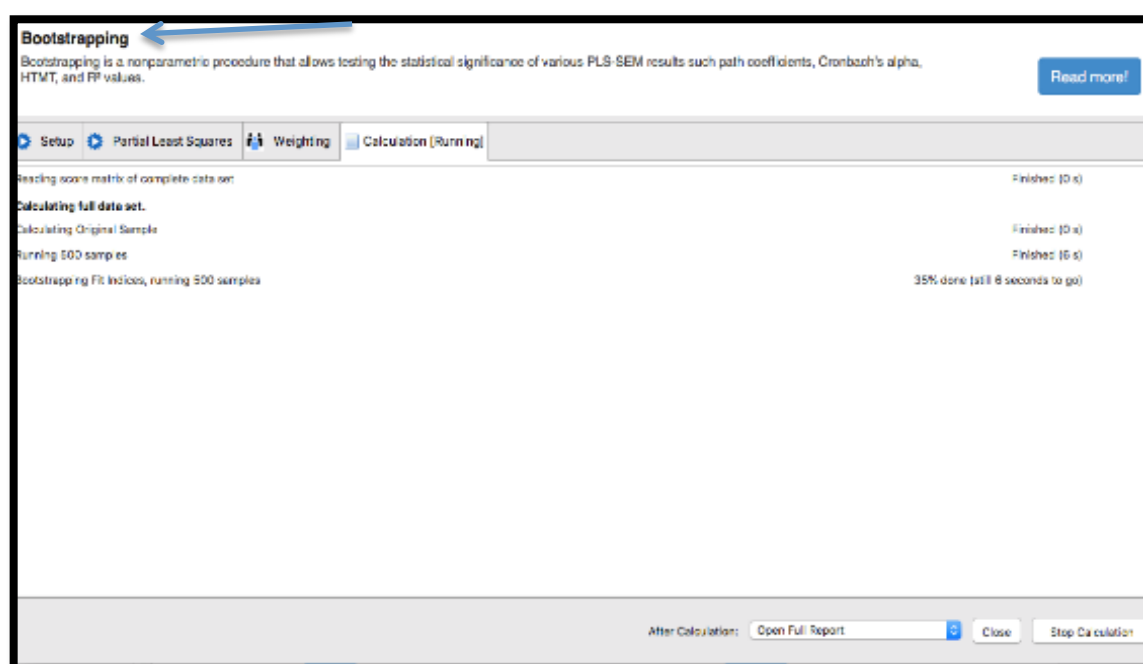


Fig 6.5: Screenshot for bootstrapping analysis-using SmartPLS

Running the PLS-SEM bootstrap test examined the scores of the significance of the path coefficients, and assessed the properties of the structural model. T-statistics were used to test the significance of the path coefficients. The study followed the typical rule of Hair (2013) in which t-static greater than 1.96 was considered significant for path coefficients at the 95% confidence level. The path coefficient clarified that the t-statistics between construct acquisition and BI efficiency scored 4.8876 which is accepted and above 1.96, t statistics between assimilation and BI efficiency scored a lower value of 2.4963 but is still required to be significant, t-statics between transformation construct and business intelligence system efficiency scored a value of 3.0721 which is significant and above 1.96, t-statistics between exploitation and business intelligence system efficiency scored a

high value of 3.1436. Finally, t-statistics between BI system efficiency and organisational efficiency scored a significant value of 7.5298 and is above 1.96. The hypothesis testing results from the PLS-SEM and the bootstrap are summarized in table 6.9. To examine the hypotheses, regression weights were assessed, and or path coefficients between every two constructs related to the hypotheses were measured to deliver perceptions into the strength of the relationships of the model constructs. The path coefficients were also assessed for significance. The test for statistical significance is achieved through a t-test. Unless a path coefficient attains a t-statistic above 1.96, it was not considered significant, and the related hypotheses were rejected. Those hypotheses with t- statistics above 1.96 were supported, and in this instance, the standard regression weights deliver meaningful insights into the strength of the relationship.

Hypothesis	Effect	Coefficient	T-Statistics	Supported /Not 'Supported
H1	Acquisition -> BI systems efficiency	0.4188	4.8876	Supported
H2	Assimilation -> BI systems efficiency	0.1659	2.4963	Supported
H3	Transformation -> BI systems efficiency	0.1659	3.0721	Supported
H4	Exploitation BI systems efficiency	0.1559	3.1436	Supported
H5	BI systems efficiency -> Organisational efficiency	0.6310	7.5298	Supported

Table 6.9: Results for supported/unsupported hypothesis T values and P values

As presented in table 6.9 that the (5) hypotheses all are supported. The variance explained ranges are from 2.4963 to 7.5298. Each hypothesis is explained separately as bellow,

- **Hypothesis H1:** There is a positive relation between Acquisition dimension of ACAP and BI systems efficiency.

H1 hypothesis was supported given the presented results because the path from acquisition latent variable and BI system efficiency latent variable is significant ($b=4.8876$, β , $p<0.01$). **Hypothesis H2**: There is a positive relation between Assimilation dimension of ACAP and BI systems efficiency.

H2 supported because the path from Assimilation latent variable to BI is significant ($b=2.4963$, β , $p>0.01$).

- **Hypothesis H3**: There is a positive relation between Transformation dimension of ACAP and BI Systems efficiency.

H3 is supported as the path Transformation to a BI system is found significant ($b=3.0721$, $P<0.01$).

- **Hypothesis H4**: There is a positive relation between Exploitation dimension of ACAP and BI Systems efficiency.

H4 is also highly supported because the path from Exploitation to BI systems is also significant ($b=3.1436$, $p<0.01$).

- **Hypothesis H5**: There is a positive relationship between BI systems and organisational systems.

H5 is supported because the path between Business Intelligence systems efficiency and organisational efficiency is also significant ($b=7.5298$, $p<0.01$).

It can be concluded from the illustrated hypothesis given above that the dimensions Acquisition, Assimilation, Transformation, and Exploitation are considered to be positive dimensions of ACAP in their role supporting BI systems efficiency as proposed in the theoretical framework. Consequently, this statistical significant support the extracted grounded qualitative categories and validates the grounded categories extraction process. Moreover, the positive role of BI systems found to have a significant effect on organisational efficiency. The model in figure 6.6 illustrates the final confirmed relationship and effects of the ACAP main dimensions and their positive effect; consequently, the positive proposed confirmed effects of BI systems efficiency on the overall organisational efficiency.

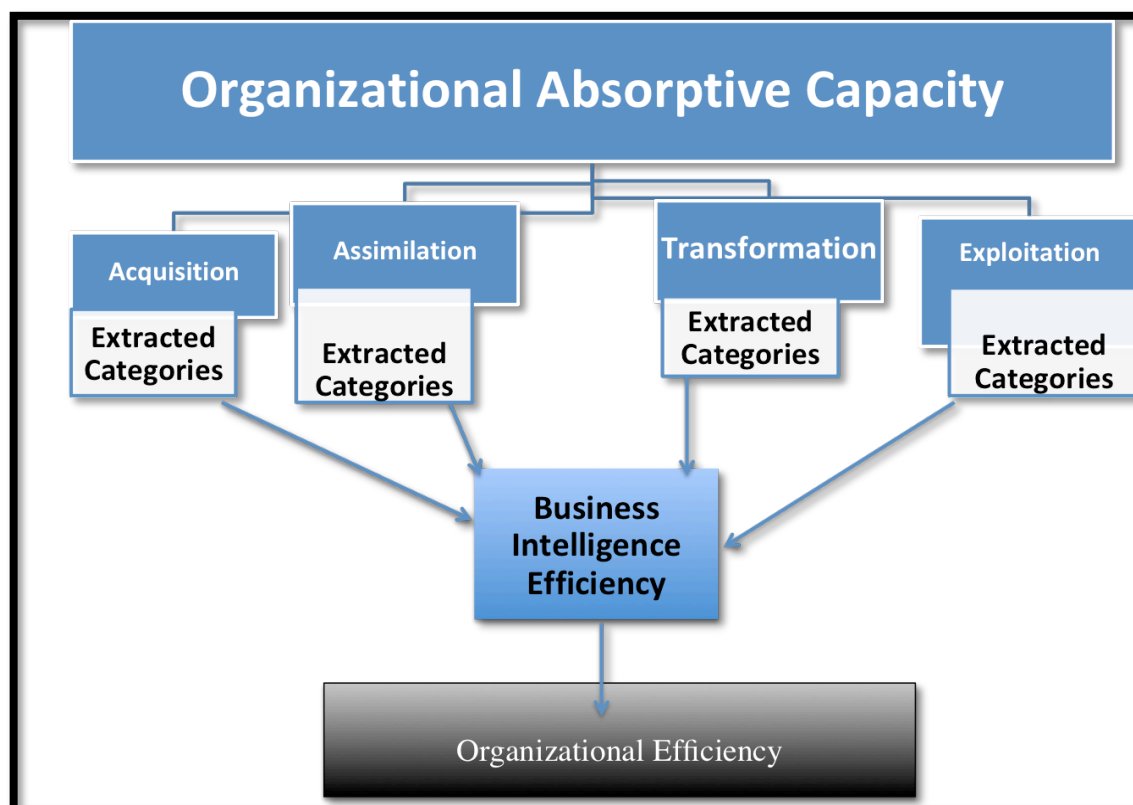


Fig 6.6: Final methodological model

6.7 Discussion of the Quantitative Results

The quantitative data for this study were collected through online surveys that included Likert scale questions with senior managers working in telecommunication companies. The chosen companies implemented BI systems within their organisation and were brought from a BI vendor. Quantitative data were first analysed to ascertain a non-bias response by comparing early responses with the relatively late response that required sending a reminder email. The result for non-bias found no significant bias with the analysed data sample. Next, data were analysed using PLS-SEM; the method was conducted to test the validity of the absorptive capacity indicators extracted from the qualitative data analysis, and that was presented in chapter (5).

PLS consistent algorithm was used to test the reliability of ACAP, BI systems, and organisational efficiency indicators. Indicator reliability resulted in overall strong loading across all.

The three constructs (ACAP, BI systems efficiency, organisational efficiency) were tested for consistency using both discernment validity and convergent validity. Consequently, convergent validity results confirm that the measurement indicators precisely exemplify clear latent constructs. And finally, results also are in line with the discriminant validity categories of all constructs assumed in the hypothesized model. The whole proposed model in the current study was assessed using SmartPLS (Ringle et al. 2005). Assessment of the model in PLS-SEM engaged the process of a bootstrapping of the samples to measure the effects between latent variables, and show significant paths between each two proposed constructs or latent variables. This indicated a path analysis. Results supported a total of five hypothesis.

6.7.1 Evaluation of the Followed Quantitative Methods

The chosen quantitative method PLS-SEM was found to be appropriate in the context of the current study due to the following explanations:

1. PLS-SEM is variance-based, in which it assisted the current research in hiring the least constraints on sample size, residual distribution, and measurement scales, (Chin et al., 2003).
2. PLS-SEM does not force multivariate normality (Birkinshaw et al. 1995; Henseler et al. 2009).

The key motive behind choosing PLS-SEM is its support for a relatively small sample size; the sample sized used was 150. The current sample size is required small in other quantitative analytical methods such as the covariance-based SEM technique, but not in PLS-SEM. Nevertheless, the small sample size used in the current research was due to the complications in assigning the surveys to only senior manager and CEO's. Another important cause in having a small sample size is the time consumed in analysing the qualitative data using grounded theory in extracting open codes needed as input in quantitative analysis. Consequently, forcing the researcher of the current thesis to adhere with a specified time frame and choose a smaller sample size for the quantitative data collection and analysis.

6.7.2 Effects of ACAP on BI Systems Efficiency

Building on the grounds of ACAP and BI systems extracted from the previous literature review and mixed with the empirical quantitative data result; the presented work intended to build a pivotal relation, and develop a model that shows the positive effect of ACAP as the main goal, later test the effect of BI systems on organisational efficiency.

ACAP in line with this study was defined as “a *dynamic capability with the ability to provide organisations ability to identify, assimilate, and exploit knowledge coming from external sources*” (Cohen and Levinthal, 1990). The study confirms the positive effect of ACAP on BI efficiency stated in previous literature. The connection includes the propositions of Elbashir et al. (2011), and other by Robert et al. (2012.) The former authors examined the role of organisational ACAP in the strategic use of BI systems to support integrated management control systems. The work proposes that for organisational ACAP or, as they stress, the capability to collect, absorb and strategically control new information coming from external sources, it is vital to create a proper technological set-up and to integrate BI systems for achieving benefits and performance. Additional outcomes demonstrate issues related to managerial hierarchy; for instance, they proposed that top management plays an indirect but critical role in effectively positioning BI systems. Building on the quantitative results and previous literature review, key findings of this study is that the ACAP dimensions proposed in the model of Cohen and Leventhal (1990); Fichman (1992) demonstrated a significant positive effect on BI system efficiency. Evident benefits found in (H1) acquisition dimension effects, and relatively low impact of assimilation on BI systems efficiency presented in (H2). Yet, established also little theoretical attention. (H3) signified a positive impact of the transformation dimension of ACAP on BI systems efficiency. The Greater ACAP dimension, which signified a high effect, was observed in (H4), proposing a positive effect from the exploitation dimension. The implications of the four dimensions, and how they affected the efficiency of BI systems are mentioned separately in each section bellow.

The current study overall finding from testing the effect of ACAP on the anticipated efficiency of BI systems revealed that ACAP as an organisational capability has a positive

role in strengthening the value attained from implemented BI systems of firms (Chen et al., 2012). Adopting BI systems not only require large expenditure, and investments in state of the art infrastructure and technology, yet, potential managerial abilities that assist them in acquiring, assimilating, transforming, and exploiting knowledge necessary for more efficient BI systems.

6.7.3 Effects of ACAP Acquisition on BI Systems Efficiency

The research revealed a positive effect of the dimension acquisition on BI efficiency. In the line of the current research, acquisition references the ability to recognise, obtain, and grasp the external knowledge required for organisational processes and growth (Lane and Lubatkin, 1998). The current research presented qualitative categories of acquisition. The categories were proposed to increase BI efficiency. The findings validated final categories that were confirmed to add a positive effect. Well-established relations with data providers enhance data acquisition inside organisations potential and might reflect better efficiency of BI systems. Also, measures like periodical meetings and workshops with experts, research development activates, and investments enhance data acquisition potential and human resource competencies, also allocating financial budgets will reflect better efficiency of BI systems. BI systems improved data collection from different systems resources using BI technical tools as proved within the methodological model.

6.7.4 Effects of ACAP Assimilation on BI Systems Efficiency

There was always a shady side to this model while researching and testing the assimilation dimension. Assimilation in line with current study was defined and cited in the Zahra and George (2002) in which referring to the firm's routines and processes that allow it to analyse, process, interpret and understand the information obtained from external sources. The current research proved the support of hypothesis H2, which indicated, "*There is a positive relationship between assimilation dimension of ACAP and BI Systems efficiency*". Reasons behind that might refer to that the categories proposed did not uncover a high correlation to BI efficiency indicators. 1) timely data Flow, 2) well-established development exchange meetings departmental employee's communication), 4) employee's literacy for acquired data, and 5) technological readiness. Nevertheless, the measures of assimilation achieved lower but were still all-significant

with BI efficiency. The indicators did not reach a negative opposite relation. This might indicate that the measures were only not strong in their effect compared to other dimensions.

6.7.5 Effects of ACAP Transformation on BI Systems Efficiency

The research revealed a positive effect of the dimension of Transformation on BI systems efficiency that was proposed in hypothesis H3. Transformation described dimension ability of the organisation to apply a series of refinement on its current routines so that it can be combined with newly acquired knowledge on business intelligence efficiency. The measures proposed in transformation dimension such as 1. The availability Of technological infrastructure, technical ability and tendency of employees, robust and effective data security measures are found to have a positive reflection on business intelligence efficiency in terms of attaining high processing and storage using data warehouse and OLAP online analytical processing, also improved efficiency of internal processes achieved by BI systems. Finally, this can affect the overall efficiency of the transformation of the internal process attained by efficient BI systems.

6.7.6 Effects of ACAP Exploitation on BI Systems Efficiency

The research revealed a positive effect of the dimension exploitation that highlights the application of knowledge highlighted in hypothesis H4. Exploitation as an organisational competency that is grounded on practices and routines that permit organisations to refine, outspread, and influence existing capabilities, otherwise to generate new, different ones by incorporating acquired and transformed knowledge into its operations (Cohen and Leventhal's, 1990). Conversely, this application of knowledge exploitation proposed measures such as quality decisions and decision-making, innovative products and service prototype production support, adoption of new technologies can reflect the efficiency of BI systems.

6.7.7 Effect of BI Systems on Organisational Efficiency

Building on the quantitative results the proposition of (H5) was supported, and that suggested a positive effect from BI system efficiency to the overall organisational

efficiency. In line with current section gaining a competitive position in any firm is required to be a key role for effectively managing the data/information and business processes as proposed within the presented and tested BI and organisational indicators in the current research (Kwon et al., 2014; Shin, 2015; Shin 2013, Estevez and Curt, 2013; Shin 2014). When BI systems are reliable as a key data management system, they will effectively act as decision-making boosters leading to an overall organisational efficiency reflected in data-driven organisations. Subsequently, this upright sequence may begin with evaluating the measures of ACAP that will potentially lead to the attained organisational efficiency through adopting systems such as BI systems. Telecommunication firm's decision-makers may be descended to adopting rapidly BI systems. Building on the current research final results that a influences a firm's ability to sustain adequate quality level BI systems efficiency will potentially affect the following organisational aspects:

- Organisational success will be higher compared with key competitors in the same industry.
- Organisational ownership of market share compared with key competitors in the same industry.
- Organisational development is at a quicker pace compared with key competitors in the same industry.
- Increasing organisational profit comparing with key competitors in the same industry.
- Organisational product and services innovation is better compared with key competitors in the same industry.

The essential, desirable goals are fundamental to exploit the information technology asset as general means within organisations, and BI systems as specific means and treated as a strategic significance source of high value, particularly if an organisation seeks to fully exploit BI systems capabilities throughout the organisation, and for its strategic advantage (Baath et al., 2012; Mayer-Schonberg and Cuvier, 2013; Galbraith, 2014).

6.8 Summary

The chapter presented clear face validity into how to approve the categories extracted from the previous qualitative stage of the research. The quantitative data was first analysed to determine a non-bias response by comparing early responses with the relatively late response that required sending a reminder email. The result for non-bias found no significant bias with the analysed data sample. Next, data were analysed using PLS-SEM; the method was conducted to test the validity of the ACAP indicators extracted from the qualitative data analysis and presented in chapter (5). PLS consistent algorithm was used to test the reliability of the ACAP, BI systems, and organisational efficiency indicators. Indicators reliability resulted in overall strong loading across all constructs. Total of five hypotheses is supported in the structural model.

CHAPTER 7- CONCLUSION AND PROPOSAL FOR FUTURE RESEARCH

7.1 Introduction

The chapter outlines the contributions built by the research presented in this thesis. Correspondingly, it reopened some of the fundamental influences shaped throughout the complete realisation progress of this work and addressed the extent to which the preliminary aim and objectives have been accomplished. It also reflects the promising future research in the area of ACAP and BI systems. The rest of this chapter spots the attention on dynamic contents; clearly, the context of the thesis and what was accomplished in each chapter.

The chapter is organised as the following: section 7.2 illustrates a brief of the chapter's conclusions; for each chapter, the core chapter contributions are presented. Section 7.3 presents managerial, practical, and methodological inclusive contributions. Additionally, the objectives of the research, and how each objective was tackled is presented in section 7.4. Finally, section 7.5, 7.6 respectively offer the research limitation, strategies for future work, and future trends in both fields of ACAP and BI systems.

7.2 Chapters Conclusion

The current research uncovered qualitative measures of ACAP dimensions from an organisational knowledge foundation. Moreover, validated the extracted measures by empirically testing their effect on data systems such as BI systems. The research was oriented towards acquiring and processing data, information, and knowledge in technology-based industries. Additionally, reflecting the potential role of BI systems and overall organisational efficiency. The mentioned research setting was achieved gradually and systematically indicated within the thesis chapters and summarised as in the following:

Chapter 2: Literature Review: The chapter presented a global view of BI systems and ACAP concepts, definitions, and available models aiming to draw a logical association

between both perceptions. A comprehensive understanding of effects and roles derived from a state of the art literature review process. Thus, the chapter presented clear face validity for understanding the managerial facets of BI systems and ACAP available and previous literature.

Chapter 3: Proposed Theoretical Model the chapter introduced the construction of the ACAP relational measurement model, and the BI-ACAP theoretical association constructed from chapter two literature review and considerations. The chapter attempted to build up a resilient connection between the two constructs by proposing the conceptual research framework. The conceptual framework was built from two important building blocks: the first one contained the illustrative theoretical framework that intended to extract essential core organisational ACAP qualitative categories. The second building block was the sequential theoretical framework, including BI systems efficiency and their managerial indicators reflected on organisational efficiency.

Chapter 4: Methodology and Research Methods initially, the chapter presented the different philosophical perception (i.e., paradigms) in IS research. Furthermore, clear rationalisation was specified, justifying the motive behind choosing the research philosophy, strategy, and approach of the study. Chapter four presented a profound background of the qualitative research methodology Grounded Theory Methodology. The chapter revealed the roots, concepts, approaches, and diverse views of Grounded Theory. Besides, a key purpose of this investigation was to form an extensive understanding of the Grounded Theory conception to later adopt it within the study as a focal research methodology in leading the pragmatic data. Subsequently, the chapter also introduced the quantitative methods of PLS-SEM and how it will lead the surveys for the quantitative data collection and analysis. Eventually, the chapter presented a clear state of the art comprehensive models for both the pragmatic steps in the qualitative research design and the quantitative research design.

Chapter 5: Qualitative Data collection, results, and discussion the main purpose of chapter five was to encapsulate collected data that mainly engaged in the involvement of the interpretation of data gathered analytically using semi-structured interviews. Moreover, to determine initial codes, and categories that were required as important

building blocks of the grounded theory extraction process following the process and paradigm modelling of Corbin and Strauss (1999). Additionally, the chapter presented the description of detailed GTM inspired and portrayed by Corbin and Strauss (2002) to extract measures, and integrate the final conceptual model that captures the extracted proposed grounded theories. The methodology went through three phases of coding model (initial coding, axial coding, and selective coding process), additionally lines of codes with the assistance of the automated Nvivo software. The chapter was concluded with a discussion of the critical qualitative extracted results presented as a final relational model, and grounded categories treated as output to the second stage of the quantitative data analysis. Finally, a discussion for qualitative data results was presented.

Chapter 6: Quantitative Data collection, results, and discussion this chapter uncovered the main research questions that supported the process of extracting the final research methodological model using a quantitative approach. The chapter is characterised as a final stage confirmation for checking the validity of the ACAP qualitative extracted categories in relevance to their effect on BI systems efficiency and organisational efficiency. This was achieved using SEM-PLS quantitative method. PLS consistent algorithm was used to test the reliability of the ACAP categories, BI systems efficiency indicators, and organisational efficiency indicators. All treated later as quantitative factors. The reliability of ACAP indicators resulted in overall strong loading across all items. The chapter was concluded with a discussion of the critical quantitative extracted results, and an explanation of the extent to the hypothesis support drew from the extracted results. Finally, a state of the art discussion of quantitative data results was provided.

7.3 Research Contributions

Prior research has shown perceived progress and contribution towards the understanding of the concept of ACAP and its potential technical and non-technical effects on organisational data processing systems, and data-driven IS environments (Dabic et al., 2019). The current research suggested a relative advancement in the currently available body of research on ACAP by treating the concepts as a focal organisational dynamic capability. Researchers in the same field and strategic managers in organisations are

encouraged to provisionally unlock their perspective of the effects and qualitative measures of ACAP, and not to treat its measures as merely a black box. This research is believed to advance both theories contribution and management accompaniments of research engaged in the same focus. Consequently, the most significant contribution of the study as a whole is characterized by extracting grounded results led by the participant perspective. Consequently, the contributions of the current research lie mainly in a two fold contribution summarised by theoretical and practical contributions as bellow sections in 7.3.1, 7.3.2.

7.3.1 Theoretical Contribution

The current research attempted to offer an extent of theoretical contribution adding to the existing body of literature. The study provided insightful understanding to both BI systems and ACAP studies as they both emerged as an essential area of study for researchers; this presented a concentration on data-driven environments and challenges proposed to be solved by ACAP in contemporary business organisations. The study contributes to enhancing theory about the interaction between ACAP and BI systems in the telecom industry context, and from a strategic perspective.

Preliminary, the theoretical contribution added to the proposition of winter (2000), which suggested treating organisational ACAP as a research focus concerned with the element “*Capability*” that refers to a paradigm that is presented within organisational activities, and that is significant for generating critical outcomes. Also, considering ACAP research focus as a “*Dynamic Capability*” treated as a key competency in generating strategic nature in an organisation, which is more or less concerned with the element ‘change’ in a certain organisation. The given concentration on treating ACAP as capability and dynamic capability will also contribute to saving the concept of being frequently rectified or altered.

The study combines and extends previous research on ACAP and BI setting, which allows the reconciliation of some absent contradictory findings concerning ACAP and knowledge creation and how they can affect the assimilation of BI systems. Also, by adding to the theoretical effort that attempted to save the concept from being frequently rectified or corrected. The ACAP measures developed in the current research might not

relate as valuable for all ACAP theoretical studies since it noticeably did not capture all items relating different managerial levels such as tactical and operational, it was more strategic focused, and may not prove successful in non-data drive environments. Hence, The scale and impact of the current research contribution to academia is evaluated by the potential buildup of the current research as being one of the least studies that tend to systematically provide a framework that thoroughly identifies qualitative grounded – based measures. Linked to strategic effect on BI data-driven system efficiency the current research addressed an analysis of the literature on the general understanding of ACAP and its dimensions. Later, exploring ACAP dimensions by developing (19) qualitative items, and classifying them into four dimensions that can measure the dimensions of ACAP suggested by Zahra and George (2002) model. The extracted categories are anticipated to function as a foundation from which to compare findings across ACAP studies such as the significant consideration of (Flatten et al., 2011) which offered a scale development approach of measuring ACAP. However, this study proposed an alternative qualitative scale making it possible to apprehend the value added of ACAP as an organisational construct in technology-based industries by testing its aspect on BI systems efficiency.

In conclusion, what might also make this research a unique piece of research that it can add to the methodological research theory-based studies and its applications by providing clear face validity for a systematic triangulated state of the art utilisation of both the quantitative and qualitative approach used in empirically uncovering the research proposition. Both approaches of qualitative and quantitative were developed and discovered from real pragmatic data treated as a core foundation.

7.3.2 Practical Contribution to Industry

In addition to the theoretical contributions, the current research also contributes to how managers could practically detect the ability to realise the benefits of the behavioural and non-technical aspect of ACAP offered as a set of potential dynamic capabilities. It is essential for managers and executives to pay more attention to the beneficial organisational outcomes that arise as a result of implementing the extracted proposed ACAP categories presented in the relational framework. Managers are recommended to be aware of the four dimensions summarised by acquisition, assimilation, transformation,

and exploitation of data and knowledge. The mentioned dimensions can act as requirements before spending a high amount to expenditure when buying BI systems, and another state of the art data processing software. The offered ACAP measures correspondingly can contribute as being a dynamic facilitator for a more successful BI systems assimilation environment, as these dimensions may help organisations to use BI systems in an altered technique.

Setting up a successful and efficient BI system centred environment has been always linked with the availability and amount of financial spending on various technological based factors such as having the appropriate IT infrastructure, having the right tools for determining how and when to analyse data similar to data warehouse and OLAP tools, and many more technical and technological efforts (Liang and Liu, 2018) .In contrast, the current research came with a realistic contribution offered to strategic managers recommending that a thriving environment for BI systems might not only rely on the technical and technological tools and process. The desired data-driven environmental success might be attained by strategic manager's effort in evaluating their ACAP initiatives and measures following the presented proposed framework. The study suggested that there are various factors to be taken into account when setting up a successful BI environment. Senior managers in technological industries should have a reasonable set of assessed measures that are proposed to evaluate their organisational weakness and strengths concerning ACAP perspective. The extracted measures are proposed to offer foundations for shaping where and how further potential organisational assets can be leveraged. While viewing the extracted measures managers, strategic data acquisition managers, senior data analysts, and even human resource managers can consider what they already have from these sets, and what is missing or needs to be further discovered. A Subordinate contribution to practice from this work lies in offering a valid practical effect testing of the extracted measures on BI systems efficiency and assimilation, reflecting overall organisational effectiveness.

Another insightful, practical contribution lies in directing the managers' attention to paying a profound consideration to identify new R&D initiatives treated as a knowledge acquisition element of ACAP. R&D can already exist in their organisations but are not being well recognised. This can be achieved by applying advanced R&D edges that

concentrate on the technological part of R&D associated with specific data processing systems. In this case, employees will have prior theoretical familiarity with the potential systems that their organisations are willing to purchase and implement.

The study provided a clear insight for the targeted managerial positions listed in the sample to reduce their strategic challenges that can be featured by the ability to achieve a combination of IT, business, and analytical tools and skills needed for generating profit and being able to respond to the changing business environments. Correspondingly, the study provided a potential solution to manager facing specific data challenges specifically in the telecommunication industries and modern organisations where the most crucial organisational element is data.

The study also contributed to presenting an extensive use of internal and external communication channels between employees, group meetings, workshops, and training in which can be encouraged by departmental efforts. BI efficiency in line with presented ACAP measures can be highly influenced by the IT managerial prior knowledge and technological tendency available in managers, this is required as a competitive defence tool leading to a more successful organisational competitiveness. In sum, this will have potential in encouraging more the degree of information sharing across business units and enhance the ability of managerial teams to assimilate the given BI systems requirements. Correspondingly, leading to better and effective decision-making process generated through both ACAP categories and BI systems. Accordingly, this might reflect a better organisational efficiency provided as means of better performance presented as innovative products and services, patents, and competitive production. Finally, the study added a final subordinate contribution by proposing that the existence of BI systems within organisations could provide significant members of organisations such as employees, partners, and suppliers with relaxed access and acquisition to information, and the ability of practical data analysis and sharing environment. This can be performed by always reflecting effective policies and organisational design structures that assist the process of knowledge transformation and protection. Consequently, this can reflect on organisational effectiveness compared with other competitors.

7.4 Achieving Research Objectives

The current section reopens the research objectives that were introduced in chapter one and ascertain its accomplishment within the provided research chapters.

Objective 1: recognise the concept of ACAP as an organisational construct; consequently develop a theoretical setting that reflects its potential support for knowledge creation. This objective was accomplished in chapter two literature review and chapter three theoretical models.

Objective 2: hypothetically consider the role of BI systems in achieving organisational efficiency by establishing a possible notional association between ACAP and BI systems. This objective was notably achieved in chapter two by initially conducting a literature review on BI definitional aspects and effects. The research presented a global view of BI definitions and a comprehensive understanding of its effects and roles derived from a state of the art literature review process. Thus, the research presented clear face validity for researchers, managers, and decision makers to help them understand the managerial facets of BI. Building on the literature review, and analytical literature review, chapter three later came to propose another hypothetical representation for the possible association. Illustrated within a hypothetical model in the chapter four that proposed a total of (5) hypostases on the possible effects of ACAP, and how each hypothesis was supported.

Objective 3: the empirically extracted categories for ACAP delivered as a relational model in terms of their significant contribution to the theory and managerial practice. This was accomplished in chapter five; the qualitative research method used for uncovering measures of ACAP from organisational knowledge foundations. The objective was achieved through the data analysis and results undertaken from a systematic grounded theory approach, and through the coding process that was implemented in a systematic technique.

Objective 4: empirically validate the extracted ACAP model by testing its effects on BI systems efficiency and overall organisational efficiency. Chapter six attempted to uncover the main research question that supported the process of extracting the final model using a quantitative approach. The chapter illustrated the final stage validation for checking the

rationality of extracted categories in relevance to BI components. Moreover, testing the hypothesis that was set in the proposed theoretical model.

Objective 5: build a comprehensive causal model that reveals the resulted effect of ACAP specific dimensions as an organisational construct on BI systems efficiency, and organisational efficiency.

7.5 Research Limitations

The current section addresses limitations as any other scientific research. An obvious limitation drawn from the pragmatic data collected and analysed was concentrated around the fact that the focus of the research on only one sector. Organisations in the telecommunication industry sector deals with high volumes of data daily. Moreover, these sectors are found to face challenges in acquiring and processing data and knowledge from a mass number of daily users to maintain their potential ACAP take place. Thus, it cannot be generalised that extracted measures apply in other industries given the fact that certain industries are characterised with certain organisational and domestic cultures that direct their organisational process, and managerial development (Hofstede, 2001).

The other limitation of this research work is that it relied highly on GTM coding techniques. Coding was an important process in extracting results; nonetheless, it was a very time consuming and draining process for the researcher. The extracted categories had to go through phases of validation, starting from bias reduction techniques reaching to quantitative validation. The process of coding line-by-line and looking at each line made the process more challenging. Besides, the process of theoretical saturation, and when to stop coding was a relatively difficult process in the overall data analysis procedure. Consequently, future research will be directed towards a different scale of improvements for the ACAP constructs.

An additional possible limitation of the current study is the use of a relatively small sample size used in the quantitative data collection and analysis, and only one supplier of BI systems endorsements brought that. The small sample size operated due to facing issues related to time constraints while spending a long time in analysing qualitative data for understanding the ACAP construct, and the complexity in selecting the relevant

managerial level for participants that found to add value when responding to the designed questioners. So, the decision for choosing the current research relied on structural modelling for analysing the theoretical model (PLS-SEM), the chosen method thought to be suitable due to its significant flexible advantage in dealing with small sample size (chin, 1997). Nevertheless, the selected (150) samples succeeded in achieving the minimally required objectives set by the study. Moreover, the results flourished in testing the total number of (5) hypothesis all supported given the small sample size.

7.6 Future Work and Latest Research Trends

Future work will incorporate additional empirical research with more relative importance to the four ACAP dimensions and in different organisational settings, such as analysing each of the four ACAP dimensions according to their specific effects within different organisational life cycles, and how they can change while the industry is evolving and changing. It will also be important to determine in future research the variations between knowledge-intensive industries such as the telecommunications and banking industries, and another less knowledge-intensive kind of industries. The determination might incorporate a pragmatic comparison process between the two types of industries and by testing how ACAP dimensions differ in shaping numerous organisational outcomes. Future research could probe into how companies go about building the routines and the knowledge underlying them that make up each of the four dimensions. Also, how can the existence of ACAP differ in newly established companies compared with mature companies, and how companies go about accomplishing and structuring their routines differently following a well-recognised ACAP framework. Accordingly, what are the strategic consequences of these new ACAP structuring on performance?. Appreciating how different ACAP dimensions may vary across time and settings could also enrich the deliberations on ACAP role in generating the new knowledge that positions firms to grow and develop. Such consideration can add to the emergent future literature that applies the knowledge-based perception of organisations (Gilbert et al., 2000).

Future research will also incorporate expanding on the quantitative sample size to include broader large-scale sample size engaging senior managers across different countries, and form more than one technological based industry, and will incorporate an analysis of the

telecom industry concentrating more on its hierarchy map and value chain. Also future, research will be directed on engaging the concept of Big Data as another trend and a more technical aspect not greatly correlated to the strategic use of BI systems. And, to associate the concept with the organisational ACAP. Lastly, BI systems will be more extensively evaluated in future research and treated as a mediator between ACAP and achieving organisational efficiency. The current research concentrated more on the behavioural ACAP more than the technical aspects of BI systems. The latest research trends and directions in the field of ACAP are focused nowadays in engaging ACAP with the perception of innovation. The concept is being strongly linked to the innovative tendency of organisations (Loon, 2019). The latest research is considering the idea as an indicator of knowledge innovation regardless if it was all applied, or one of its dimensions.

Additionally, most recent trends in ACAP are linking the concept with not only organisational change. Instead, the concept is also being engaged with public sectors, countries and nation 's wide innovative perceptive. The innovation in terms of improving the ability of countries and to acquire better, absorb, assimilate, and exploit knowledge needed for the development of governments and public sectors data policies and procedures (Loon, 2019). Precisely, the trend now is to have ACAP as important component framework followed in developing policies inside organisations and government sectors. These policies tend to advance the innovative behaviour of firms. Consequently, this will reflect its technical and technological innovation as well (Kumar et al., 2001).

The new trends engaged in BI systems landscape also is evolving at a rapid pace. Mao et al., 2019). Latest trends observed in the last two years are that BI systems are now oriented towards being customised additionally to fit organisational requirements and strategies. While before companies were wondering if they need such technology or not due to its high expenditure. Now, organisations understand the necessity of their existence as a strategic data processing platform and are looking to customise the system according to their challenging requirements. A new term entered the field of BI in the current year which is "Data Quality Management "DQM, "recent attempts are merging the two concepts as a new technique to generate a quality based strategic decisions and

performance produced from process that ensures the integrity of the databases and data clearness (Mao et al., 2019).

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APPENDIX A

Ethics Form / Consent Letter



LETTER OF INFORMED CONSENT

Study Title: The effect of organizational knowledge Absorptive Capacity on Business Intelligence Efficiency in the Jordanian Telecommunication Industry

You are kindly invited to participate in research that is going to take place at your organization in Amman /Jordan branch, starting March 2015. Before agreeing to participate in this research, I encourage you to read the following clarifications of the study. This declaration defines the purpose and procedures of the study. Your right to withdraw at any stage of the research is also described. The research is part of my doctoral studies and has been approved by the ethics committee of Brunel University London; it is expected to result in a thesis that will be used for examination purposes only.

Explanation of Procedures

The research will investigate the extent to which a concept called 'Absorptive capacity' or the previous knowledge that managers own can facilitate Business Intelligence systems adoption and efficiency. As a participant in this study, I will interview you individually for about thirty minutes; the Interviews will be recorded and transcribed for the purpose of data analysis following the interview a second stage of surveys might be circulated as well.

Risks and Discomforts

There are no risks or worries expected as a result of your participation in this research.

Potential risks or discomforts include emotional sad feelings that will affect you when asked Questions during the interview.

Benefits

The anticipated benefits of your participation is your contribution to the researcher understanding of Business Intelligence technology applied in the telecom sector, and how it can be facilitated and better improved by a set of acquisition, assimilation, transformation and exploitation processes identified as potential ways of achieving managerial and organizational paybacks that we will be testing via our questions and analysis.

Withdrawal without Prejudice

Participation in this research is voluntary; should you decide to withdraw at any stage of the research, you will not be penalized. Moreover, you have the right to refuse to answer any question you might be asked during the interview.

Confidentiality

The data that will be produced throughout this study will be handled with the highest level of Confidentiality. This means that no other person except the researcher will have access to it and the data will be stored on a password-protected computer. In addition, your name will not appear anywhere in the final report; where necessary, a pseudonym will be used. The same applies to the name of your organization. Moreover, after the thesis has been examined, the recorded data will be erased from the recorder and the notes taken during the interview will be destroyed upon completion of the study.

Further Questions and follow-Up

After the interview, you are welcome to ask the researcher any question that you thought of during the interview or seek clarification. If you have any concerns or complaints regarding this project please contact siscm.srec@brunel.ac.uk or Dr Malcolm Clarke Tel. No. 01895 265053.

I have read the above information. I freely agree to participate in this research. I fully understand that my participation is voluntary and that I have the right to refuse to answer any question during the interview. I also understand that I can withdraw from the research at any stage, should the need arise. Further, I understand that my answers will be recorded anonymously: my name and that of the company will not appear in the thesis.

Participant Signature.

Date.....

APPENDIX B

Quantitative Survey

The surveys were analysed according to the number of points on each scale taken from the original scales, where applicable.

Question: To what extent you agree or disagree with the following statements?

ACAP Measures

ACAP Acquisition

- Q1) Management support for data exchange exists in my organisation.
- Q2) Departmental data management exists in my organisation.
- Q3) There is support for well-established relations with data providers.
- Q4) Research development activates, and investments exist in my organisation.
- Q5) Periodical Meetings and workshops with experts occur in my organisation.
- Q6) Human resource competencies are highly encouraged.
- Q7) my organisation does allocate financial budgets supporting different initiatives for data exchange purposes.

ACAP Assimilation

- Q8) Timely data flow is organised and noticeable in my organisation.
- Q9) Well-established development exchange meetings occur in my organisation.
- Q10) Departmental employee's communication occurs in my organization.
- Q11) In my organisation employees have a degree of literacy regarding acquired data from other resources
- Q12) Technological readiness is apparent in employees in terms of data processing competencies.

ACAP Transformation

- Q13) in my organisation, there is adequate availability of technological infrastructure.
- Q14) in my organisation technical ability and tendency of employees is highly present.
- Q15) Robust, and effective data security measures are implemented in my organisation.

ACAP Exploitation

- Q16) in my organisation, there is an acceptable degree of quality decisions and decision-making.

-
- Q17) in my organisation exists apparent innovative products and service.
 - Q18) we have prototype production support.
 - Q19) my organisation always seek the adoption of new technologies.

BI systems Efficiency

Question: To what extent you agree or disagree with the following statements?

- Q20) BI systems improved data collection from different systems resources using BI technical tools.
- Q21) in my organisation using the BI system and BI technical tools increased employee productivity.
- Q22) BI system improved data collection from different systems resources.
- Q23) BI systems added enhanced coordination between partners, suppliers, and our organisation internally.
- Q24) BI systems lowered the cost of transactions with business partners/suppliers and data providers.
- Q25) BI system improved data processing and storage using data warehouse and OLAP online analytical processing tools.
- Q26) BI systems improved the efficiency of internal processes.
- Q27) BI systems in my organisation lowered operational cost.
- Q28) BI systems reduced the time and cost-to-market products/services.
- Q29) BI systems reduced the cost of effective decision-making.

Organisational Efficiency:

Question: To what extent you agree or disagree with the following statements?

- Q30) Organizational success in our organisational is higher compared with key competitors in the same industry.
- Q31) we have increased organisational ownership of market share compared with key competitors in the same industry.
- Q32) Organizational development in our organisations is at a quicker pace compared with key competitors in the same industry.
- Q33) we have Increasing organisational profit comparing with key competitors in the same industry.
- Q34) Organizational product and services innovation is better compared with key competitors in the same industry.

APPENDIX C

A Sample of Nvivo Qualitative Phrase Analysis

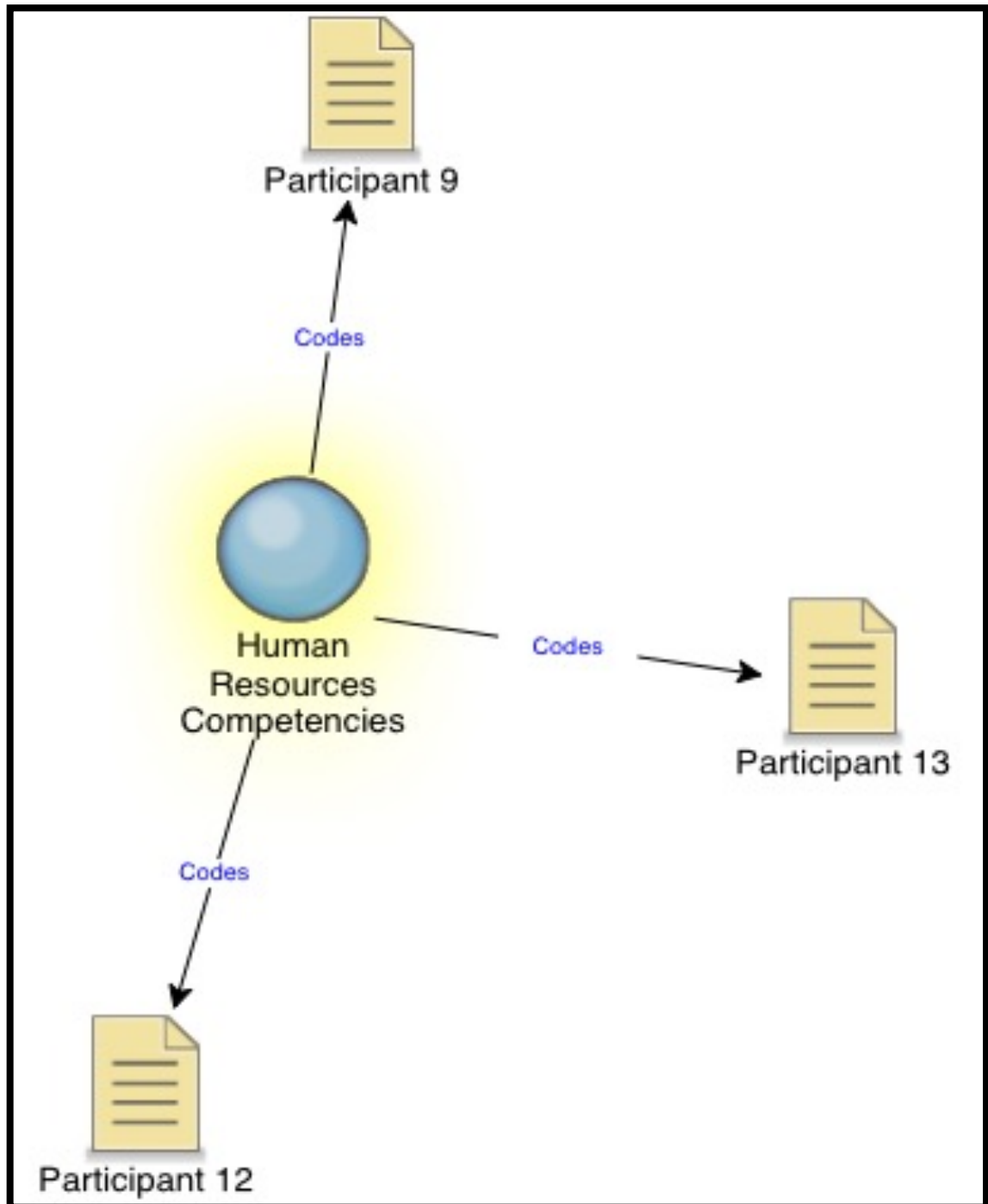
Word categories Extracted	Length	Count	Weighted Percentage
Data	4	13	3.19%
Knowledge	9	9	2.21%
Employees	9	8	1.96%
Organization	12	8	1.96%
Management	10	6	1.47%
Storage	7	5	1.23%
Process	7	4	0.98%
Special	7	4	0.98%
Annual	6	3	0.74%
Company	7	3	0.74%
Meeting	7	3	0.74%
Potential	9	3	0.74%
Procedures	10	3	0.74%
Processed	9	3	0.74%
Reports	7	3	0.74%
Sharing	7	3	0.74%
Technological	13	3	0.74%

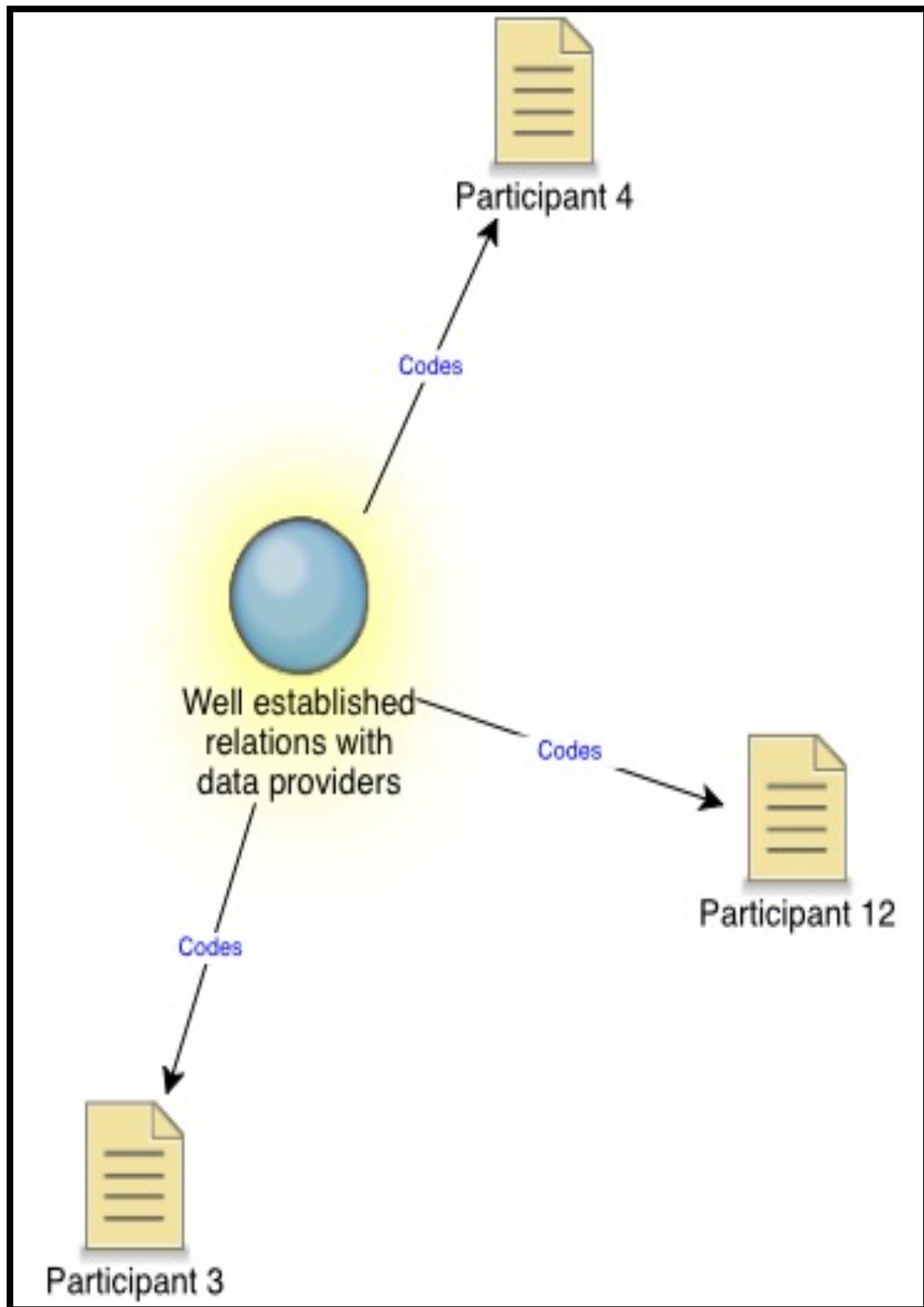
Appendix c

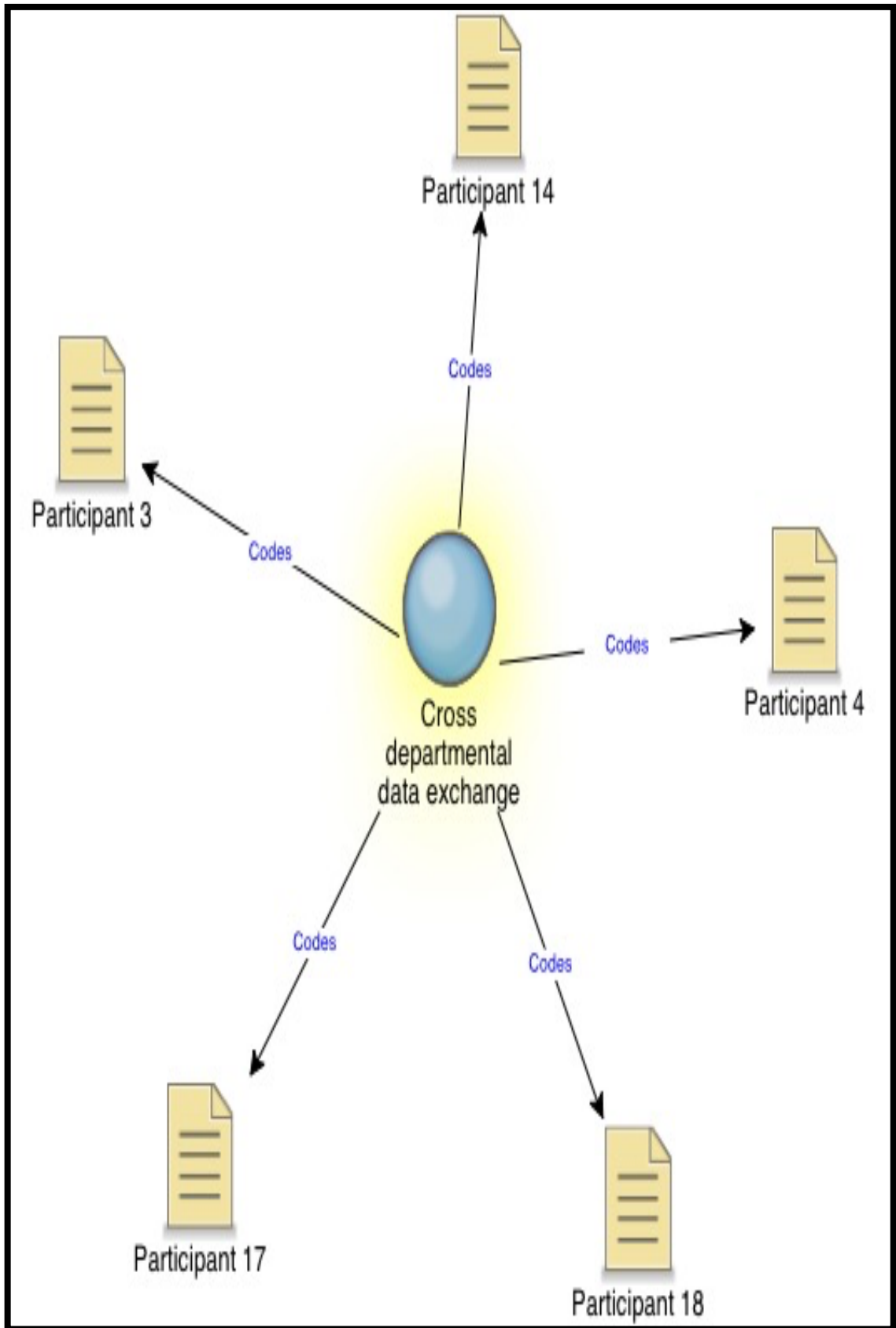
Across	6	2	0.49%
Awareness	9	2	0.49%
Breach	6	2	0.49%
Category	8	2	0.49%
Communication	13	2	0.49%
Consent	7	2	0.49%
Department	10	2	0.49%
Different	9	2	0.49%
Document	8	2	0.49%
Efforts	7	2	0.49%
Encouraged	10	2	0.49%

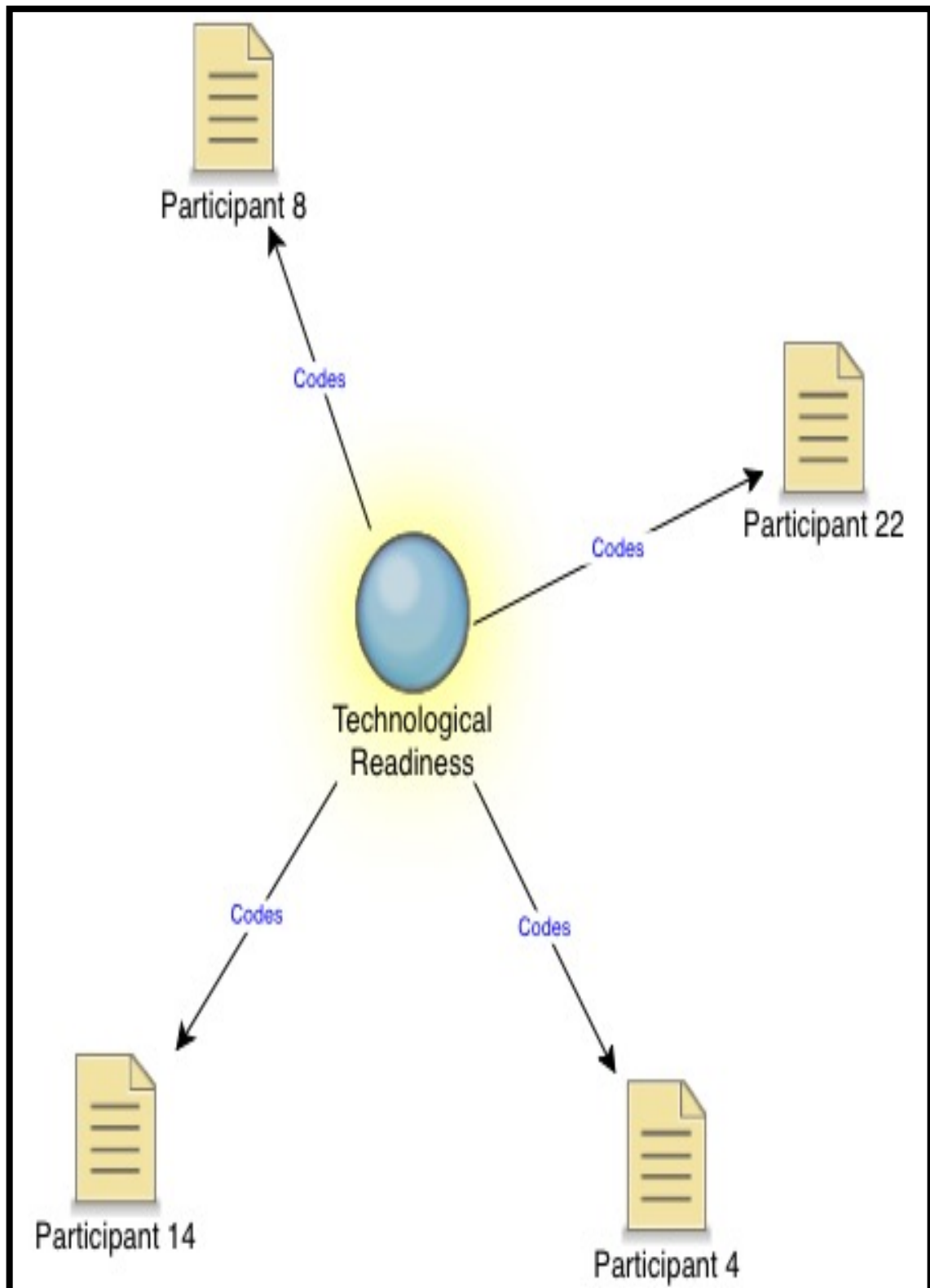
APPENDIX D

Sample of NVivo Codes for selected to participants









APPENDIX E

References Coverage for Qualitative Initial Open Codes

The screenshot displays a software interface for qualitative data analysis. The main window shows a list of codes on the left and a detailed view of a specific code on the right. The code being viewed is 'Availability of technological infrastructure', which is categorized under 'Transformation'. The interface shows three references with their respective coverage percentages:

- Files\Interviews\Participant 1**: 1 reference coded, 1.91% coverage. Reference text: "Our company uses tools (e.g., intranet, internal studies/reports) to spread knowledge in the whole organization."
- Files\Interviews\Participant 3**: 1 reference coded, 1.34% coverage. Reference text: "Our company has the ability to work more effective by adopting new technologies."
- Files\Interviews\Participant 8**: 1 reference coded, 1.47% coverage. Reference text: "Our company owns tools to enhance knowledge that secures the company's competitiveness."

The interface includes a navigation menu on the left with categories like DATA, FILES, CODES, CASES, NOTES, SEARCH, and MAPS. The top navigation bar includes options like Home, Create, Data, Analyze, Query, Explore, Layout, and View. The bottom status bar shows the current path: CODES > Nodes > Transformation > Availability of technological infrastructure.

The screenshot displays a software interface with a top navigation bar (Home, Create, Data, Analyze, Query, Explore, Layout, View) and a search bar. Below the navigation bar are icons for 'Tools' and 'Sort & Filter'. The left sidebar contains a 'DATA' section with a tree view of folders: Files (Interview, File Classif., Externals), CODES (Notes), CASES (Cases, Case Class.), NOTES, SEARCH, MAPS (Maps), and OPEN ITEMS. The main area is titled 'Adoption of new technologies' and has tabs for 'Summary' and 'Reference'. It displays two text excerpts with their associated reference codes and coverage percentages.

Reference Code	Coverage Percentage	Text Excerpt
Files\Interviews\Participant 1	1 reference coded, 1.91% coverage	Our company uses tools (e.g., intranet, internal studies/reports) to spread knowledge in the whole organization.
Files\Interviews\Participant 4	3 references coded, 4.17% coverage	Our company owns tools to enhance knowledge that secures the company's competitiveness.

At the bottom of the interface, a breadcrumb trail shows: CODES > Notes > Exploitation > Adoption of new technologies.

The screenshot shows a software interface with a top navigation bar (Home, Create, Data, Analyze, Query, Explore, Layout, View) and a search bar. Below the navigation bar are icons for 'Reset Settings', 'Sort By', and 'Filter'. A left sidebar contains a tree view with categories: DATA, CODES, CASES, NOTES, SEARCH, and MAPS. Under 'CODES', there are sub-categories like 'Nodes' and 'Case Class.'. Under 'CASES', there are 'Cases' and 'Case Class.'. Under 'NOTES', there are 'NOTES'. Under 'SEARCH', there are 'SEARCH'. Under 'MAPS', there are 'Maps'. The main content area is titled 'Technological Readiness' and has tabs for 'Summary' and 'Reference'. It displays four search results, each with a link to a file, the number of references coded, and the coverage percentage. The results are: 1) Files\Interviews\Participant 14 (1 reference coded, 3.18% coverage), 2) Files\Interviews\Participant 22 (1 reference coded, 3.66% coverage), 3) Files\Interviews\Participant 4 (1 reference coded, 1.45% coverage), and 4) Files\Interviews\Participant 8 (1 reference coded, 1.47% coverage). The bottom of the interface shows a breadcrumb trail: CODES > Nodes > Assimilation > Technological Readiness.

APPENDIX F

Nvivo Qualitative Nodes / Coding References

Nodes	The aggregate number of coding references	Number of items coded	The aggregate number of items coded
Nodes\\Acquisition	32	7	10
Nodes\\Acquisition\\Allocating Financial Budgets	3	3	3
Nodes\\Acquisition\\Cross departmental data exchange	6	8	5
Nodes\\Acquisition\\Human Resources Competencies	4	4	4
Nodes\\Acquisition\\Management support for data exchange	12	6	6
Nodes\\Acquisition\\Periodical meetings and workshops	3	2	7
Nodes\\Acquisition\\Research development activates and investments	2	6	6
Nodes\\Acquisition\\Well established relations with data providers	4	3	3
Nodes\\Assimilation	13	0	10
Nodes\\Assimilation\\Departmental employees communication	5	4	4
Nodes\\Assimilation\\Employees literacy for acquired data	4	3	3
Nodes\\Assimilation\\Technological Readiness	4	4	4

Appendix F

Nodes\\Assimilation\\Timely Data Flow	2	2	2
Nodes\\Assimilation\\Well established development exchange meetings	3	3	3
Nodes\\Exploitation	9	0	5
Nodes\\Exploitation\\Adoption of new technologies	4	2	3
Nodes\\Exploitation\\Innovative products and services	2	2	3
Nodes\\Exploitation\\Prototype production support	2	2	3
Nodes\\Exploitation\\Quality of decisions and decision making	3	1	4
Nodes\\Transformation	9	3	6
Nodes\\Transformation\\Availability of technological infrastructure	3	3	3
Nodes\\the \\Transformation\\Robust and effective data security measures	3	1	5
Nodes\\Transformation\\Technical Ability and the tendency of employees	3	3	3