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Ollscoil na hÉireann, Corcaigh

National University of Ireland, Cork

Department of Accounting and Information Systems

University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Exploring the Organisational Performance Impact of Private Cloud Infrastructure-as-a-Service (PCIaaS) Using Resource-Based View (RBV) Theory: A Study of Tertiary Institutions in the UK and Ireland

Charles Osemwingie Amayo, BSc, BBS (Hons), MSc

A Thesis Submitted to the National University of Ireland, Cork for the Degree of Doctor of Philosophy (PhD) in Management Information Systems

Head of School/Department: Professor Joseph Feller

Research Supervisors: Dr Tadhg Nagle and Dr Fergal Carton

2021

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List of Abbreviations

ACM	Activity Competency Model
AD	Active Directory
AWS	Amazon Web Services
BI	Business Intelligence
BIS	Business Information Systems
CC	Cloud Computing
CIT	Cork Institute of Technology
CoC	Code of Conduct
CPU	Central Processing Unit
CSP	Cloud Service Provider
DevOps	Development and Operations
DHCP	Dynamic Host Configuration Protocol
GDPR	General Data Protection Regulation
HaaS	Hardware-as-a-Service
HBR	Harvard Business Review
HC	Hybrid Cloud
HOD	Head of Department
IaaS	Infrastructure-as-a-Service
IS	Information Systems
ISP	Internet Service Provider
IT	Information Technology
ITBV	Information Technology Business Value
JCT	Job Characteristics Theory
MSC	Market Sensing Capabilities
NUIG	National University of Ireland Galway
OE	Operational Effectiveness
OP	Organisational Performance
ORG	Organisational
OU	Oxford University
PaaS	Platform-as-a-service
PCIaaS	Private Cloud Infrastructure-as-a-Service
RBV	Resource-Based View
ROI	Return on Investment
RPO	Recovery Point Objective
RTO	Recovery Time Objective
SaaS	Software-as-a-Service
SLA	Service-Level Agreement
SMEs	Small and Medium-sized Enterprises
SOA	Service-Oriented Architecture
SOPs	Standard Operating Procedures
SP	Strategic Positioning
TEL	Technology-Enhanced Learning
UCC	University College Cork
vCloud	Virtual Cloud
vDesktop	Virtual Desktop
VDI	Virtual Desktop Infrastructure
vLab	Virtual laboratory
VLE	Virtual Learning Environment
VM	Virtual Machine
VPC	Virtual Private Cloud
VPN	Virtual Private Network
vServer	Virtual Server
WDS	Windows Deployment Services

Declaration

This is to certify that the work I am submitting is my own and has not been submitted for another degree, either at University College Cork or elsewhere. All external references and sources are clearly acknowledged and identified within the contents. I have read and understood the regulations of University College Cork concerning plagiarism and intellectual property.

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ABSTRACT

As a new paradigm in IT infrastructure, there is a paucity of research on the organisational performance impact of PCIaaS and the resources and capabilities involved. One of the top challenges faced by organisations is the lack of resources and expertise in exploiting the potential of PCIaaS. From the perspective of RBV theory, PCIaaS IT personnel and organisational factors are the two organisational resources required to develop the capabilities for exploiting PCIaaS. This study addresses these gaps in knowledge through a qualitative, exploratory, multiple case study of three tertiary educational institutions in the UK and Ireland. Utilising the RBV to develop a conceptual research model as a theoretical lens, qualitative data were collected and analysed across the cases. This study identified the organisational performance impact of PCIaaS across three levels: 39 PCIaaS performance measures, nine PCIaaS business value dimensions, and two PCIaaS organisational performance categories. The study also identified the skills/knowledge and activities performed by PCIaaS IT personnel that contribute to PCIaaS performance impact and 13 organisational factors that impacted the organisational performance impact of PCIaaS. The study also highlighted three PCIaaS capabilities that emanated from the combination of PCIaaS IT personnel and organisational factors for exploiting PCIaaS to improve organisational performance.

The study contributes to both theory and practice by investigating and providing empirical on how two organisational resources combine to create the three capabilities to exploit PCIaaS for organisational performance. Having detailed all the key inputs (resources) and resulting outputs (performance impacts) of PCIaaS, this study goes beyond the linear RBV models presented in the literature and uncovers the complexity of deriving value from PCIaaS through a network of resource combinations. Furthermore, the collection of performance measures, business value dimensions and organisational performance categories developed for PCIaaS form a detailed performance impact evaluation instrument that can be applied and or extended to many other technologies, supporting researchers and practitioners alike to tackle one of the most challenging problems in IS/IT, which is to detail the business value of technology implementations accurately. Finally, the study provides insight into the specific PCIaaS skills/knowledge and the activities performed by PCIaaS IT personnel and the organisational factors that support the exploitation of PCIaaS.

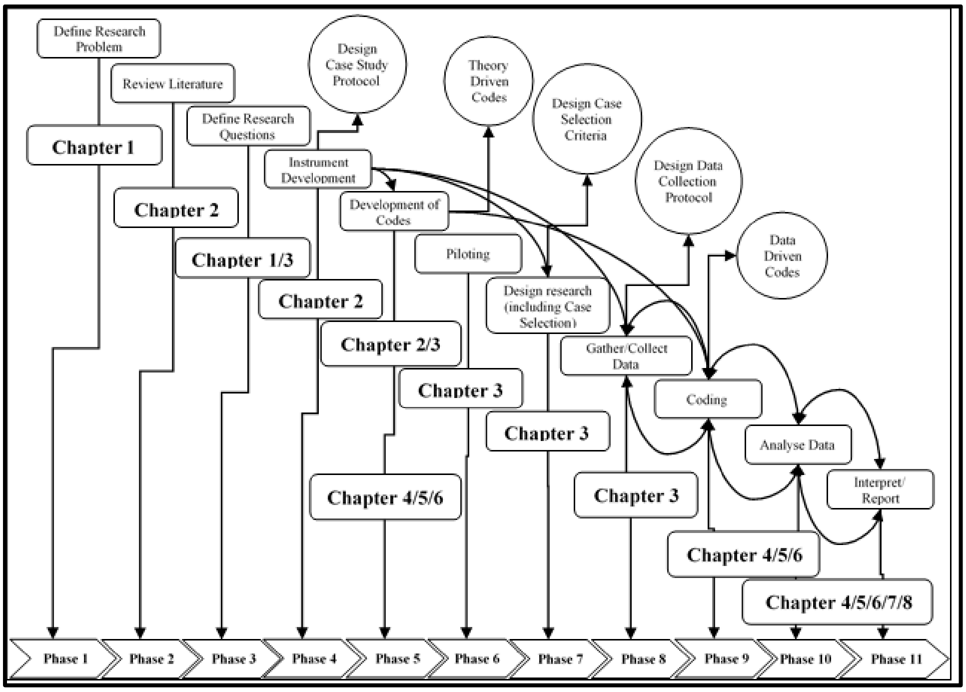
Chapter One – Introduction

1.0 Introduction

This study investigates the organisational performance impact of Private Cloud Infrastructure-as-a-Service (PCIaaS). This chapter provides an introduction and overview of this research study which draws on literature from IT business value (ITBV), cloud computing (CC), and resource-based view (RBV) theory. This chapter begins with an overview of the research process in Section 1.1. Section 1.2 followed by defining the research problem and gaps in the existing literature. Afterwards, Section 1.3 presents the research objective and questions, while Section 1.4 presents an overview of the key contributions of this study. Finally, Section 1.5 outlined the structure of the thesis.

1.1 An Overview of the Research Process

Kothari (2004, p. 10) advised that "*before embarking on the details of research methodology and techniques, it seems appropriate to present a brief overview of the research process*". Figure 1-1 presents the research process, highlighting the 11 phases or stages, starting with defining the research problem and ending with the interpretation and reporting of the results.



Source: Adapted from Kothari (2004)

Figure 1-1: The 11 Stage/Phase Research Process

Figure 1-1 outlines the phases of this study's research process, showing the main activities between phase one and phase 11. This study's "*research process consists of series of actions or steps necessary to effectively carry out research and the desired sequencing of these steps*" (Kothari, 2004, p. 10). The phases, although outlined in sequence, had some overlaps as highlighted with the loop between phases. The following section presents a brief discussion of the research problem.

1.2 Research Problem and Gap

Defining the research problem is one of the most crucial initial steps in any research study (Kothari, 2004). The research problem was defined based on the gaps identified in the literature review of ITBV, CC, and RBV theory (Kothari, 2004). Evaluating the organisational performance impact of IT has been an area of research for more than half a century (Emery, 1971; King & Schrems 1978; Kauffman & Weill, 1989) and of great importance to both researchers and practitioners (Bakos, 1987; Brynjolfsson, 1993; Barua et al., 1995; Soh & Markus, 1995; Brynjolfsson & Hitt, 1998; Davern & Kauffman, 2000; Lee, 2001; Melville et al., 2004; Agarwal & Lucas, 2005; Ravichandran & Lertewongsatien, 2005; Tanriverdi, 2005; Gregor et al., 2006; Aral & Weill, 2007; Kohli & Grover, 2008; Prasad, 2008; Weinman, 2012; Schryen, 2013; Wiengarten et al., 2013; Barenfanger et al., 2014; Akbar et al., 2015; Za & Braccini, 2017; Mahler & Westergren, 2018; Jean et al., 2021).

Despite more than half a century of ongoing research in this area, its importance to researchers and practitioners, and the significant number of studies, significant gaps remain. The literature suggests that IT has evolved and witnessed several eras since its inception, such as the mainframe, personal computer, network, internet, grid computing, and CC (Melville et al., 2004; Voas & Zhang, 2009; Sabherwal & Jeyaraj, 2015). Earlier eras of IT relied on physical IT infrastructure, while the present era of CC relies on virtualised IT infrastructure. Most of the existing literature in the domain of ITBV focuses primarily on traditional IT or non-cloud IT infrastructure. Given that PCIaaS is a relatively new technology, there is a paucity of empirical investigations on the organisational performance impact of virtualised or cloud IT infrastructure.

Researchers have described CC as a new technology, a paradigm shift, a new phenomenon, next-generation IT infrastructure, and one of the most significant innovations in the IT industry (Armbrust et al., 2009, 2010; Liu et al., 2009; Bhardwaj et al., 2010; Marston et al., 2011; Wang et al., 2011; Lian et al., 2014; Sabi et al., 2016; Liu et al., 2016; Liu et al., 2018). In addition, many more have called for research to investigate its business value (Wang et al., 2011; Berman et al., 2012; Hoberg et al., 2012; Yang & Tate, 2012; Musa & Walker, 2013; Chen et al., 2016; Liu et al., 2016; Bayramusta & Nasir, 2016; Lynn et al., 2020). For example, Berman et al. (2012) argued that "*cloud computing is widely recognised as a technology game-changer because it offers anytime, anywhere services, its potential for driving business innovation remains virtually untapped* (p. 27)". Berman et al. (2012) also stated that *"cloud technology has the power to fundamentally shift competitive landscapes by providing a new platform for creating and delivering business value* (p. 27)*"*. However, Musa & Walker (2013) contended that "*there is lack of adequate research identifying the business value of emerging cloud computing* (p. 602)". In addition, Liu et al. (2016) stated that "*it is still not clear how firms can exploit such (cloud computing) features to contribute to business* (p. 8)". Similarly, Bayramusta & Nasir (2016) also argued that "*the impact of cloud computing on organisations and institutions is immense and is in need of investigation* (p. 365)".

However, CC consists of four deployment models and three service models (Mell & Grance, 2009, 2011). Therefore, following the advice of De Haes & Grembergen (2009) that "*research scope needs to be narrowed* (p.125)", by demarcating the four deployment and three service models of CC into 12 possible combinations (see Chapter Two, Figure 2-2 in Section 2.2.1), focusing explicitly on the combination of referred to as PCIaaS. Private Cloud, the preferred choice of large organisations, enables large organisations sceptical of other deployment models of CC, due to security and privacy concerns, to harness the potential of this innovative technology for their exclusive use while keeping their mission-critical and core business applications under their control (Dillon et al., 2010; Lu et al., 2014; Awadallah, 2016). For example, Awadallah (2016) regards the private cloud as the preferred choice for large organisations' CC deployment models. However, the private cloud also consists of three service models available in CC. Infrastructure-as-a-Service (IaaS) is the underlying infrastructure other service models such as Software-as-a-Service (SaaS), and Platform-as-a-Service (PaaS) depend on (Mell & Grace, 2009; Dawoud et al., 2010; Krieger et al., 2010; Bojanova & Samba, 2011; Doelitzscher et al., 2011; Gonzalez-Martínez et al., 2015; Yauri & Abah, 2016).

A search of the titles and abstracts of all scholarly papers available on online research databases with different combinations of these phrases “organisational performance”, or “organizational performance” or “business value”, and “private cloud”, and “IaaS” revealed that literature and empirical studies on the organisational performance impact of PCIaaS did not exist. Therefore, leaving the potential of PCIaaS virtually untapped and significant gaps in knowledge and understanding of its organisational performance impact. Consequently, our current knowledge of the organisational performance impact of PCIaaS lies mainly in the realms of conjecture and anecdote. This study presents 35 PCIaaS performance measures across nine dimensions of business value and two organisational performance categories (see Table 2-14 in Chapter Two, Section 2.6.3).

The literature on RBV argues that organisational capabilities to exploit IT to improve organisational performance depend on IT personnel and organisational factors (Wernerfelt, 1984; Barney, 1991; Grant, 1991; Clemons & Row, 1991). The IT personnel in organisations include CIOs, computer operators, technical specialists, IS managers, systems analysts, designers, programmers, analysts, database administrators, network specialists, web admins, and software engineers (Ang & Slaughter, 2000, 2004; Wade & Parent, 2002; Nord et al., 2007; Colomo-Palacios et al., 2010; Aasheim et al., 2019). The IT personnel charged with managing and supporting PCIaaS (referred to in this study as PCIaaS IT personnel) is a relatively new and emerging role in the IT profession. Several researchers have argued that changes in technology result in changes and the acquisition of new skills/knowledge by IT personnel (Liu & Cai, 2013; Avram, 2014). For example, Avram (2014) argues that “*the IT organisation will be affected by cloud computing, as has been the case with other technology shifts* (p. 533)”. Avram (2014) identifies two dimensions in shifts in technology – “*the first is acquiring the new skill sets to deploy the technology in the context of solving a business problem, and the second is how the technology changes the IT role* (p. 533)”. The emerging nature of CC in general and PCIaaS, particularly in large organisations, vis-a-vis the relatively new and emerging role of PCIaaS IT personnel, requires a better understanding of the activities performed and their skills/knowledge.

Investigating the skills/knowledge of IT personnel is not only vital to ITBV but is always under scrutiny in organisations and an area of ongoing research that is of great importance to both academia and practitioners (Nelson, 1991; Lee et al., 1995; Todd et al., 1995; Byrd & Turner, 2001, Ang & Slaughter, 2000, 2004; Gallavin et al., 2004; Goles et al., 2008; Gallagher et al., 2010). Nelson (1991) argues that identifying the skills/knowledge required by IT personnel to perform their jobs successfully is a fundamental issue for both practice and academia. Several researchers argued that changes or paradigm shift in technology also results in changes or paradigm shifts in the requisite skills/knowledge needed by IT personnel (Watson et al., 1990; Lee et al., 1995; Rockart et al., 1996; Broadbent et al., 1996; Ang & Slaughter, 2000; Bharadwaj, 2000; Byrd & Turner, 2001; Wade & Parent, 2002; Gallivan et al., 2004; Byrd et al. 2005; Zwieg et al., 2006; Khajeh-Hosseini et al., 2010). Therefore, Todd et al. (1995) argue that investigating IT personnel skills/knowledge helps to "*increase our current understanding of the IS profession to enhance the processes of educating, training, recruiting, hiring, and promoting IS professionals* (p. 2)".

IT personnel in organisations often lack the necessary skills/knowledge to manage and support PCIaaS (Khajeh-Hosseini et al., 2010; Liu & Cai, 2013; Avram, 2014). Similarly, recent surveys conducted by Rightscale in 2016 and 2017 reveal that the lack of resources and expertise and the complexity of building a private cloud rank among the highest eight challenges organisations face using CC (see Appendix 1, Appendix 2, and Appendix 3). These surveys reinforced the importance of PCIaaS IT personnel in the ability to exploit PCIaaS for performance improvement. In addition, some researchers have highlighted the importance of IT skills in the management of IaaS (Lynn et al., 2020). For example, Lynn et al. (2020) noted that IaaS "*requires a high level of IT skills in order to optimise and manage the infrastructure* (p, 22)". Given the emerging role of PCIaaS IT personnel and their importance in organisations' ability in exploiting PCIaaS to enhance their performance, it is surprising that the skills/knowledge of and the activities performed by PCIaaS IT personnel remain understudied (Lian et al., 2014; Rockmann et al., 2014).

Furthermore, researchers have highlighted the importance of certain organisational factors in an organisation's ability to exploit or leverage IT for business value (Bharadwaj 2000; Lee, 2001; Melville et al., 2004; Cao, 2010; Cao et al., 2011;

Wiengarten et al., 2013; Prasad, 2020). Several researchers have also highlighted the importance of organisational factors in the adoption, implementation, effective management, integration, and exploitation of the full potential of CC and its performance impact (Low et al., 2011; Garrison et al., 2012; Borgman et al., 2013; Lian et al., 2014; Stieninger & Nedbal, 2014). Surprisingly, most studies to date on the organisational factors in the context of CC focused primarily on the adoption of CC. There is a lack of empirical studies on the organisational factors that impact the performance impact of PCIaaS.

In summary, there is a lack of research on the organisational performance impact of PCIaaS, the necessary skills/knowledge and activities, and the organisational factors that underpin the business value of PCIaaS. This study is motivated by the desire to address these gaps and provide a detailed insight into the organisational performance of PCIaaS.

1.3 Research Objective and Research Questions

Given the research gaps identified, the research's scope is bounded explicitly by the following research objective:

Investigate the organisational performance impact of PCIaaS and the organisational resources and capabilities involved

In order to fulfil this research objective, the study adopts RBV theory as its theoretical lens. RBV is an influential and popular strategic management theory used in this context in investigating organisational performance. However, there are two theoretical frameworks of RBV of organisational performance – the direct model (resources and performance) and the indirect model (resources and capabilities and performance). The theoretical research model developed and proposed for this study is grounded on the Grant (1991) framework of the indirect model of RBV, consisting of the following three variables, including (1) organisational resources (input), (2) organisational capabilities (mediator), and (3) organisational performance (output). This study adopts Barney's (1991) classification of organisational resources, including (1) PCIaaS (a proxy of technological resources), (2) PCIaaS IT personnel (a proxy of human capital resources), and (3) organisational factors (a proxy of organisational capital resources). By conducting this investigation, this study aims to examine how organisational resources' attributes and characteristics shape organisations' capabilities to exploit PCIaaS to improve their performance.

To achieve the objective of this research, the formulation of appropriate research questions was paramount. Mason (2002) posits that "*researchers should be clear about what is the essence of their enquiry and should express this as an intellectual puzzle with a clearly formulated set of research questions*". In addition, Wade & Hulland (2004) advise that "*to explore the usefulness of the RBV for IS research, it is necessary to explicitly recognise the characteristics and attributes of resources that lead them to become strategically important*". Accordingly, the researcher formulated four research questions to achieve the research objective, as presented in Table 1-1.

Table 1-1: Research Questions

Research questions
RQ1. What is the organisational performance impact of PCIaaS?
RQ2. What are the organisational factors that influence the organisational performance impact of PCIaaS?
RQ3. What are the contributions of PCIaaS IT personnel to the organisational performance impact of PCIaaS?
RQ4. What organisational capabilities are required to improve organisational performance through PCIaaS?

This study developed and leveraged a conceptual research model grounded in RBV theory to investigate the organisational performance impact of PCIaaS, the two organisational resources involved, and the capabilities developed. RBV theory is a lens used in investigating the links between organisational resources, capabilities, and performance and has been used widely in IS and ITBV research (Bharadwaj, 2000; Melville et al., 2004; Wade & Hulland, 2004; Zhu, 2004; Jean et al., 2008; Cao, 2010; Cao et al., 2011; Garrison et al., 2012; Lim et al., 2009, 2013; Wiengarten et al., 2013; Rockmann et al., 2014; Devece et al., 2017).

This study is the first to investigate the organisational performance impact of PCIaaS and the organisational resources and capabilities involved. Building a research model specifically for PCIaaS, the study incorporates:

1. The 35 PCIaaS performance measures developed from the literature on CC (see Table 2-13), across nine PCIaaS business value dimensions, and two PCIaaS organisational performance categories derived from Porter (1996) and Tallon et al. (2000).

2. Five organisational factors previously validated and used in prior studies of RBV of ITBV (Cao, 2008, 2010; Cao et al., 2011; Wiengarten et al., 2013).
3. The Activity Competency Model (Wu et al., 2004), incorporating the five profiles of activities of IT personnel (Guillemette & Pare, 2007, 2012a, 2012b; Guillemette et al., 2008, 2017; Koffer et al., 2015; Wiedemann et al., 2017; Pare et al., 2020), and two dimensions of competencies (Teo & King, 1997; Haggerty, 2000; Bassellier et al., 2001, 2003; Bassellier & Benbasat, 2004; Mithas & Krishnan, 2004; Masrek et al., 2009; Colomo-Palacios et al., 2010); and
4. Two categories of capabilities previously validated and used in prior studies (Day, 1994; Wade & Hulland, 2004; Blois & Ramirez, 2006; Hulland et al., 2007; Sharma et al., 2007; Radhakrishnan et al., 2008; Stoel & Muhanna, 2009; Liang et al., 2010; Neirotti et al., 2013; Wei et al., 2014; Chen & Ong, 2015; Neirotti & Raguseo, 2017; Fink et al., 2017; Liu et al., 2018).

Figure 1-2 presents the proposed research model showing the three main variables and their components.

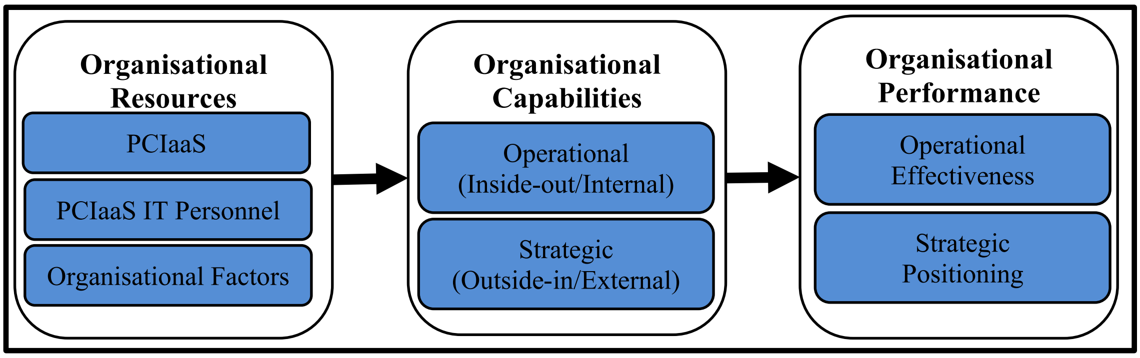


Figure 1-2: Proposed Conceptual Research Model

In addressing this research objective and answering the four research questions, this study makes several significant contributions to theory and practice, as summarised in the following section.

1.4 Overview of the Study Contributions

This study makes several key contributions to both IS theory and practice in the domains of ITBV, CC, and RBV. First, it leverages a research model rooted in RBV to investigate the organisational performance impact of PCIaaS. Secondly, it also uncovers the organisational performance impact of PCIaaS. Third, it identifies the organisational factors that influenced the organisational performance impact of PCIaaS. Fourth, it also identifies the activities performed and the skills/knowledge of PCIaaS IT personnel. Fifth, it highlights PCIaaS capabilities and the potential of PCIaaS for tertiary educational institutions, particularly in the UK and Ireland.

1.5 Chapter and Thesis Structure Summary

The thesis consists of eight chapters and is structured as follows. Firstly, Chapter One provides the introduction and background for the entire thesis. Firstly, it provides a brief overview of the research process, after which the research problem and gaps this study aims to fill presented. This chapter also outlined the objective of the research, after which the research questions presented. Finally, the chapter also presents a brief overview of the key contributions made by this study to theory and practice.

Chapter Two provides a comprehensive review of the literature and theoretical foundation for this study, which comprises three domains, including (1) ITBV, (2) CC, and (3) RBV. The chapter consists of eight sections, beginning with the introduction in Section 2.0. Following is Section 2.1, which presents an overview of ITBV research. This section also discusses the importance of ITBV evaluation. Section 2.2 presents an overview and definition of CC. Also discussed in this section is the anatomy of cloud computing, which demarcated CC into 12 different combinations. Section 2.3 presents the theoretical lens of RBV, upon which the conceptual research model is developed. Based on the insights from extant literature on RBV, the indirect model of RBV comprising three core variables (see Figure 2-3) was adopted and adapted to guide this research, as discussed in Section 2.3.1. Section 2.4 operationalises the two organisational resources involved in exploiting PCIaaS. Organisational capabilities were operationalised in Section 2.5 as consisting of two topologies: (1) operational (inside-out/internal) capabilities and (2) strategic (outside-in/external) capabilities. Section 2.6 discusses the operationalisation of organisational performance as consisting of two topologies: operational effectiveness and strategic positioning. Section 2.7 presents the conceptual research model, which incorporates all three domains in this study: ITBV, CC, and RBV. Finally, Section 2.8 summarises the chapter.

Chapter Three, which presents the research methodology adopted for this study, comprises nine sections, beginning with Section 3.0. Section 3.1 restates the research objective this study aims to achieve by answering the four research questions formulated and proposed. The research philosophy is presented in Section 3.2, while section 3.3 presents the research strategy, which justifies the choice of case study research and the case study protocol that guides this study. This section also discusses the procedure for selecting the three cases. Section 3.4 discusses the rigour undertaken in developing the PCIaaS organisational performance impact evaluation instrument that gauges the analysis of organisational performance impact of PCIaaS. Section 3.5 and Section 3.6 discuss data collection and data analysis methods that led to the findings in this study. Section 3.7 outlines the measures taken to enhance the validity and reliability of this study. Finally, Section 3.8 summarises the chapter.

Chapters Four (CIT), Five (OU), and Six (UCC) present the within-case analyses beginning with the introduction to the chapters in Section 4.0, 5.0, and 6.0, respectively. Sections 4.1, 5.1, and 6.1 present the within-case analysis of RQ1, which investigates the organisational performance impact of PCIaaS. Sections 4.2, 5.2, and 6.2 present the within-case analysis of RQ2, which investigates the organisational factors that impacted the organisational performance impact of PCIaaS. Sections 4.3, 5.3, and 6.3 present the within-case analysis of RQ3, which investigates the skills/knowledge and the activities performed by PCIaaS IT personnel. Sections 4.4, 5.4, and 6.4 present the within-case analysis of RQ4, which investigates the organisational capabilities that emerged from combining the resources investigated in RQ2 and RQ3. Finally, Section 4.5, 5.5, and 6.5 summarises chapters highlighting the key findings.

Chapter Seven presents the cross-case analysis of the findings presented in Chapters Four, Five, and Six. Firstly, Section 7.0 presents the chapter's introduction. Next, section 7.1 (RQ1), Section 7.2 (RQ2), Section 7.3 (RQ3), and Section 7.4 (RQ4) present the analysis, comparison, and synthesis of the data across the three cases. Section 7.5 finally presents the summary of the chapter. Finally, chapter eight presents the overall conclusions of the research study, beginning with the introduction in Section 8.0. Section 8.1 reiterated the research objective and research questions to be investigated. Following is Section 8.2, which summarises the pathway from organisational resources and capabilities to organisational performance as understood by the researcher. Section 8.3 discusses the finding in the context of the contributions of this research to theory and practice. Finally, Section 8.4 presents the limitations of this study and recommendations for further studies.

Chapter Two – Literature Review

2.0 Introduction

A comprehensive review of relevant extant literature was conducted to form this study's foundation for advancing knowledge, facilitating theory development, and uncovering research gaps (Marshall & Rossmann, 1999; Webster & Watson, 2002; Boote & Beile, 2005). Following Webster and Watson's (2002) recommendation, a search of the titles and abstracts of scholarly papers available on online research databases was conducted. The study begins by reviewing extant literature on IT business value (ITBV) research (Kauffman & Weill, 1989; Melville et al., 2004) using different phrases such as "business value", "organisational performance" "performance effect", and "performance impact". It then moves to literature in the domain of cloud computing (CC), which consists of four deployment models, three service models, and 12 possible combinations, including private cloud Infrastructure as a Service (PCIaaS). A search on the business value or organisational performance of PCIaaS was then conducted using different combinations of phrases such as "organisational performance", or "organizational performance" or "business value", and "private cloud", and "IaaS" but surprisingly found that there is a lack of research on the topic.

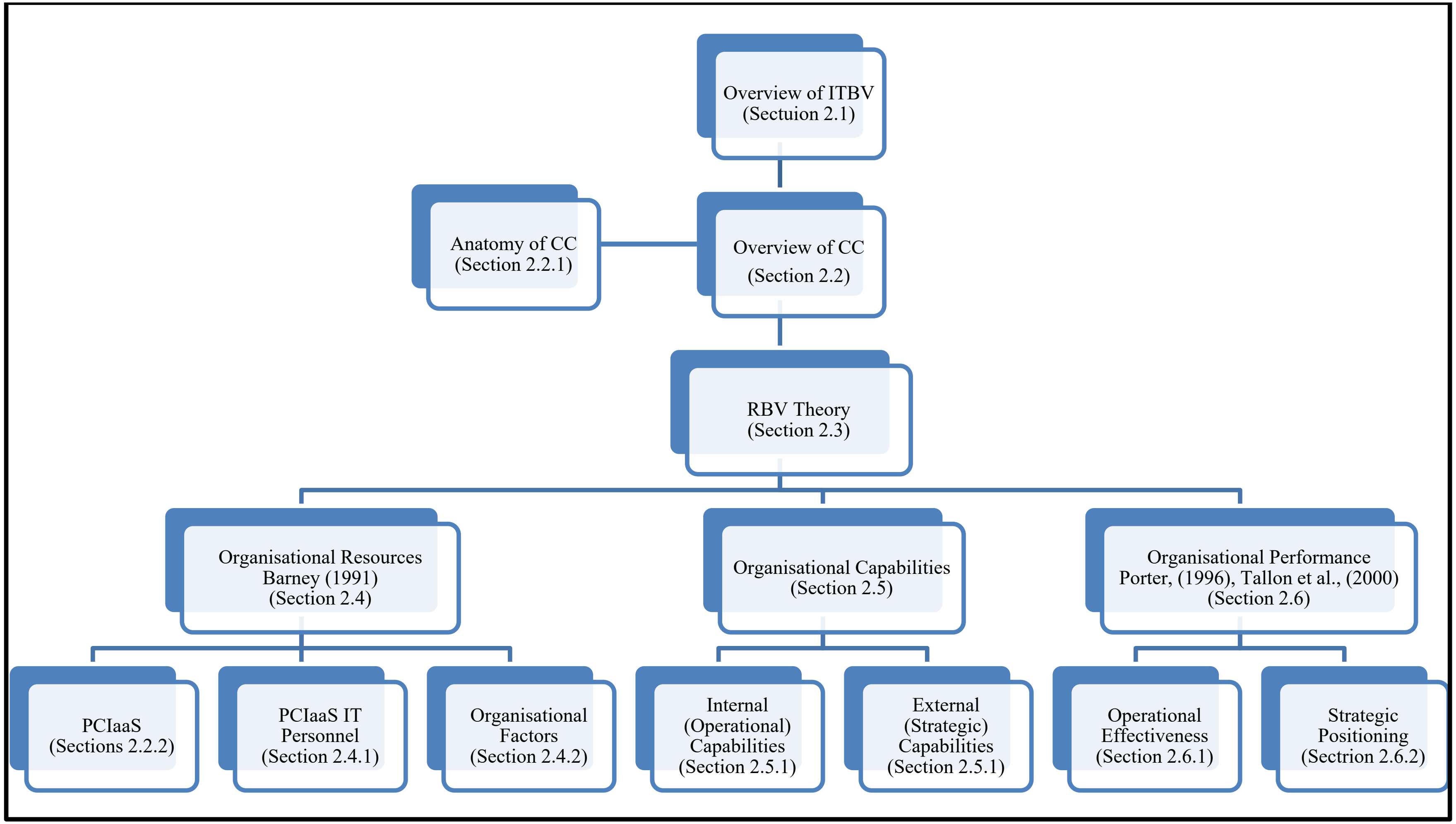
From the extant literature reviewed across the two aforementioned domains, especially ITBV, resource-based view (RBV) theory was identified as a robust theoretical lens (Melville et al., 2004; Jean et al., 2008) and one of the most prominent theories in ITBV (Lim et al., 2009, 2013). RBV is a strategic management theoretical lens for examining the links between organisational resources, capabilities, and performance (Barney, 1991; Grant, 1991). Consequently, the indirect model of RBV theory (Liang et al., 2010; Kimiti & Kilika, 2018) was adopted as the theoretical lens of this study, consisting of three main variables including (1) organisational resources, (2) organisational capabilities, and (3) organisational performance. The study then draws on extant literature on ITBV, CC, and RBV and several secondary theories to further develop the conceptual research model, which is adopted in this research.

The structure of Chapter Two is as follows: Section 2.1 begins with a discussion of ITBV research, i.e., the organisational performance impact of IT (Kauffman & Weill, 1989; Melville et al., 2004). Section 2.2 discusses CC and its basic anatomy.

Researchers describe CC as a new paradigm in using IT and computing resources that replaces the physical IT infrastructure that dominated the established traditional IT delivery model (Rao et al., 2015; Mody et al., 2020). The review then examines the Private Cloud Infrastructure-as-a-Service (PCIaaS), a combination of the private cloud deployment model and the Infrastructure-as-a-Service (IaaS) service model of CC.

The subsequent section discusses RBV, including RBV in ITBV research (Section 2.3). RBV is a strategic management theoretical lens for examining the links between organisational resources and organisational performance (Barney, 1991; Grant, 1991). From the perspective of RBV, the two organisational resources involved in developing capabilities to exploit the potential of PCIaaS for organisational performance include (1) PCIaaS IT personnel and (2) organisational factors. Sections 2.4, 2.5, and 2.6 discuss the operationalisation of the three main variables in the research model, including organisational resources, organisational capabilities, and organisational performance. Finally, Section 2.7 presents the conceptual research model that serves as the theoretical lens of this study. Figure 2-1 summarises the structure of the literature reviewed.

Figure 2-1: Research Structure



Furthermore, Section 2.6.2 highlights the potential of PCIaaS, while Section 2.6.3 discusses the development of PCIaaS performance measures across nine PCIaaS business value dimensions in developing a performance evaluation instrument specific to PCIaaS. Next, section 2.7 presents the conceptual research model that was developed and proposed for this study. The conceptual model will be tested in multiple case studies to address these research gaps. Finally, Section 2.8 presents the conclusion and a summary of the chapter. The following section presents an overview of ITBV research to provide context for the study.

2.1 Overview of ITBV Research

ITBV research is also referred to by some researchers as "*IS success research", "IS effectiveness research*", "*IT valuation research*", or "*IT value research*" (Kauffman & Weill, 1989; Mirani & Lederer, 1998; DeLone & McLean, 2003; Melville et al., 2004; Kumar, 2004; Kohli & Grover, 2008; Petter et al., 2012). This stream of information systems (IS) research investigates the organisational performance impact of IT (Kauffman & Weill, 1989; Melville et al., 2004; Kohli & Grover, 2008). Based on the literature reviewed in this study, some of the earliest studies in this stream of research date back to the late 1960s (Sharpe, 1969; Emery (1971). Arguably, researchers found that IS research date back to the late 1950s (Banker & Kauffman, 2004). However, the domain was not defined and named not until the 1980s by Kauffman & Weill (1989). These authors postulated that "*a growing body of research into the firm performance effects of IT investment has emerged and is sometimes referred to as IT business value research"* (p. 0). They then went further to state that "*ITBV research is concerned with measuring the effects of investment in IT on aspects of firm performance"* (p. 1).

However, the domain's name and definition rose to prominence in the 2000s when Melville et al. (2004) define ITBV as "*the organisational performance impacts of IT at both the intermediate process-level and the organisation-wide level and comprising both efficiency impacts and competitive impacts"* (p. 287). These authors also went further to define "*IT business value research as any conceptual, theoretical, analytic, or empirical study that examines the organisational performance impacts of IT"* (p. 288). The prominence of Melville et al. (2004) study was acknowledged by Nicolian et al. (2015) when they noted that the study is "*one of the most cited IT value research* *papers"* (p. 137). A Google's scholar citation search conducted by the researcher also confirmed Nicolian et al. (2015). It shows that Kauffman & Weill (1989) recorded 301 citations, while Melville et al. (2004) recorded 4,265 citations.

Since its inception, ITBV and ITBV research have witnessed several contradictions, controversies, and inconsistencies, such as the IT paradox (Brynjolfsson, 1993; Mukhopadhyay et al., 1995) and controversial scholars (Strassmann, 1997; Carr, 2003). However, over the past few decades, researchers are unanimous of the importance of ITBV and ITBV research (Bakos, 1987; Tanriverdi, 2005; Kohli & Grover, 2008; Schryen, 2013; Barenfanger et al., 2014; Lee et al., 2014). Exploring the organisational performance impact of IT "*is at the core of IS research discipline*" (Bakos, 1987, p. 1), "*an enduring research question*" (Tanriverdi, 2005, p. 311), and a dominant and unending theme in the IS research (Schryen, 2013; Barenfanger et al., 2014; Lee et al., 2014). However, Kohli & Grover (2008) was more forceful by arguing that "*[IT] evaluation research should have a centrality in our field, as it is germane to the existential debate on the field's core, especially given our sensitivity to IT value issues"* (p. 24). Due to the great importance of ITBV and ITBV research, they even called for "*a charter on demonstrating not only whether IT creates value, but how, when and why it does*" (p. 24). The position of these researchers highlights the importance of ITBV research to researchers and organisations. The following section discusses the importance of evaluating ITBV.

2.1.1 ITBV Evaluation

Underpinning the importance of ITBV research, Table 2-1 highlights the summary of statements relating to the topic. However, despite the importance of ITBV to researchers and practitioners, significant gaps remain, particularly on the "*uncertainty and debate about what we know and do not know"* (Melville et al. (2004, p. 283) and "*the exact way how IT resources create business value, especially in interaction with other organisational resources such as processes and people* (Barenfanger et al., 2014, p. 1397). Some researchers have called for more studies on ITBV research, particularly to provide a "*better understanding of the value of specific technologies of their age* (Barenfanger et al., 2014, p. 1400) and due to the constantly evolving nature of IT and the new solutions and offerings currently on the market (Mahler & Westergren, 2018, p. 178). Therefore, it is not surprising that quite recently, Jean et al. (2021, p. 1) also noted that "*recent work has called for more research on performance effect of IT*". Table 2-1 outlines the opinion postulated by these authors.

Table 2-1: Consensus on the Importance of ITBV Evaluation Research

Description	Authors
"*Understanding where potential value lies and how best to contextually measure the firm's realised value that results from IT investment remain(s)* ***important concerns for managers and scholars alike***".	Davern & Kauffman (2000, p. 122)
"*understanding IT business value is* ***a vitally important issue in today's technology-intensive world***".	Lee (2001, p. 191)
"*Information technology is one of the most important driving forces in business in the 21st century. Our discipline is of* ***vital importance to managers, academics, and business education****. The technology is transforming organizations, industries, and markets. IS research should* ***help key decision-makers understand IT's potential and impact so they can take advantage of what technology offers.***"	Agarwal and Lucas (2005, p. 182)
"*IT value research represents an* ***important stream of work*** *that deals with business value*".	Kohli & Grover, (2008, p. 24)
ITBV research "*is an* ***important issue for researchers, [to] resource managers, and other stakeholders***".	Prasad (2008, p. 1)
"*Understanding how IT investments contribute to business value is* ***an important issue, and this assists in the efficient use of technology resources in businesses***".	Prasad (2008, p. 1)
"*Understanding whether and how IT has affected firm performance is* ***an important research issue, as it allows the manager to know the value of IT investment***".	Akbar et al. (2015, p. 110); Liang et al. (2010, p. 1138)
"*Assessing organisational benefits of IT services is of* ***great importance both for the literature and for the practice***".	Za & Braccini (2017, P. 4)

However, Lee et al. (2014, p. 111) argued that "*little is understood about how IT creates value in the public sector*". Indeed, researchers argued that little is known about the suitability of the RBV model for the public sector, where innovation and competitive advantage are less meaningful than in the private sector (Szymaniec-Mlicka, 2014; Clausen et al., 2019). The assertions of the above authors have never been more accurate than in today's world of CC, described as a new phenomenon and a paradigm shift in IT.

More studies on ITBV have become more critical due to the paradigm shift in IT that has revolutionised the way organisations provisioned and used IT brought about by CC (Son & Lee, 2011). The majority of what we know about ITBV is from earlier IT eras, which relied predominantly on physical IT resources. Based on the literature reviewed, most prior studies in ITBV research are on the traditional IT model. Very little is known about the organisational performance impact of IT in the present era of

CC, which relies on virtualised IT resources. Very few studies have explored the organisational performance impact of CC. The literature on the organisational performance impact of PCIaaS does not exist. As a result, no study has empirically investigated the exact resources that combine to develop the capabilities to exploit PCIaaS for performance impact. There is, therefore, a gap in theory and practice, which this study hopes to investigate and answer. This study answers the above researchers' calls and fills identified gaps by investigating the organisational performance impact of PCIaaS, one of the 12 possible combinations of CC.

2.2 Overview and Definition of Cloud Computing

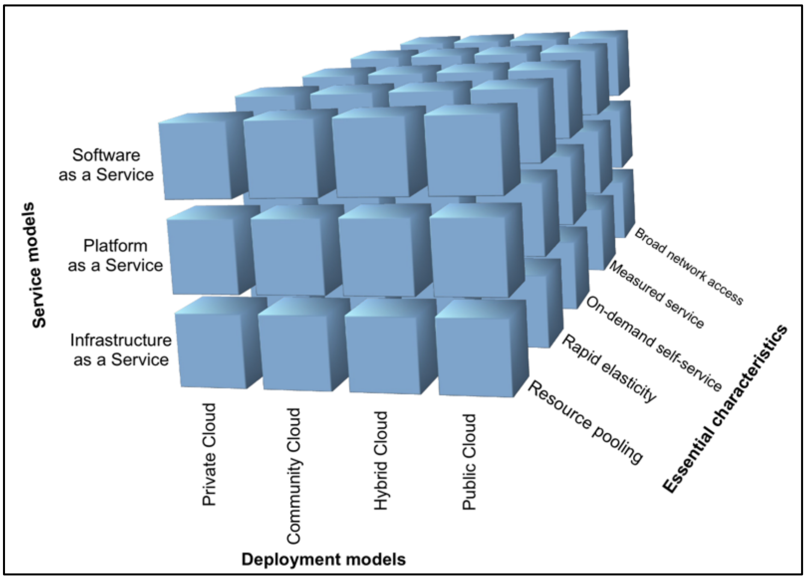
Several researchers view CC as a new phenomenon and a paradigm shift that has fundamentally changed and revolutionised how IT and computing resources are invented, designed, developed, but also purchased, delivered, deployed, used, provisioned, stored, and maintained (Vaquero et al., 2008; Voas & Zhang, 2009; Armbrust et al., 2009, 2010; Bhardwaj et al., 2010; Stanoevska-Slabeva & Wozniak, 2010; Misra & Mondal, 2011; Marston et al., 2011; Rimal et al., 2011; Sabi et al., 2016). In contrast, Iyer & Henderson (2010) noted that CC is not a new technology but "*can be seen as an evolutionary development*" (p. 118), which leverage combinations of existing technologies such as virtualisation, Web 2.0, Web services, Multi-tenancy, SOA, Grid, Cluster, Utility and Autonomic computing (Vaquero et al., 2008; Zhang & Zhou, 2009; Gong et al., 2010; Wang et al., 2010; Zhang et al., 2010; Rimal et al., 2011; Marston et al., 2011; Carlin & Curran, 2012).

The term cloud is a metaphor for the internet where IT and computing resources such as networks, operating systems, applications, and storage are pre-installed for provisioning and use as a service. CC enables ubiquitous provisioning and the use of dynamically scalable and highly elastic IT and computing resources in the form of virtual machines (VMs) over the internet (Mell & Grance, 2009, 2011). CC supports vertical and horizontal scaling (Darekar et al., 2019). They noted that vertical scaling, referred to as scaling up, adds more resources such as more central processing units (CPUs) and more memory to increase an existing server's power while horizontal scaling, or scaling out, adds more servers that function or work together as a unit.

CC has evolved from being the long-held vision of utility computing and rapidly gaining momentum as a mainstream approach in providing and using IT infrastructure and resources in organisations (Rochwerger et al., 2009; Mahmood, 2011; Sithole et al., 2013; Clemente-Castello et al., 2014). However, a standard definition has yet to be agreed on by researchers (Vaquero et al., 2008; Gong et al., 2010; Rimal et al., 2011). Nevertheless, there is a consensus among some researchers that the most cited definition of CC is that suggested by the National Institute of Standards and Technology (NIST) (Dillon et al., 2010; Chen & Zhao, 2012; Sultan, 2013, 2014; Stieninger & Nedbal, 2014; Sabi, 2016). The NIST defines CC as "*a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction*" (Mell & Grance, 2009, p. 9, 2011, p. 2). The following section discusses CC's anatomy based on Mell & Grance's conceptualisation of CC's service and deployment models.

2.2.1 Anatomy of Cloud Computing

CC consists of four deployment models, three service models, and five essential characteristics (Mell & Grance, 2009, 2011). Figure 2-2 presents the three-dimensional anatomy of CC.



Source: Craig–Wood (2010)

Figure 2-2: Cloud Computing 4X3X5 Anatomy

Figure 2-2 highlights the four deployment models and three service models, the five essential characteristics, and the 12 possible combinations available in CC. Each of the deployment and service models, including the 12 combinations, have five essential characteristics. However, several researchers have suggested the inclusion of several other characteristics (Vaquero et al., 2008; Durkee, 2010; Gong et al., 2010; Zhang et al., 2010; Stanoevska-Slabeva & Wozniak, 2010; Mell & Grance, 2011; Liu, 2012; Goyal, 2014). For example, Gong et al. (2010, p. 275) argued that "*the key characteristics of cloud computing are agility, low cost, device and location independence, multi-tenancy, high reliability, high scalability, security, and sustainability"* (p. 275). In contrast, Zhang et al. (2010) argued that some of the key features of CC include the capability of acquiring and releasing resources on-demand and dynamic resource provisioning.

Other researchers argued that on-demand, scalability, and virtualisation are the key characteristics of CC (Vaquero et al., 2008; Dong et al., 2009; Stanoevska-Slabeva & Wozniak, 2010 Mell & Grance, 2011; Liu, 2012; Goyal, 2014). There is a consensus among some researchers that the five essential characteristics model of CC, as suggested by NIST (Mell & Grance, 2009, 2011), is the most adopted approach (Zhang et al., 2010; Takabi et al., 2010; Subashini & Kavitha, 2011).

The deployment models of public, private, and community clouds are stand-alone deployment, while the hybrid cloud combines any other three models.

1) Public cloud, or utility computing (Armbrust et al., 2009, 2010), or external clouds (Mahmood, 2011), is for the public and can be owned, managed, and operated by an organisation or a large industry group selling cloud services such as business, academic, or government organisation, or some combination of them. It usually exists on the cloud provider's premises (Mell & Grance, 2011; Hogan et al., 2011).
2) Private cloud, or an internal cloud, can be owned, managed, and operated by the organisation, a third party, or some combination. It can also exist on or off premises (Mell & Grance, 2011; Hogan et al., 2011). According to Liu et al. (2011), a private cloud can be managed on-premises (on-site private clouds) or off-premises (out-sourced private clouds).
3) Community cloud can be owned and shared by several organisations. It can be managed and operated by one or more of the community's organisations, a third party, or some combination of them, and it may exist on- or off-premises (Mell & Grance, 2011; Hogan et al., 2011). Community cloud may be managed

on-premises (on-site community cloud) or off-premises (out-sourced community cloud) (Liu et al., 2011).

4) Hybrid cloud is a composition of two or more deployment models (private, community, or public) but is bound together by standardised or proprietary technology that enables data and application portability (e.g., cloud bursting for load-balancing between clouds) (Mell & Grance, 2011; Hogan et al., 2011).

Each of the four deployment models consists of the three service models, including (1) IaaS, (2) SaaS, and (3) PaaS. Appendix 4 highlights a description of the services applicable to each service model.

1) IaaS, which is also referred to as HaaS by Wang et al. (2010), enables the provisioning and delivery of hardware (i.e., server, storage, and network), associated software, and other fundamental computing resources where the consumer can deploy and run arbitrary software, which can include operating systems and applications.
2) PaaS enables applications to be developed, executed, or deployed on the cloud infrastructure.
3) SaaS enables software or business applications to run on a cloud infrastructure. The software or business applications are accessible from various client devices through a thin client interface, such as a web browser (e.g., web-based email) or a program interface.

This study focuses on the combination of CC referred to in Figure 2-2 as PCIaaS, which the next section discusses

2.2.2 PCIaaS

Private cloud refers to the internal data centres exclusively owned, provisioned, and used by a single organisation and not made available to, or shared with, third parties, but owned, designed, operated, and provisioned for the exclusive use of a single organisation (Armbrust et al., 2009, 2010; Dawoud et al., 2010; Dillon et al., 2010; Zhang et al., 2010; Fenn & LeHong et al., 2011; Liu et al., 2011; Smith, 2011; Patidar et al., 2012; Singh & Jangwal, 2012). There is no unified definition of the term private cloud (Armbrust et al., 2009, 2010; Dawoud et al., 2010; Zhang et al., 2010; Fenn &

LeHong et al., 2011; Smith, 2011; Patidar et al., 2012; Goyal, 2014). Table 2-2 presents some of the private cloud definitions as postulated by different researchers.

Table 2-2: Definitions of Private Cloud

Definition	Author
Private cloud refers to ***internal data centres*** of an enterprise which ***are not available to the general public***	Dawoud et al. (2010, p. 1)
Private cloud refers to **internal data centres** of a business or other organisation that are **not made available to the public**	Armbrust et al. (2009, p. 4)
Private cloud refers ***to internal data centres*** of a business or other organisation, ***not made available to the general public***	Armbrust et al. (2010, p. 51)
Private cloud is "***operated solely within a single organisation*** *and managed by the organisation or a third-party regardless of whether it is located on-premise or off-premise*."	Dillon et al. (2010, p. 28)
Private cloud computing is a form of cloud computing that is ***used by only one organisation*** or that ensures that an organisation is completely isolated from others	Fenn & LeHong et al. (2011, p. 39); Smith (2011, p. 49)
Private cloud refers to ***internal data centres*** of a business or other organisation, ***not made available to the general public***	Patidar et al. (2012, p 394)
Private cloud refers "to ***internal data centres*** of a business or other organisation, ***not made available to the general public***".	Singh & Jangwal (2012 p. 17)
A private cloud is hosted in the data centre of a company and ***provides its services only to users inside that company or its partners***	Goyal (2014, p. 24)

Despite the above inconsistency in private cloud definitions, private cloud is exclusively for a single organisation. Private cloud can be hosted and managed internally by and within the organisation or externally by a third party. Therefore, the private cloud consists of two architectural models, including the On-Site Private Cloud (on-premises) and Out-Sourced Private Cloud (off-premise) (Liu et al., 2011). Therefore, private cloud is defined by ownership and privacy and not by its management, operation, or location.

IaaS is also one of the three service models of CC, as described in Section 2.2.1. Table 2-3 presents the definition of IaaS as suggested by different researchers.

Table 2-3: Definition of IaaS

Definition	Author
"*IaaS is the delivery of hardware (server, storage, and network) and associated software (operating systems virtualisation technology, file system) as a service*".	Bhardwaj et al. (2010, p. 62)
"*IaaS is the provision of 'raw' machines (servers, storage, networking, and other devices) on which the service consumers install their own software, usually as VM images*".	Boniface et al. (2010, p. 155)
"*IaaS refers to the on-demand provisioning of infrastructural resources, usually in terms of VMs*".	Zhang et al. (2010, p. 10)

IaaS is a new phenomenon and paradigm shift that enabled IT hardware infrastructures such as computers, servers, storage, and networks such as routers and switches to be provisioned and used over the internet (Chen et al., 2016). Some researchers also described IaaS as pools of dynamically scalable virtualised resources typically in the form of VMs (vServer, vDesktop, and vCloud) accessible and used over the internet using the login authentication systems and passwords from any dumb terminal (Chahal et al., 2010; Dillon et al., 2010; Gupta et al., 2013).

Several researchers argued that IaaS is the foundation and underlying infrastructure of CC on which other service models (PaaS and SaaS) is based, with PaaS built upon IaaS while SaaS built upon PaaS (Mell & Grace, 2009; Dawoud et al., 2010; Krieger et al., 2010; Bojanova & Samba, 2011; Doelitzscher et al., 2011; Gonzalez-Martínez et al., 2015; Yauri & Abah, 2016). For example, IaaS is regarded not only as a "*general-purpose cloud computing*" (Krieger et al., 2010, p. 103) but also as "*the foundation of all other delivery models*" (Dawoud et al., 2010, p. 2) and "*the foundation of all cloud services"* (Salah et al., 2015, p. 2). IaaS, as the foundation and underlying infrastructure of CC, enables organisations to exploit or harness the potential of all three service models if implemented under a private cloud. Furthermore, PCIaaS offers organisations an alternative way of provisioning and using IT resources such as computers, servers, storage, and network in organisations in the form of VMs or virtual desktop infrastructures (VDIs). This study investigates the organisational performance impact of PCIaaS.

However, researchers argued that two organisations might have the same IT and still derive differential performance impact (Kohli & Grover, 2008; Radhakrishnan et al., 2008; Aral et al., 2010). Such a scenario highlights that IT in isolation does not improve performance. Instead, the differential impact of IT on organisational performance results from organisations' ability to leverage their resources and capabilities in exploiting IT for performance improvement. Consequently, researchers argued that the mixed empirical result in prior studies on ITBV is an invitation to seek a better theory to investigate ITBV (Soh & Markus, 1995). However, prior studies have found that most of the theories used by researchers in IS research, including ITBV, are drawn from other disciplines (Hitt & Brynjolfsson, 1996; Kauffman & Weill, 1989; Melville et al., 2004; Lee et al., 2004; Lim et al., 2009, 2013; Schryen, 2013). Schryen (2013, p. 141) argues that "*researchers have employed many theoretical paradigms when analysing the value that IS creates for organisations*". He identified some of the theories used in previous studies, including "*microeconomics, industrial organisation theory, socio-political paradigms, organisational behaviour theory, RBV and decision theory (p141)*". This study proposed and adopted the RBV theory as its theoretical lens based on its suitability for exploring the link between organisational resources and performance. The following section presents an overview of the theoretical lens of RBV.

2.3 Overview of Theoretical Lens

RBV, although initially applicable to the field of strategic management and other management disciplines, has also gained traction in the field of IS research, including ITBV research. RBV is among the most prominent theories used in IT and organisations (ITO), IT and groups (ITG), and ITBV research (Lim et al., 2009, 2013). (See Appendix 5 and Appendix 6). The prominence, potential, usefulness, and calls for the use of RBV in IS research, inclusive of ITBV research, has been well documented and emphasised in the literature (Bharadwaj, 2000; Melville et al., 2004; Wade & Hulland, 2004; Zhu, 2004; Cao, 2010; Cao et al., 2011; Wiengarten et al., 2013). Researchers in ITBV research exploring RBV as a theoretical lens considered the theory a robust theoretical lens for investigating ITBV (Melville et al., 2004; Jean et al., 2008). For example, RBV, argues Melville et al. (2004, p. 291), is "*a robust framework for analysing whether and how IT may be associated with competitive advantage*". Several researchers have leveraged the theory as a viable theoretical lens in several studies in IS research, including ITBV research (Ross et al., 1996; Powell & Dent-Micallef, 1997; Bharadwaj, 2000; Amit & Zott, 2001; Peteraf & Barney, 2003; Santhanam & Hartono, 2003; Melville et al., 2004; Wade & Hulland, 2004; Zhu, 2004; Aral & Weill, 2007; Nevo & Wade, 2010; Cao, 2010; Cao et al., 2011; Garrison et al., 2012; Wiengarten et al., 2013; Rockmann et al., 2014; Devece et al., 2017).

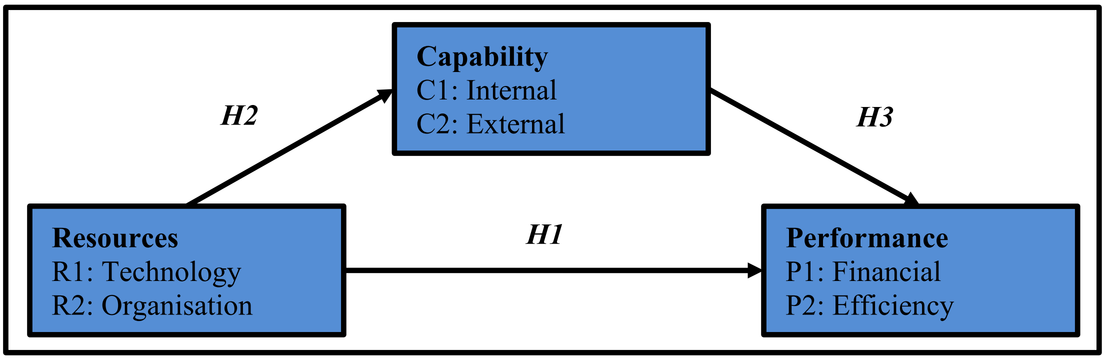
RBV, which originated from the work of Penrose (1959), has been described as an internally focused strategic management theoretical lens for examining the links between organisational resources, capabilities, and performance and thus competitive advantage (Barney, 1991; Conner, 1991; Grant, 1991; Peteraf & Barney, 2003). For example, Barney (1991, p. 99) describes RBV as a theory that "*examines the link* *between firm resources and sustained competitive advantage*". Similarly, Barney (1991) described RBV as a theory that "*examines the link between a firm's internal characteristics and performance"* (p. 100).

From the perspective of RBV theory, organisational resources, capabilities, and performance are its core variables (Barney, 1991; Clemons & Row, 1991; Grant, 1991; Lado & Wilson, 1994; Bharadwaj, 2000; Peteraf & Barney, 2003). Resources are the source of the capabilities for exploiting IT for performance improvement and competitive advantage (Barney, 1991; Clemons & Row, 1991; Grant, 1991; Bharadwaj, 2000; Peteraf & Bergen, 2003). For example, Grant (1991, p. 116) "*internal resources and capabilities provide the basic direction for a firm's strategy*" that "*enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness* (Barney, 1991, p. 101*)*". The researcher proposed RBV as the theoretical lens for this study due to its suitability in investigating the organisational resources and capabilities needed to improve organisational performance. The following section discusses the development of the conceptual research model, which is grounded in RBV theory.

2.3.1 Development of Conceptual Research Model

Organisational resources, capabilities, and performance are the core variables in RBV theory (Barney, 1991; Clemons & Row, 1991; Grant, 1991; Lado & Wilson, 1994; Bharadwaj, 2000; Peteraf & Barney, 2003). However, resources and capabilities are the two critical variables employed by organisations to improve their performance and competitive advantage (Barney, 1991; Clemons & Row, 1991; Grant, 1991; Bharadwaj, 2000; Peteraf & Bergen, 2003). However, prior studies on RBV differ on the path from organisational resources to organisational performance, including a direct link between organisational resources and organisational performance and an indirect link, with organisational capabilities as the mediator between organisational resources and organisational performance (Zhang, 2007; Liang et al., 2010; Kim et al., 2011; Kimiti & Kilika, 2018). The premise of the indirect model of RBV predicates Grant's (1991, p. 119) suggestion that "*while resources are the source of a firm's capabilities, capabilities are the main source of its competitive advantage*".

Other researchers have also argued in favour of the indirect model. For example, a study conducted by Liang et al. (2010) found that the indirect model is a better explanation of IT's value than the direct model. Equally, Kimiti & Kilika (2018) argued that "*the path from resources to performance is not direct but goes through an intermediate state for the resources to unleash their potential. This intermediate state describes the capabilities that firms must build to align the resources to address the demands of the high-velocity context*" (p. 195). Figure 2-3 presents the direct and indirect models of RBV as illustrated by Liang et al. (2010), showing the path from organisational resources to organisational performance.



Source: Liang et al. (2010)

Figure 2-3: RBV Models of Organisational Performance

The indirect model of RBV provides a robust theoretical lens for exploring the organisational performance impact of PCIaaS and the capabilities of the organisational resources involved. The indirect model of RBV, the foundation of the conceptual research model's framework, highlights the three core variables in RBV theory. The operationalisation of the three main variables, (1) organisational resources, (2) organisational capabilities, and (3) organisational performance, will be discussed in Sections 2.4, 2.5, and 2.6, respectively. The following section discusses the operationalisation of organisational resources.

2.4 Operationalisation of Organisational Resources

From the perspectives of RBV, organisational resources and their attributes and characteristics are the strength and foundation of organisational performance and competitiveness (Wernerfelt, 1984; Barney, 1991; Grant, 1991; Ma, 1999; Ismail et al., 2012). Early proponents of RBV are divergent on the classification of organisational resources involved in organisational performance (Wernerfelt, 1984; Barney, 1991; Grant, 1991; Clemons & Row, 1991). However, to have a unified view of organisational resources, Barney (1991) categorised organisational resources into three broad taxonomies, (1) physical capital resources (e.g., technology resource), (2) human capital resources (e.g., training, experience, judgement, intelligence, relationships, and insight), and (3) organisational capital resources (e.g., structure, planning, controlling, coordinating and internal and external relationships).

Prior studies in the domain of ITBV have adopted and adapted the Barney (1991) taxonomy of organisational resources to investigate the performance impact of IT (Ross et al., 1996; Powell & Dent-Micallef, 1997; Bharadwaj, 2000; Melville et al., 2004; Ravichandran and Lertwongsatien, 2005; Aral & Weill, 2007; Wiengarten et al., 2013; Rockmann et al., 2014; Garrison et al., 2012, 2015). Table 2-4 presents the classification of resources in prior studies and their adaptation to this study.

Table 2-4: Classification of Organisational Resources

Related Studies	Barney (1991) Taxonomy of Organisational Resources		
	Technology Resources	**Human Capital Resources**	**Organisational Capital Resources**
Ross et al. (1996)	Technology base	Highly competent IT human resource	Strong partnering relationship between IT and business management
Powell & Dent-Micallef (1997)	Technology	Human	Business
Bharadwaj (2000)	IT infrastructure	Human IT resources	IT-enabled intangibles
Melville et al. (2004)	Technical IT resources	Human IT resources	Complementary organisational resources
Ravichandran and Lertwongsatien (2005)	IT infrastructure	IS human capital	IS partnership quality
Aral & Weill (2007)	IT assets	Competencies and skills of the human resources	Organisational practices and routines
Wiengarten et al. (2013)	Technological IT resources	Human IT resources	Organisational factors
Rockmann et al. (2014)	Technological dimension	Human dimension	Organisational dimension
Garrison et al. (2012, 2015)	Technical capability	Managerial capability	Relational capability

Research might be divergent on the exact terms used to describe the different variables of organisational resources. There is consistency in the use of one pattern of classification across these studies. They all adopted and mirrored Barney's (1991) taxonomy of organisational resources. Following the precedence of prior studies, this study draws on Barney (1991) to classify organisational resources to be investigated in this study to include: (1) PCIaaS (a proxy for technology resource), (2) PCIaaS IT personnel (a proxy for human capital resources), and (3) organisational factors (a proxy for organisational capital resources). Section 2.2.2 have discussed PCIaaS.

However, researchers argued that any IT asset in whatever shape, type, or form is a commodity that is by itself imitable, readily available, and can easily be bought or purchased by any organisation in the marketplace (Barney, 1991; Clemons & Row, 1991; Broadbent & Weill, 1997; Santhanam & Hartono, 2003; Ravichandran & Lertwongsatien, 2005; Kohli & Grover, 2008; Wade & Hulland, 2004; Devece et al., 2017). Similarly, researchers argued that CC, of which PCIaaS is a constituent, like any other type of IT, is not only a commodity that is readily available in the marketplace (Marston et al., 2011; Rimal et al., 2011) but has the same common characteristics regardless of the organisation. What enables IT to create business value is the ability to leverage both its IT personnel and organisational factors to develop the capabilities to exploit the potential offered by IT (Powell & Dent-Micallef, 1997; Bharadwaj, 2000; Wade & Hulland, 2004; Ravichandran & Lertwongsatien, 2005; Radhakrishnan et al., 2008; Kohli & Grover, 2008; Devece et al., 2017).

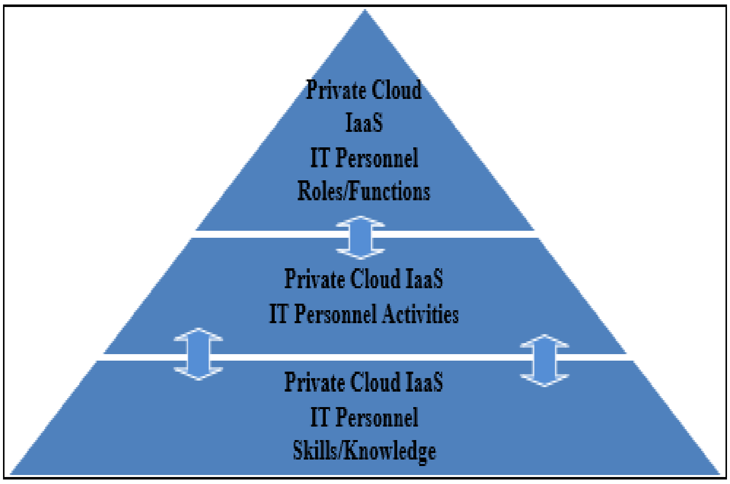
The above authors highlight the critical resources involved in exploiting IT for optimal performance, consisting of IT personnel and organisational factors. As previously noted, PCIaaS IT personnel refer to the IT personnel responsible for managing and supporting PCIaaS in organisations. The following section discusses PCIaaS IT personnel.

2.4.1 PCIaaS IT Personnel

Researchers are divergent on the terms used in describing human capital resources (Powell & Dent-Micallef, 1997; Bharadwaj, 2000; Melville et al., 2004; Aral & Weill, 2007; Cao, 2010; Cao et al., 2011; Wiengarten et al., 2013). Some studies refer to human capital resources as human IT resources (Ang & Slaughter, 2000; Bharadwaj, 2000; Melville et al., 2004; Wiengarten et al., 2013), IT personnel (Byrd & Turner, 2000; Ang & Slaughter, 2000), human resources (Aral & Weill, 2007), or human IT infrastructure (Weill, 1994; Byrd & Turner, 2000). Other studies also described human capital resources as IT staff (Ang & Slaughter, 2000) or IT/IS professionals (Lee et al., 1995; Todd et al., 1995; Ang & Slaughter, 2000, 2004; Tesch et al., 2008; Gallagher et al., 2010). In the context of this study, these terms refer to IT personnel.

IT personnel are the mortar that binds all the IT components into robust and reliable IT infrastructure services (Broadbent et al., 1996, 1999; Broadbent & Weill (1997). Gallagher et al. (2007) described IT personnel as *"those with the talent to understand and solve business problems, design and coordinate IT efforts, and deal with vendors help organisations ensure delivery of business value"* (p. 15). In contrast, Nord et al. (2007, p. 3) referred to IT personnel "*as those who make IT work*". Prior studies have found that IT personnel are vital to organisations' ability to effectively design, assemble, implement, integrate, build, manage, mobilise, deploy, and leverage IT in the attainment of business goals and objectives and thus ITBV (Amit & Schoemaker, 1993; Ross et al., 1996; Bharadwaj, 2000; Ang & Slaughter, 2000; Lee, 2001; Rockmann et al., 2014). For example, Stemberger et al. (2011) described IT personnel as vital in attaining successful IT implementation. Consequently, the role of PCIaaS IT personnel in organisations' ability to exploit PCIaaS for performance improvement has become more influential.

PCIaaS IT personnel is a new role in organisations and the IT profession brought about by CC. No empirical study has investigated the activities performed or the skills/knowledge required to fit into this new and emerging role in the IT profession. The Activity Competency Model (ACM), derived from the Job Characteristics Theory (JCT), provides a robust theoretical framework to investigate the activities performed and the skills/knowledge required by PCIaaS IT personnel. According to the model, the ability of IT personnel to perform their activities depend on their skill and knowledge. Figure 2-4 presents the ACM, highlighting its three layers.



Source: Adapted from Wu et al. (2004)

Figure 2-4: The Activity Competency Model (ACM)

In the ACM model, roles and functions are at the apex (top level), which in the context of this study refers to the PCIaaS IT personnel. The middle level contains the professional activities needed to fulfil the roles or functions, while the bottom level contains the skills/knowledge required to perform the activities. Several researchers have used ACM in IS research and other disciplines as a viable lens for examining the activities performed and the skills/knowledge required by IT professionals (Wu et al., 2004, 2005, 2007; Chen & Wu, 2011). The model is adapted to the study as a theoretical framework to investigate the PCIaaS IT personnel, a proxy of human capital resources, as defined by Barney (1991). The following section presents the activities performed by IT personnel.

2.4.1.1 Activities Performed by IT Personnel

Researchers have attempted to understand the activities performed by IT personnel that contribute to organisational performance (Lee et al., 1995; Ang & Slaughter, 2004; Pawlowski & Robey, 2004; Wu et al., 2007; Stemberger et al., 2011). For example, Lee et al. (1995) identified 21 critical activities performed by IT professionals. Similarly, Wu et al. (2007) identified 20 critical activities performed by IS managers. Pawlowski & Robey (2004) listed systems design and implementation and knowledge brokering as IT professionals' critical activities. IT personnel's professional activities have also been broadly categorised into technical and business-oriented roles (Ang & Slaughter, 2004; Stemberger et al., 2011).

To pave the way for a unified view of the profiles of IT personnel through which IT personnel contributes to organisational performance, Guillemette & Pare (2005) proposed a new theory of the contribution of the IT function to business value by categorising the profile or archetype of IT professionals into five typologies, (1) architecture builder, (2) systems provider, (2) project coordinator, (2) partner, and (5) technological leader. Several researchers have used, validated, and referenced the five profiles of activities in their studies (Guillemette & Pare, 2007, 2012a, 2012b; Guillemette et al., 2008, 2017; Koffer et al., 2015; Wiedemann et al., 2017; Pare et al., 2020). However, Pare et al. (2020) further categorised these five profiles into two groups, (1) operational orientation and (2) strategic orientation. Table 2-5 presents the activities profiles of IT professionals.

Table 2-5: Profiles of Activities of IT Professionals

	Operational Orientation			Strategic Orientation	
	Systems Provider (SP)	**Architecture Builder (AB)**	**Project Coordinator (PC)**	**Partner (P)**	**Technological Leader (TL)**
Primary mission	Providing IT applications that meet the needs of employees and managers along with high-quality technical support	Ensuring the performance of the IT infrastructure and maximising the integration of IT applications	Implementing an optimal procurement strategy for IT applications and coordinating their deployment in the various departments	Supporting departments to improve and optimise their work processes with the help of IT	Stimulating innovation and supporting the strategic objectives of the organisation with the help of IT
Core activities	The acquisition/ configuration of software packages or the development of IS, as well as the technical support provided to users via a helpdesk	The development and deployment of a reliable and flexible technological architecture and management of IT applications' data integrity	IT project management as well as the development of long-term relationships with system providers and integrators through the negotiation of outsourcing contracts	The revision, reengineering and optimisation of business processes as well as the implementation of technological solutions in business units	Technology scanning and experimentation with emerging technologies. Active participation of the CIO in the development of the business strategy
Relationships with business units and external partners	The IT department responds to requests from business units through an effective helpdesk. IT professionals stay outside of business units	IT staff stay outside of business units but respond to their requests via a standardised IT architecture, and they oversee communication with external parties	The IT department acts primarily as an intermediary between business units and external partners and reacts quickly to business units' requests	There is close collaboration between the IT department and business units. There is a significant permanent presence of IT staff in business units	The IT department maintains a close relationship with the top management team
Knowledge and skills most important for IT professionals	Technical (programming, configuration) and interpersonal skills	Deployment and management of IT architecture, IT infrastructure and data integration	In-depth knowledge of IT project management principles with good negotiation and interpersonal skills	Knowledge of the business processes in place, principles and methods of process optimisation, and interpersonal skills	Knowledge of emerging IT trends and the main issues or challenges facing the organisation and its environment
IT governance	The IT department is responsible for developing IT systems on time and within budget. The business units are responsible for realising the benefits associated these systems	The IT department is responsible for setting up a robust and flexible IT architecture that enables the organisation to adapt quickly to changing environmental conditions	The IT department is primarily responsible for ensuring strong IT project management and the success of the outsourcing strategy (costs and availability)	The success of IT projects is a responsibility that is fully shared between the IT department and business units	The responsibility of the IT department goes beyond the success of IT projects and concerns the achievement of the organisation's strategic objectives

Source: Pare et al. (2020)

These five profiles are the unique ways IT personnel contribute to the organisational performance of IT (Guillemette et al., 2008; Guillemette & Pare, 2012a). For example, Guillemette et al. (2008, p. 7) noted, "*each profile is a unique way for IT to contribute to an organisation. One is not better than the other, nor is one profile more or less mature than any other. Each represents a different, consistent way of organising IT to deliver value*". This study adopts these five profiles to investigate the activities performed by PCIaaS IT personnel.

The skills/knowledge of IT personnel influenced their ability to perform their activities and contributions to organisational performance (Willcocks and Feeny, 2006; Fink & Neumann, 2007). For example, Willcocks and Feeny (2006, p. 49) define "*a capability as a distinctive set of human resource-based skills, orientations, attributes, motivations, and behaviours that have the potential, in suitable contexts, to contribute to achieving specific activities and influencing business performance*". However, the skills/knowledge required by PCIaaS IT personnel to perform these five profiles of activities are unknown. Therefore, the following section discusses the skills/knowledge of IT personnel.

2.4.1.2 Skills/Knowledge of IT Personnel

IT personnel's skills/knowledge are vital to organisations' ability to leverage and exploit IT to deliver reliable IT services that are fit for purpose to improve their organisational performance and competitiveness (Broadbent et al., 1996, 1999; Broadbent & Weill, 1997; Gallagher et al., 2007). Fink & Neumann (2007) argued that the lack of IT personnel with appropriate IT skills might seriously debilitate efforts to redesign business processes to meet competitive demands. These researchers' position amplifies the importance of IT personnel's skills/knowledge in the organisations' ability to exploit IT to improve organisational performance.

There is a large volume of empirical research spanning decades that have investigated the skills/knowledge of IT personnel (Lee et al., 1995; Todd et al., 1995; Feeny & Willcocks, 1998; Bharadwaj, 2000; Byrd & Turner, 2000, 2001; Brohman & Parent, 2001; Bassellier et al., 2001, 2003; Ross, 2003; Melville et al., 2004; Wade & Parent, 2002; Kumar, 2004; Byrd et al., 2005; Aral & Weill, 2007; Tesch et al., 2003, 2008; Fink & Neumann, 2007, 2009; Gallagher et al., 2007; Dhillon, 2008; Kollmann et al., 2009; Aral et al., 2010; Lee & Mirchandani, 2010; Anwar & Masrek, 2014). Some researchers suggested that "*technical competencies or skills are the building blocks of desired organisational capabilities*" (Clark et al., 1997, p. 437). Others also suggested that "*IS professionals require in-depth business functional knowledge to be able to reengineer business processes, as well as to interpret business problems in order to apply appropriate technical solutions*" (Tesch et al., 2008, p. 4). However, some researchers have either adopted or used Lee et al.'s (1995) taxonomy of skills/knowledge to broadly categorise the skills/knowledge of IT personnel into four generic taxonomies (Byrd & Turner, 2000, 2001; Wade & Parent, 2002; Tesch et al., 2003; Kumar, 2004; Byrd et al., 2005; Tesch et al., 2008; Fink & Neumann, 2009; Anwar & Masrek, 2014; Zylka & Fischbach, 2017). Table 2-6 presents the taxonomies of IT personnel skills/knowledge cited in prior studies.

Table 2-6: Taxonomy of IT Personnel Skills/Knowledge

Author	**Business Functional**	**Technical**	**Interpersonal & Management**	**Technology Management**	**Behavioural**	**Organisational**	**Legal & Regulatory**
Lee et al. (1995)	X	X	X	X			
Ang & Slaughter (2000)							X
Byrd & Turner (2000)	X	X	X	X			
Byrd & Turner (2001)	X	X	X	X			
Wade & Parent (2002)	X	X	X	X		X	
Tesch et al. (2003)	X	X	X	X			
Kumar (2004)	X	X	X	X			
Byrd et al. (2005)	X	X	X	X	X	X	
Tesch et al. (2008)	X	X	X	X	X		
Fink & Neumann (2007)	X	X	X				
Goles et al. (2008)							X
Fink & Neumann (2009)	X	X			X		
Karanja & Zaveri (2012)							X
Anwar & Masrek (2014)	X	X	X	X			
Ford et al. (2015)							X
Zylka & Fischbach (2017)	X	X	X	X			

The four main taxonomies of IT personnel skills/knowledge are the four generic skills/knowledge suggested by Lee et al. (1995). Similar to the position adopted by other researchers (Trinh-Phuong et al. 2010), the researcher grouped behavioural skills/knowledge under interpersonal and management skills/knowledge. However, some studies have highlighted the need for IT personnel to have legal and regulatory skills/knowledge (Ang & Slaughter, 2000; Goles et al., 2008; Karanja & Zaveri, 2012;

Ford et al., 2015). It is imperative for IT personnel be "*familiar with legal issues associated with data breaches*" (Ford et al., 2015, p. 86). Mainly due to "*the latest trends in IS such as outsourcing, contracting, and cloud computing involve, among others, the search, acquisitions, monitoring, negotiation, and enforcement strategies that are usually suited to an individual with a combination of legal and technical expertise*" (Karanja & Zaveri, 2012, p. 154).

The researcher added a fifth dimension of skills/knowledge (legal and regulatory). Researchers have been hinting that legal and regulatory skills/knowledge to be included in consideration of the IT profession (Ang & Slaughter, 2000; Goles et al., 2008; Karanja & Zaveri, 2012; Ford et al., 2015). Table 2-7 presents a description of each of the taxonomies of IT personnel skills/knowledge.

Table 2-7: Description of IT Personnel Skills/Knowledge

Skills/ Knowledge	Description
Technical	"*Technical skills measure covers the depth and breadth of the IT technical specialties (operating systems, programming languages, database management systems, networks, telecommunications, etc.) within the organisation"* (Byrd et al., 2005, p. 66).
	"*Technical specialties skills cover various IT technical specialties"* (Zylka & Fischbach, 2017, p. 58).
Technology Management	"*Technology skills are concerned with where and how to deploy IT effectively and profitably for meeting strategic business objectives"* (Byrd et al., 2005, p. 66).
	"*Technology management skills answer the questions of where and how to deploy information technologies effectively and meet strategic business objectives profitably"* (Zylka & Fischbach, 2017, p. 58).
Interpersonal and Management	"*Interpersonal skill includes the ability to communicate effectively with personnel in functional areas and to work in a collaborative environment, along with the ability to lead project teams"* (Byrd et al., 2005, p. 66).
	"*Interpersonal and management skills include the boundary-spanning role IT professionals must assume in organisations"* (Zylka & Fischbach, 2017, p. 58).
Business functional	"*Business skills involve the level of knowledge of the various functions within the business and the ability to understand the overall business environment"* (Byrd et al., 2005, p. 66).
	"*Business functional skills cover both general business skills as well as knowledge of and ability to learn about business functions"* (Zylka & Fischbach, 2017, p. 58).
Legal & Regulatory ***	Skills/knowledge of legal and regulatory that apply to the IT profession

***Fifth dimension included by the researcher

Prior studies have also broadly categorised IT personnel's skills/knowledge into two dimensions of competencies (Teo & King, 1997; Haggerty, 2000; Bassellier et al., 2001, 2003; Bassellier & Benbasat, 2004; Mithas & Krishnan, 2004; Masrek et al., 2009; Colomo-Palacios et al., 2010). For example, Mithas & Krishnan (2004) suggested that "*competencies comprise of two major dimensions: technical competencies and business management competencies"* (p. 5). This study adopts Mithas & Krishnan (2004) dimension of IT personnel competencies to further classified the five taxonomies of skills/knowledge into two dimensions of competencies. Figure 2-5 presents the categorisation of the five taxonomies of skills/knowledge into the two dimensions of competencies.

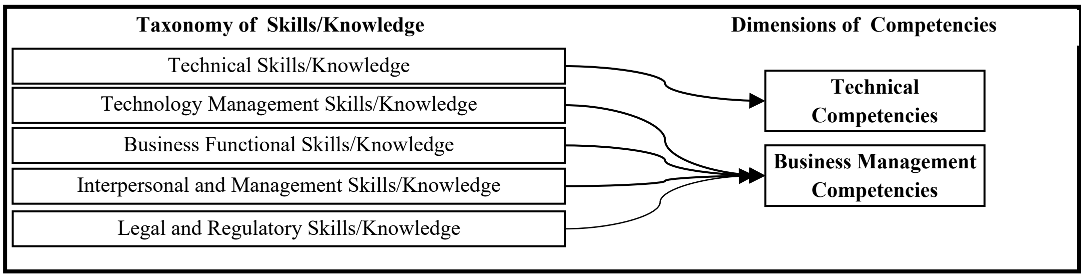


Figure 2-5: Categorisation of Taxonomies of Skills/Knowledge into Competencies

This study operationalises the five generic IT personnel's skills/knowledge across two dimensions of competencies: (1) technical competencies and (2) business management competencies. Technical competencies consist of one taxonomy of skills/knowledge, while business management competencies consist of four taxonomies of skills/knowledge. In contrast to the categorisation of competencies in this study, Wade & Parent (2002) categorised technology management skills/knowledge as technical competencies. However, apart from the IT personnel, organisational factors also play a significant role in exploiting IT for performance improvement. The following section presents a discussion on organisational factors.

2.4.2 Organisational Factors

Prior studies on RBV have referred to organisational capital resources as business resources (Powell & Dent-Micallef, 1997), IT-enabled intangibles (Bharadwaj, 2000), complementary organisational resources (Melville et al., 2004), organisational practices and routines (Aral & Weill, 2007), organisational factors (Cao, 2010; Wiengarten et al., 2013), organisational dimension (Rockmann et al., 2014). Wiengarten et al. (2013, p. 33) refer to organisational factors as "*non-IT resources*", "*firm's subsystems*", and "*complementary to IT resources*". Following Wiengarten et al. (2013), this study refers to these resources as organisational factors.

Prior studies have highlighted the critical role played by organisational factors in the performance impact of IT (Bharadwaj 2000; Lee, 2001; Melville et al., 2004; Cao, 2010; Cao et al., 2011; Wiengarten et al., 2013; Prasad, 2020), and IT adoption (Zhang et al., 2007; Cao, 2010; Lian et al., 2014). Organisational factors are also essential "*differentiators which explain why some firms are more successful than others"* (Prasad, 2020, p. 341). However, some researchers have also called for more research on how organisational factors complement IT to create business value (Cao, 2010). For example, Cao (2010) posited that "*more research is needed to understand how IT and organisational factors work together to create ITBV (p.271)*".

Prior studies have highlighted the critical role of organisational factors on cloud computing adoption (Low et al., 2011) and its implementation and performance impact (Gupta et al., 2018). Based on the literature reviewed in this study, there is a lack of empirical studies on the organisational factors that influence the organisational performance impact of cloud computing, which includes PCIaaS. An investigation of the organisational factors impacting the performance impact of PCIaaS addresses this gap in understanding.

2.4.2.1 Dimensions of Organisational Factors

Organisational factors play a central role in organisations' ability to effectively leverage IT for organisational performance (Lee, 2001; Keen, 1993; Tallon et al., 2000; Chun, 2003; Tallon & Kraemer, 2003; Melville et al., 2004; Ravichandran & Lertewongsatien, 2005; Aral & Weill, 2007; Yanosky, 2008; Babcock, 2009; Durmusoglu, 2009; Cao, 2010; Khajeh-Hosseini, 2010; Cao et al., 2011; Wiengarten et al., 2013; Rightscale, 2016). Some organisational factors used in prior studies include flexible culture, strategic planning, and IT integration (Powell & Dent-Micallef, 1997), education (Chun, 2003), top management's support (Durmusoglu, 2009; Low et al., 2011; Lian et al., 2014), organisational size, organisational strategy, organisational business processes, organisational culture, skills, know-how, knowledge, experience, management practices, and organisational structure (Melville et al., 2004; Wade & Hulland, 2004; Ravichandran & Lertewongsatien, 2005; Kohli

& Grover, 2008; Cao, 2010), and organisational practices, patterns, or routines (Aral & Weill, 2007).

Organisational factors capable of undermining the ability to exploit PCIaaS include process issues (Singh & Jangwal, 2012), stakeholders (Khajeh-Hosseini, 2010; Garrison et al., 2012), the authority of the IT department (Yanosky, 2008), top management (Wade & Hulland, 2004; Low et al., 2011; Gupta et al., 2018), and internal IT policies (Doelitzscher et al., 2011), strategic goals and objectives, organisation resistance, and business process re-engineering (Gupta et al., 2018). However, based on the extensive review and synthesis of prior studies, some researchers suggest a taxonomy of organisational factors for future RBV of ITBV research (Cao, 2008, 2010; Cao et al., 2011; Wiengarten et al., 2013). Table 2-8 presents the dimensions of organisational factors suggested by these authors and the adopted definition.

Table 2-8: Dimensions of Organisational Factors and Definition

Organisational Factors	Adopted Definition	Cao, (2008)	Cao (2010)	Cao et al. (2011)	Wiengarten et al. (2013)
Organisational Process	Organisational process can be defined as activities or procedures designed to support business operations by transforming certain inputs into outputs of value to customers (Wiengarten et al., 2013, p. 34)	X	X	X	X
Organisational Structure	Organisational structure can be defined as the degree and type of horizontal and vertical differentiation, mechanisms of coordination and control, formalisation, and centralisation of power (Wiengarten et al., 2013, p. 34)	X	X	X	X
Organisational Culture	Organisational culture can be defined as patterns of shared values, beliefs and assumptions underlying behavioural norms between organisational members (Wiengarten et al., 2013, p. 34)	X	X	X	X
Organisational Strategy	Organisational strategy can be defined as the identification of long-term goals/objectives of a company, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals (Wiengarten et al., 201, p.3 43)	X		X	X

Organisational Factors	Adopted Definition	Cao, (2008)	Cao (2010)	Cao et al. (2011)	Wiengarten et al. (2013)
Organisational Power & Politics	Organisational power and politics refer to "*how the systems of power and influence are used to affect decision-making in an organisation*" (Cao, 2010, p. 272)		X	X	

Prior studies have stressed the importance of the above five organisational factors in enhancing the organisational performance of IT (Cao, 2008, 2010; Cao et al., 2011; Wiengarten et al., 2013). Therefore, this study adopts the above five organisational factors to investigate the organisational performance impact of PCIaaS. As previously noted, PCIaaS IT personnel and organisational factors are the two resources involved in building the organisational capabilities for exploiting PCIaaS for performance impact. The following section discusses the operationalisation of organisational capabilities.

2.5 Operationalisation of Organisational Capabilities

Some researchers represent an organisation as a bundle of resources that work together to create organisational capabilities to exploit IT to improve organisational performance (Wernerfelt, 1984; Barney, 1991; Grant, 1991; Bharadwaj, 2000). From the perspective of RBV, organisational resources can be a strength or a weakness that can positively or negatively impact organisational performance (Wernerfelt, 1984; Barney, 1991). For example, Wernerfelt (1984, p. 172) argued that "*a resource is anything which could be thought of as a strength or weakness of a given firm*". Similarly, Barney (1991, p. 101) noted that "*firm resources are strengths that firms can use to conceive of and implement their strategies*".

Researchers have perceived organisational capabilities as the outcome of co-creation, or synergistic combination, or complex fusions of organisational resources working together (Barney, 1991; Grant, 1991; Amit & Schoemaker, 1993; Bharadwaj, 2000; Helfat & Peteraf, 2003; Ravichandran & Lertwongsatien, 2005; Fink & Neumann, 2009; Liang et al., 2010; Oh et al., 2014). Table 2-9 presents the conceptualisation of organisation capabilities by these researchers.

Table 2-9: Prior Research Conceptualisation of Organisational Capabilities

Conceptualisation of Capabilities	Author
"*The capabilities of a firm are what it can do as a result of teams of resources* ***working together****"* (p. 120).	Grant (1991)
"*A capability is the capacity for a* ***team of resources*** *to* ***perform some task or activity****"* (p. 119).	
"*capabilities involve complex patterns of* ***coordination between people and between people and other resources****"* (p. 122).	
"*Firm's capacity to deploy* ***resources, usually in combination****, using organisational processes to* ***effect a desired end****"* (p. 35).	Amit & Schoemaker (1993)
"***The synergistic combination*** *of IT resources copresent with other organisational resources and capabilities"* (p. 186).	Bharadwaj (2000)
"*ability to mobilise and deploy IT-based* ***resources in combination or copresent*** *with other resources and capabilities"* (p. 171).	
"*The ability of an organisation* ***to perform a coordinated set of tasks****, utilising organisational resources, for the purpose of* ***achieving a particular end result****"* (p. 999).	Helfat & Peteraf (2003)
"*the* ***capacity of a team of resources*** *to perform some task or activity and are often developed in functional and sub-functional areas by combining physical, human, and technological resources"* (p. 240).	Ravichandran & Lertwongsatien (2005)
"*A capability is the capacity for* ***resources to perform a task or activity*** *together"* (p. 91).	Fink & Neumann (2009)
"A capability is the capacity for ***resources to perform a task or activity together****"* (p. 1143).	Liang et al. (2010)
"Organisational IT capabilities ***as complex bundles of IT-related managerial ability*** *coordinated through a business process that enables firms to incorporate their IT assets to* ***provide desired results****"*. (p. 4491)	Oh et al. (2014)

The central theme consistent in the conceptualisation of organisation capabilities by the above researchers is that organisational capabilities develop from a team of organisational resources working together to achieve desired outcomes, organisational performance.

Researchers have highlighted the importance of organisational capabilities in ITBV as the glue that binds "*assets together and enables them to be deployed advantageously*" (Day, 1994, p. 38) to specifically "*strengthens the performance effects of IT assets and broadens their impact beyond their intended purpose"* (Aral & Weill, 2007, p. 763). Hence, Wei et al. (2014, p. 4) described capabilities as "*an important catalyst to realise business value and sustain competitive advantage*". Therefore, Chae et al. (2018) highlighted its importance in improving business performance, including increasing revenue, reducing cost, responding swiftly to changing market conditions, developing new products, innovations, or patents. Consequently, researchers attribute the differential ITBV not to the technology itself but to the ability (capabilities) to exploit or harness the potential of IT (Ross et al., 1996; Bharadwaj, 2000; Bhatt &

Grover, 2005; Radhakrishnan et al., 2008). Hence, Bharadwaj (2000) described capabilities as "*an important differentiator*" of dynamic organisational performance, enshrined in RBV theory. For example, Bharadwaj (2000, p. 176) argued that "*the resource-based view of IT suggests that firms can and do differentiate themselves on the basis of their IT resources*" She continued by adding that "*a firm's IT infrastructure, its human IT skills, and its ability to leverage IT for intangible benefits serve as firm-specific resources, which in combination create a firm-wide IT capability*" (p. 176). The following section presents the classification of organisational capabilities as understood in the literature reviewed.

2.5.1 Classification of Organisational Capabilities

Researchers broadly classified organisational capabilities into two taxonomies (Day, 1994; Wade & Hulland, 2004; Blois & Ramirez, 2006; Hulland et al., 2007; Sharma et al., 2007; Radhakrishnan et al., 2008; Stoel & Muhanna, 2009; Liang et al., 2010; Neirotti et al., 2013; Wei et al., 2014; Chen & Ong, 2015; Neirotti & Raguseo, 2017; Fink et al., 2017; Liu et al., 2018). Table 2-10 presents the classification of organisational capabilities in prior studies.

Table 2-10: Taxonomies of Organisational Capabilities

Typology of Organisational Capabilities	**Authors**												
	Day (1994)	Wade & Hulland (2004)	Blois & Ramirez, (2006)	Hulland et al. (2007)	Sharma et al. (2007)	Stoel & Muhanna (2009)	Liang et al. (2010)	Neirotti, et al., (2013)	Wei et al. (2014)	Chen & Ong, (2015)	Neirotti & Raguseo, (2017)	Fink et al., (2017)	Liu et al., (2018)
Inside-out capabilities	X	X											
Outside-in capabilities	X	X											
Spanning capabilities	X	X											
Internally focused capabilities			X	X	X	X							X
Externally focused capabilities			X	X	X	X							X
Internal capability							X						
External capability							X						
Internally oriented IT capabilities								X	X	X			

Typology of Organisational Capabilities	Authors												
	Day (1994)	Wade & Hulland (2004)	Blois & Ramirez, (2006)	Hulland et al. (2007)	Sharma et al. (2007)	Stoel & Muhanna (2009)	Liang et al. (2010)	Neirotti, et al., (2013)	Wei et al. (2014)	Chen & Ong, (2015)	Neirotti & Raguseo, (2017)	Fink et al., (2017)	Liu et al., (2018)
Externally oriented IT capabilities								X	X	X			
IT Business Spanning capability									X				
Aggregate-focused IT capabilities										X			
Internally oriented IT-based capabilities											X		
Externally oriented IT-based capabilities											X		
Operational capabilities												X	
Strategic capabilities												X	

Table 2-10 shows that researchers broadly classified organisational capabilities into two categories of capabilities, (1) operational (inside-out/internal) capabilities and (2) strategic (outside-in/external) capabilities. The third typology, spanning/aggregate, is a combination of the two broad categories. These categories of organisational capabilities are identified based on the business processes or activities supported (Grant, 1991; Day, 1994; Sharma et al., 2007; Radhakrishnan et al., 2008; Stoel & Muhanna, 2009; Liu et al., 2018), or the business value created (Blois & Ramirez, 2006; Hulland et al., 2007). For example, Stoel & Muhanna (2009, p. 182) distinguished between *"based on the primary business process area supported, thus reflecting the firm's choices of where and how IT resources were deployed*". A position also adopted by Liu et al. (2018) when they noted that "*capabilities into two categories based on the primary business process area the capability supports: externally focused and internally focused*" (p. 128). In contrast, Blois & Ramirez (2006, p. 1028) asserted that "*different ways to classify capabilities have been put forward. One is whether the value finally created is internally or externally focused*". Table 2-11 presents the key distinction between the two categories of organisational capabilities.

Table 2-11: Description of Categories of Organisational Capabilities

Operational (Inside-out/Internal) Capabilities	Strategic (Outside-in/External) Capabilities
"*Internally focused capabilities are developed or acquired mainly to* ***enhance the firm's operational performance***" (Blois & Ramirez, 2006, p. 1028).	"*Externally focused capabilities involve changes to the product itself and the ways in which it is delivered to customers, or the better understanding and* ***exploitation of the firm's product markets***" (Blois & Ramirez, 2006, p. 1028).
"*Internally focused capabilities emphasise IT infrastructure, information management, and* ***operational efficiencies***" (Hulland et al., 2007).	"*Externally focused capabilities place emphasis on* ***anticipating market requirements*** *and creating durable customer relationships and are thus more closely associated with* ***market demand***" (Hulland et al., 2007).
"*Internally focused IT capabilities are bundles of IT-related resources, skills and accumulated knowledge that help the firm* ***offer reliable products and services*** *and* ***minimise overhead costs*** *(back-office production, operational support, and fulfilment processes)*" (Stoel & Muhanna, 2009, p. 182).	"*Externally focused IT capabilities as bundles of IT-related resources, skills/knowledge that help the firm* ***sense and respond*** *in a timely way to* ***changes in its markets and shifts in the needs*** *of customers and suppliers*" (Stoel & Muhanna, 2009, p. 182).
"*Internally oriented IT-based capabilities are mainly aimed at achieving* ***greater efficiency and cost reduction***" (Neirotti & Raguseo, 2017, p. 6).	"*Externally oriented IT-based capabilities* ***support market adaptation and product differentiation***" (Neirotti & Raguseo, 2017, p. 6).
"*Inside-out capabilities, also known as internally focused capabilities, are resources, skills, and knowledge that help organisations* ***offer products and services and minimise costs associated with production, operational support, and fulfilment***" (Liu et al., 2018, p. 128).	"*Outside-in capabilities, also known as externally focused capabilities, are resources, skills, and knowledge that help a firm* ***sense, understand, and respond in a timely manner to changes*** *in its markets and to the needs of customers and suppliers*" (Liu et al., 2018, p. 128).

Table 2-11 shows that researchers broadly classified organisational capabilities into two categories of capabilities, (1) operational (inside-out/internal) capabilities and (2) strategic (outside-in/external) capabilities. The third typology, spanning/aggregate, is a combination of the two broad categories. However, the key distinction between both categories of capabilities is their strategic direction. Operational (inside-out/internal) capabilities include enhancement to operational efficiencies (Blois & Ramirez, 2006; Hulland et al., 2007; Neirotti & Raguseo, 2017), reliable products and services (Stoel & Muhanna, 2009; Liu et al., 2018), and cost reduction (Stoel & Muhanna, 2009; Neirotti & Raguseo, 2017; Liu et al., 2018). In contrast, while strategic (outside-in/external) capabilities exploit new ideas, markets, or new business opportunities (Blois & Ramirez, 2006; Hulland et al., 2007; Stoel & Muhanna, 2009), support market adaptation and product differentiation (Neirotti & Raguseo, 2017; Liu et al., 2018).

From the perspective of RBV, resources are the sources of capabilities, while capabilities are the sources of organisational performance (Grant, 1991). The following section discusses the operationalisation of organisational performance.

2.6 Operationalisation of Organisational Performance

ITBV, as defined in Section 2.1, is the organisational performance impact of IT. Both terms are used interchangeably from now on. However, the term organisational performance will be the main focus. The organisational performance impacts of IT have always been of interest to IS researchers and practitioners, resulting in "*a plethora of IS business value evaluation methods*" (Cronk & Fitzgerald, 1999, p. 41) and "*numerous performance measures*" (Schryen, 2013, p. 141). However, a literature review of CC and ITBV research shows that the performance measures of PCIaaS are still elusive. Schryen (2013, p. 142) regards "*the question of what to measure*" as one of the essential topics in the domain of ITBV. Although developing an exhaustive metric of PCIaaS performance measures is beyond this study's scope, it is essential to develop a basic shared understanding of how PCIaaS improved performance will be measured or assessed in this study.

2.6.1 Classification of Organisational Performance

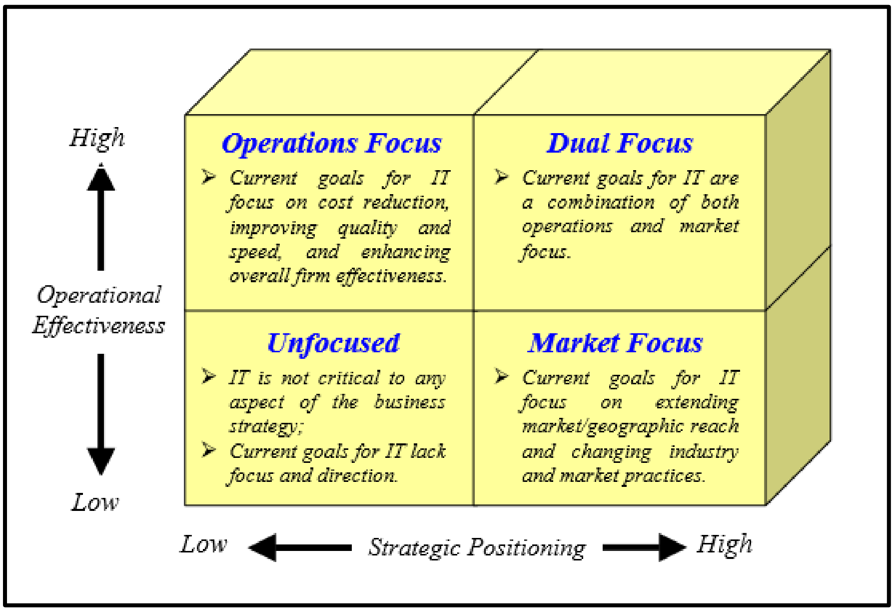
Researchers have yet to agree on a common taxonomy of organisational performance. Table 2-12 presents the categorisation of organisational performance in the literature reviewed.

Table 2-12: Description and Categories of Organisational Performance

Authors	Taxonomy	Description
Davis & Pett (2002)	Efficiency	"***Efficiency** refers to the **internal** functioning of an organisation*" (p. 88).
	Effectiveness	"***Effectiveness** is represented by the firm's ability to relate to its **environment***" (p. 88)
Melville et al. (2004)	Efficiency	"E*mphasises an **internal** perspective, employing such metrics as **cost reduction** and **productivity enhancement** in the assessment of a given **business process** or **doing things right**"* (p. 287).

Authors	Taxonomy	Description
	Effectiveness	"**Effectiveness** "*denotes the achievement of organisational objectives in relation to a firm's* ***external*** *environment and may be manifested in the attainment of* ***competitive advantage****, i.e., effecting a unique value-creating strategy with respect to competitors"* (p. 287).
Schwarz et al. (2010)	Operational impact	"*The operational impact of IT (which we view as the day-to-day operations of the firm*)" (p. 63).
	Strategic impact	"*The strategic impact of IT (which we view as the long-term growth of the firm)"* (p. 63).
Fink & Sukenik (2011)	Operational impact	"O*perational impact represents the impact of IT on the efficiency of* ***business processes****, such as the facilitation of* ***internal and external collaboration****, the* ***reduction of operating costs****, and the* ***improvement of productivity****"* (p. 305)
	Strategic impact	"S*trategic impact represents the ability of IT to create a competitive advantage by supporting strategic objectives, such as* ***product differentiation*** *and* ***geographic reach***" (p. 305).
Schryen (2013)	Internal value	"*Internal value is achieved when IS contributes to* ***redesigned business processes****,* ***better decision-making****,* ***improved coordination flexibility****, and* ***productivity****"* (p. 151).
	Competitive value	"C*ompetitive value is achieved when IS supports market-oriented performance, such as stock market performance reactions, and profit ratios, and innovation and protection of resources"* (p. 151).
Fink et al. (2017)	Operational	Operational "*impacts included efficiency improvement, process optimisation, and time and cost reduction"* (p. 40).
	Strategic	Strategic "*impacts included improvements in effectiveness, profitability, market share, and customer satisfaction"* (p. 40).
Bourdeau et al. (2018)	Internal	"*Internally focused performance measures are usually related to* ***operations and processes efficiency****"* (p. 7).
	External	"E*xternally focused measures are usually related to broader economic considerations such as, for instance, financial valuation by shareholders or* ***market share****"* (p. 7).

Table 2-12 shows that researchers differ in the terms they use in categorising organisational performance. However, there is consistency in the performance measure across the two categories of organisational performance, including (1) internal/operational/efficiency and (2) external/strategic/market/competitive. This categorisation further reinforced Melville et al. (2004) review and analysis of literature on ITBV that there are two formulations of performance: efficiency and effectiveness. More so, Tallon et al. (2000) corporate goals or strategic intent for IT model best explain the concept of internal/operational/efficiency and external/strategic/market organisational performance of IT. Tallon et al. (2000, p. 7) noted that "*corporations differentially focus on two key business objectives, operational effectiveness and* *strategic positioning*". In a study conducted by Rivard et al. (2006) to investigate IT contributions to organisational performance, they confirmed Tallon et al.'s (2000) position on the IT model's corporate goals or strategic intent. Figure 2-6 presents Tallon et al. (2000) model of corporate goals or strategic intent for IT.



Source: Tallon et al. (2000)

Figure 2-6: Corporate Goals for IT

Tallon et al.'s (2000) model categorised the organisational performance impact of IT against Porter's (1996) two main foci of organisational performance, (1) operational effectiveness and (2) strategic positioning. The model consists of two axes and four quadrants representing the four foci of the organisational performance impact of IT. The two axes include (1) operational effectiveness and (2) strategic positioning, while the four quadrants include (1) operations focus, (2) market focus, (3) dual focus, and (4) unfocused.

The model highlights the key distinctions between operational effectiveness and strategic positioning. According to Tallon et al. (2000), operational effectiveness is operations or internally focused, while strategic positioning is market or externally focused. Examples of operational effectiveness include reducing costs, improving and increasing productivity, quality, speed, and overall organisational effectiveness, while examples of strategic positioning include extending the existing market and geographic reach and changing industry or market practices. However, Tallon et al. (2000, p. 15) noted, "*operations-focus emerges as a dominant goal for IT, indicating* *that a significant number of firms are still primarily using IT to reduce operating costs, improve quality and increase productivity*". Therefore, this study categorises the organisational performance impact of PCIaaS into (1) operational effectiveness (internal/operations) and (2) strategic positioning (external/market). Kim et al. (2008) argued that the firm's strategic positioning reflects its ability to generate a competitive advantage. However, Al-alak & Tarabieh (2011, p. 80) argued that organisations "*doing both innovation differentiation and market differentiation simultaneously achieves greater competitive advantage that leads to best results in organisational performance*".

PCIaaS is the virtualised form of the physical IT infrastructure, potentially creating several opportunities, particularly in the educational industry. Understanding its potential is the first step in developing identifying and developing its performance measures, which will be vital in evaluating its organisational performance impact. The following sections discuss the potential of PCIaaS and the development of PCIaaS performance measures.

2.6.2 Potential of PCIaaS

The growing popularity, adoption, use, prominence, attractiveness and enormous potential of CC and PCIaaS in organisations, including in tertiary educational institutions, has been recognised in several studies (Averitt et al., 2007; Lunsford, 2009; Petrović & Fertalj, 2009; Armbrust et al., 2009, 2010; Ercan, 2010; Sultan, 2010; Chen et al., 2011; Doelitzscher et al., 2011; Mircea & Andreescu, 2011; Bharadwaj & Lal, 2012; Chandra & Borah, 2012; Dinita et al., 2012; Hwang & Wood, 2012; Suciu et al., 2012; Yoo et al., 2012; Burd et al., 2013; Chrobak, 2014; Goyal, 2014; Pardeshi, 2014; Rapoza, 2015; Salah et al., 2015; Gonzalez-Martínez et al., 2015).

Prior studies suggest that "*cloud computing is an excellent alternative for educational institutions which are especially under budget shortage*" (Ercan, 2010, p. 938), capable of relieving educational institutions from the burden of handling complex IT infrastructure management and maintenance activities and lead to substantial cost savings (Chandra & Borah, 2012). In addition, cloud computing also enhances the delivery of "*better services even with fewer resources*" (Chandra & Borah, 2012, p. 1), "*create new products and services*", and "*new market, thus attracting new* *customer segments and generating entirely new revenue streams*" (Berman et al., 2012, p, 27).

Several researchers regard the public cloud as the most suitable, popular and financially attractive of all the four deployment models of CC, particularly for small and medium-sized enterprises (SMEs), who usually lag behind large organisations in the use of IT for business purposes due to their low capital outlay (Kuan & Chau, 2001; Deakins et al., 2004; Dyerson et al., 2009; Armbrust et al., 2010; Marston et al., 2011; Misra & Mondal, 2011; Neves et al., 2011; Yang et al., 2011; Martini & Choo, 2012; Suciu et al., 2012; Gupta et al., 2013; Carcary et al., 2014; Goyal, 2014). For example, Marston et al. (2011) argued that the public cloud provides SMEs with "*a cost-effective way to deploy IT solutions"* (p. 180).

Despite the suitability, popularity, and attractiveness of the public cloud, it also has its unique challenges such as security, data privacy, legal, vendor lock-in, loss of control, performance, reliability, licensing, price models, confidentiality, compliance, and data governance (Armbrust et al., 2009; Dillon et al., 2010; Carlin & Curran, 2012; Gupta et al., 2013; Gonzalez-Martínez et al., 2015). The most notables of these challenges are data security and privacy concerns (Armbrust et al., 2009; Carlin & Curran, 2012; Chen & Zhao, 2012; Ko et al., 2013; Goyal, 2014). For example, Goyal (2014, p. 26) argued that "*one of the pitfalls of adopting a public cloud is data security and privacy*".

To reap the enormous potentials of CC without encountering any of the risks and challenges of public cloud, large organisations are moving towards private cloud as an alternative way of harnessing the enormous potentials of CC for internal usage while keeping the privacy, governance and security of their mission critical and core business data, applications and systems under their control and within the firewall of their organisation, similar to traditional IT (Armbrust et al., 2009, 2010; Doddavula & Gawande, 2009; Dillon et al., 2010; Sato et al., 2010; Stanoevska-Slabeva & Wozniak, 2010; Ramgovind et al., 2010; World Economic Forum, 2010; Zhang, et al., 2010; De Chaves et al., 2011; Doelitzscher et al., 2011; Fenn & LeHong et al., 2011; Marston et al., 2011; Mahmood & Hill, 2011; Wang et al., 2011; Sindhu & Mukherjee, 2011; Subashini & Kavitha, 2011; Jansen & Grance, 2011; Chen & Zhao, 2012; Aljabre, 2012; Horrow et al., 2012; Carlin & Curran, 2012; Jadeja & Modi, 2012; Konstantinou et al., 2012; Liu, 2012; Patidar et al., 2012; Suciu et al., 2012; Aruna et al., 2013;

Carrozza et al., 2013; Northbridge, 2013; Avram, 2014; Goyal, 2014; Lu et al., 2014; Rapoza & Csapler, 2014; Rockmann et al., 2014; Chou, 2015; Bahrami & Singhal, 2015; Rightscale, 2016). For example, Dillon et al. (2010) also argued that "*security concerns including data privacy and trust also make private cloud an option for many firms*" (p. 26).

Recent surveys have also shown the increasing growth in the investment and adoption of private cloud (IDC, 2016; RightScale, 2016, 2017). Prior studies suggest that private cloud provides "*greater control over the cloud infrastructure and are often suitable for larger installations*" (Marston et al., 2011, p. 180) and is often used by academics "*for research and teaching purposes*" (Dillon et al., 2010, p. 28) and by "*large companies with a large pool of resources or products with intellectual properties should consider private clouds*" (Lu et al., 2014, p. 559). The private cloud provides large organisations distinct and compelling advantages over the traditional IT (Sun et al., 2014; Wu et al., 2015) and is more appealing and economical to large organisations than the public cloud (Misra & Mondal, 2011; Marston et al., 2011; Konstantinou et al., 2012; Goyal, 2014). Researchers have also acknowledged the increasing popularity of the private cloud with large organisations (Pantic & Babar, 2012; Ross & Blumenstein, 2013).

Researchers have compared the cost of the public and private cloud to determine which is more economical (Konstantinou et al., 2012; Singh & Jangwal, 2012). Most of these studies found that the total cost of a private cloud over three years was more economical than a public cloud. However, researchers also found evidence that the more economical deployment argument was a paradox (Butler, 2014). Apart from the risk of moving data to a public cloud, a private cloud also saves organisations the cost of moving data to and from the cloud (Armbrust et al., 2009; Rosenthal et al., 2010). For example, Rosenthal et al. (2010) found that public cloud providers charge substantially in moving data to and off their cloud infrastructure.

Despite the attractiveness of PCIaaS to large organisations, some researchers criticise the private cloud concept for being like traditional IT in terms of the enormous capital expenditure of purchasing equipment, software, and staffing (Armbrust et al., 2010; Zhang et al., 2010; Marston et al., 2011; Goyal, 2014). For example, Zhang et al. (2010) found evidence of significant up-front capital costs with private cloud migrations. In addition, Armbrust et al. (2010) found that private cloud adoption does not benefit from the economies of scale that make public clouds financially attractive. Similarly, Goyal (2014, p. 26) argued that a private cloud is "*costly, so not every organisation can afford a private cloud*". The purchase, maintenance and management of a private cloud is also like that of the public cloud or utility computing model where the IT department acts as the cloud service provider (CSP) while the individual business units that utilise the cloud services act as the cloud consumer. The individual business units may then pay the IT department in line with agreed chargeback mechanisms on the services provided by the IT departments (Kim et al., 2009; Low et al., 2011). The internal operation of private cloud in organisations is, in this sense, akin to a "pay-per-use" pricing model but operated within the organisation's boundaries.

Prior studies have highlighted some of the benefits of private cloud to include: "*to maximise and optimise the utilisation of existing in-house resources*" (Dillon et al., 2010, p. 26) and enable organisations to retain "*full control over the infrastructure*" (Patidar et al., 2012). Others also suggested that private cloud "*cut IT costs by promoting asset consolidation through virtualisation*" (Katz et al., 2010), and "*reduce costs, help to efficiently utilize the resources, minimize security risks, and help meet many core IT goals and requirements*" (Aruna et al., 2013, p. 82). Private cloud also offers large organisations, especially those that have invested huge capital in building their traditional IT environment, the benefit of building their private cloud on their existing IT infrastructure to harness the potential of cloud computing (Doelitzscher et al., 2011, 2011b; Mahmood & Hill, 2011; Vecchiola et al., 2011; Aruna et al., 2013; Devi et al., 2013).

Despite the growing popularity and potential of PCIaaS to large organisations, researchers have yet to investigate its organisational performance impact empirically. Hence the lack of performance measures for evaluating the organisational performance impact of PCIaaS. The following section discusses the development of PCIaaS performance measures.

2.6.3 Development of PCIaaS Performance Measures

In developing PCIaaS performance measures for this study, a review of the extant literature on CC identified potential PCIaaS performance measures. The review and synthesis of 45 journal papers on CC published between 2009 and 2016 identified 305 potential benefits of PCIaaS. After several synthesis, consolidation, and iterations, 252 appearance frequency of potential benefits of PCIaaS and 35 potential PCIaaS performance measures across nine PCIaaS business value dimensions. Figure 2-7 summarises the frequency and the number of PCIaaS performance measures in each business value dimension.

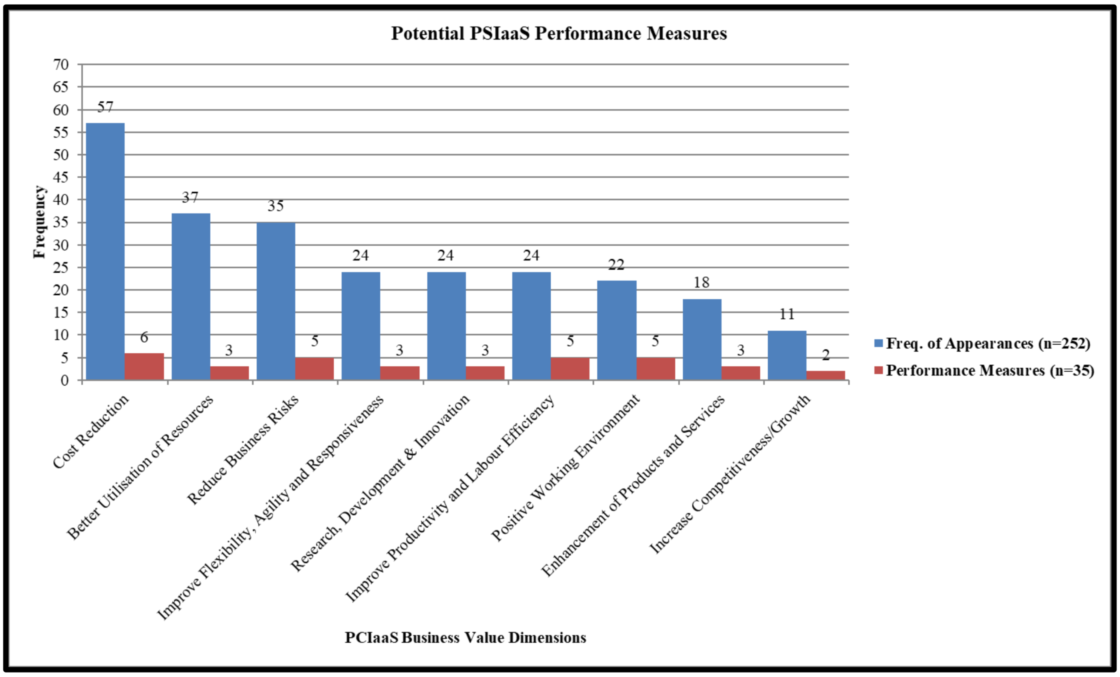


Figure 2-7: Categorisation of Potential PCIaaS Performance Measures

A synthesis of the extant literature indicates that cost reduction is the most mentioned dimension of PCIaaS business value, with 57 appearances and six PCIaaS performance measures. Better utilisation of resources is the second most mentioned, with 37 appearances and three PCIaaS performance measures. Business risks reduction is the third most mentioned with 35 appearances and five PCIaaS performance measures. Following this are the dimensions of productivity improvement and labour efficiency, and positive working environment. Finally, increase competitiveness and growth is the least mentioned PCIaaS business value dimension with 11 appearances and two PCIaaS performance measures. Table 2-13 presents an overview of the synthesis of the extant literature on CC showing the PCIaaS performance measures in each dimension of PCIaaS business value, their frequency, and contributing author.

Table 2-13: Synthesis and Consolidation of Literature on Cloud Computing

Dimensions	Code No	PCIaaS Performance Measures	Appearance Frequency	Armbrust et al., (2009)	Zhang & Zhou, (2009)	Buyya et al., (2008, 2009)	Petrovic & Fertalj, (2009)	Armbrust et al., (2010)	Bhardwaj et al., (2010)	Brynjolfsson, et al., (2010)	Ercan, (2010)	Khajeh-Hosseini, (2010)	Kumar & Lu, (2010)	Krieger et al., (2010)	Ruthkoski, (2010)	Ramgovind et al., (2010)	Sultan, (2010)	World Economic Forum, (2010)	Zhang et al., (2010)	Mell & Grance, (2011)	Beloglazov et al., (2011)	Carroll et al., (2011)	Marston et al., (2011)	Mahmood & Hill, (2011)	Ma et al., (2011)	Subashini & Kavitha, (2011)	Yoo, (2011)	Iyer & Henderson, (2012)	Aljabre, (2012)	Beloglazov et al., (2012)	Garrison at al., (2012)	Hwang & Wood, (2012)	Jadeja & Modi, (2012)	Konstantinou et al., (2012)	Takai, (2012)	Avram, (2014)	Shahzad, (2014)	Stieninger & Nedbal, (2014)	Chrobak, (2014)	Goyal, (2014)	Rockmann et al., (2014)	Lacity & Reynolds, (2014)	Chou, (2015)	Yaghmaei & Binesh, (2015)	Rightscale, (2016)	Liu et al., (2016)	Alhadidi et al., (2016)	Chen, et al., (2016)
Increase Competitiveness & Growth	TBV#01	Opportunity for potential growth	**2**									X						X																														
	TBV#02	Increase/Improve Competitiveness	**9**															X				X	X	X				X	X		X					X					X							
Positive Working Environment	TBV#03	Improve Satisfaction of Work	**2**									X						X																														
	TBV#04	Create Training and Development Opportunities	**1**									X																																				
	TBV#05	Collective Problem-Solving	**3**																									X	X												X							
	TBV#06	Go Green/reduced carbon footprint	**13**				X						X					X		X	X	X	X						X				X	X					X				X	X				
	TBV#07	Improve/Enhance User Experience	**3**															X																	X							X						
Cost Reduction	TBV#08	Cost-effective and affordable enterprise-class IT services	**30**	X	X		X	X		X	X	X				X	X	X		X		X	X	X	X		X		X		X		X	X		X		X	X	X	X	X	X	X	X			X
	TBV#09	Lower Cost of Failure	**1**															X																														
	TBV#10	Lower IT management expenses/costs	**10**						X		X	X	X					X	X								X				X	X		X														
	TBV#11	Reduce the costs of cooling and power – Energy savings	**9**									X	X				X			X	X	X	X						X					X														
	TBV#12	Lower/Eliminate software costs	**4**								X	X														X			X																			
	TBV#13	Lower IT staffs' costs	**3**														X												X																X			
Better Utilisation of Resources	TBV#14	Centralisation and Consolidation	**2**				X												X																													
	TBV#15	Efficient and better utilisation of IT resources	**32**	X	X	X	X	X	X		X	X	X						X		X	X	X	X		X	X	X	X	X	X		X	X	X	X	X				X	X	X	X	X	X		X
	TBV#16	Reduce the amount of space	**3**								X											X							X																			
Productivity Improvement and Labour Efficiency	TBV#17	IT Staff Efficiency (Time)	**4**				X										X	X																											X			
	TBV#18	Free up time to focus on core business	**8**						X		X				X							X		X				X	X		X																	
	TBV#19	Improve Productivity	**1**																										X																			
	TBV#20	Allow employees to work remotely	**2**						X																				X																			
	TBV#21	Ease and Simplicity of IT management	**9**				X				X								X		X	X		X								X	X						X									
Improvement in Flexibility, Agility and Responsiveness	TBV#22	Provide opportunities for flexibility and autonomy	**6**				X				X							X		X																					X					X		
	TBV#23	Rapid Responsiveness to business needs	**15**	X			X		X				X					X		X		X	X	X		X			X							X	X								X	X		
	TBV#24	Rapid Development of Applications/Shorter start-up time for new services	**3**										X									X													X													
Enhancement of Products and Services	TBV#25	Better and Higher Quality of Services	**2**												X														X																			
	TBV#26	Improve Standard and Modernity of IT Infrastructure	**2**											X																																	X	
	TBV#27	Higher and Better Performance IT Resources	**14**						X	X	X										X	X	X	X	X		X		X			X			X					X					X			
Research, Development & Innovation	TBV#28	Accelerate /Lower IT barriers to Innovation	**10**					X	X	X								X					X	X						X						X				X	X							
	TBV#29	Enables development of new classes of products, applications, and services	**7**	X								X						X					X					X								X					X							
	TBV#30	Research Repository and Collaboration	**7**															X						X		X	X	X	X																	X		
Business Risks Reduction	TBV#31	Better Disaster recovery and business continuity capability	**10**				X				X		X	X								X		X	X	X							X												X			
	TBV#33	High Availability and Reliability	**9**				X					X									X	X					X		X			X	X												X			
	TBV#32	Improved Infrastructure/Data Security	**7**				X															X		X	X	X						X							X									
	TBV#34	Less worry/Flexibility applying system-wide upgrades and update	**7**				X		X			X													X					X	X	X																
	TBV#35	Greater Resiliency	**2**																					X		X																						
Author's Frequency of Appearance			**252**	**4**	**2**	**1**	**12**	**3**	**8**	**3**	**10**	**11**	**7**	**2**	**2**	**1**	**4**	**14**	**4**	**5**	**6**	**14**	**9**	**12**	**5**	**7**	**6**	**6**	**17**	**3**	**6**	**6**	**6**	**5**	**4**	**6**	**2**	**1**	**4**	**3**	**7**	**3**	**3**	**3**	**8**	**4**	**1**	**2**

The researcher identified 35 potential PCIaaS performance measures across nine business value dimensions by reviewing and synthesising the extant literature on CC. The top eight performance measures in the literature in order of hierarchy were: (1) efficient and better utilisation of IT resources, (2) cost-effective and affordable enterprise-class IT services, (3) rapid responsiveness to business needs, (4) higher and better performance IT resources, (5) go green/reduced carbon footprint, (6) better disaster recovery and business continuity, (7) lower IT management expenses/costs, and (8) accelerate/lower IT barriers to innovation. The dimensions of increase competitiveness and growth and productivity improvement, and labour efficiency have no measures in the top eight performance measures in the literature. The outcome of this review is the development of the PCIaaS organisational performance impact evaluation instrument presented in Table 2-14.

Table 2-14: PCIaaS Organisational Performance Impact Evaluation Instrument

Dimensions	Code No	Measures	Categories	
			OE	SP
Increase Competitiveness & Growth	TBV#01	Create opportunities for potential growth		
	TBV#02	Increase/improve competitiveness		
Positive Working Environment	TBV#03	Improve satisfaction of work		
	TBV#04	Create training and development opportunities		
	TBV#05	Collective problem-solving		
	TBV#06	Go green/reduced carbon footprint		
	TBV#07	Improve/enhance user experience		
Cost Reduction	TBV#08	Cost-effective and affordable enterprise-class IT services		
	TBV#09	Lower cost of failure		
	TBV#10	Lower IT management expenses/costs		
	TBV#11	Reduce the costs of cooling and power – energy savings		
	TBV#12	Lower/eliminate software costs		
	TBV#13	Lower IT staff costs		
Better Utilisation of Resources	TBV#14	Centralisation/consolidation		
	TBV#15	Efficient and better utilisation of IT resources		
	TBV#16	Reduce the amount of space and equipment		
Productivity Improvement & Labour Efficiency	TBV#17	IT staff efficiency (time)		
	TBV#18	Free up time to focus on core business		
	TBV#19	Improve productivity		
	TBV#20	Allow employees to work remotely		
	TBV#21	Ease and simplicity of IT management		
Improvement in Flexibility, Agility & Responsiveness	TBV#22	Provide opportunities for flexibility and autonomy		
	TBV#23	Rapid responsiveness to business needs		
	TBV#24	Rapid development of applications		
Enhancement of Products & Services	TBV#25	Better and higher quality of services		
	TBV#26	Improve standard and modernity of IT infrastructure		
	TBV#27	Higher and better performance IT resources		
Research, Development & Innovation	TBV#28	Accelerate/lower IT barriers to innovation		
	TBV#29	Enables development of new classes of products and services		
	TBV#30	Research repository and collaboration		

Dimensions	Code No	Measures	Categories	
			OE	SP
Business Risks Reduction	TBV#31	Better disaster recovery and business continuity capability		
	TBV#32	Improved infrastructure/data security		
	TBV#33	High availability and reliability		
	TBV#34	Less worry/flexibility applying system-wide upgrades/updates		
	TBV#35	Greater resiliency		

Legend: OE: Operational Effectiveness, SP: Strategic Positioning

Table 2-14 presents the PCIaaS organisational performance impact evaluation instrument developed and proposed for this study, highlighting the dimensions, measures, and categories of the organisational performance impact of PCIaaS. The instrument will serve as a framework for identifying and measuring the organisational performance impact of PCIaaS. The instrument is operationalised in investigating RQ1 from three different levels (1) PCIaaS performance measures, (2) PCIaaS business value dimensions, and (3) PCIaaS organisational performance categories.

In summary, in Section 2.3, the researcher adopted the indirect model of RBV theory consisting of three main variables in building the conceptual research model that serves as the theoretical lens for this study. Sections 2.4, 2.5, and 2.6 operationalised the three variables: organisational resources, organisational capabilities, and organisational performance. The following section presents the conceptual research model that serves as the theoretical lens for this study.

2.7 Conceptual Research Model

Drawing upon theoretical considerations of RBV, ITBV, and CC, this study develops and proposes a conceptual model to investigate the organisational performance impact of PCIaaS and the resources and capabilities involved. Figure 2-8 presents the conceptual research model proposed and developed for this study.

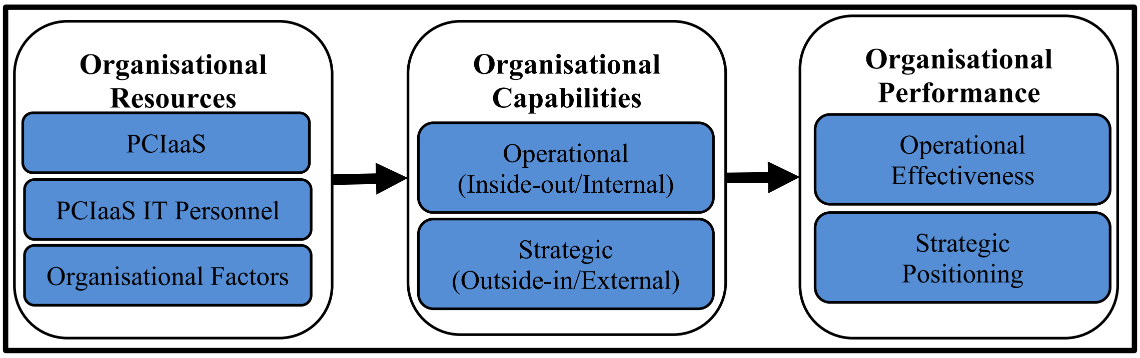


Figure 2-8: Conceptual Research Model for PCIaaS

Figure 2-8 highlights the three main variables in the conceptual research model, comprising (1) organisational resources, (2) organisational capabilities, and (3) organisational performance. At a high theoretical level, this study adapted Liang et al. (2010) indirect framework of RBV, predicated upon Grant's (1991) to develop and propose the conceptual research model for the organisational performance impact of PCIaaS. Furthermore, based on prior precedence, this study incorporates Barney's (1991) typology of organisational resources, i.e., (1) technology resources (PCIaaS), (2) human capital resources (PCIaaS IT personnel), and (3) organisational capital resources (organisational factors).

This study draws on prior studies to broadly classify organisational capabilities into (1) operational (inside-out/internal) capabilities and (2) strategic (outside-in/external) capabilities. Furthermore, it draws on several prior studies to broadly classify the organisational performance impact of PCIaaS into (1) operational effectiveness and (2) strategic positioning. Introducing variables of organisational capabilities, consisting of operational (inside-out/internal) capabilities and strategic (outside-in/external) capabilities and organisational performance impact of PCIaaS, consisting of (1) operational effectiveness and (2) strategic positioning, provides a framework for correlating organisational capabilities to organisational performance.

Finally, the study provided great insights and step by step details in building a conceptual model grounded in the indirect model of RBV theory for investigating the performance impact of PCIaaS. Based on extant literature across three domains, the study operationalised the three variables and delineated every construct therein.

2.8 Chapter Summary

To further advance the body of knowledge on the organisational performance impact of PCIaaS, this chapter conducts a literature review in the domain of RBV theory, CC, and ITBV to develop a research model for evaluating (1) the organisational performance impact of PCIaaS, (2) the two resources involved in developing the capabilities needed in exploring PCIaaS for performance improvement. The literature reviewed highlights what is known and unknown, uncovered gaps that need exploring and filling, and lay this study's theoretical foundation and a precursor to the choice of the research methodology.

PCIaaS is fast becoming the mainstream approach in the use of IT infrastructure in organisations. However, there is little or nothing known about its organisational performance impact. In Section 2.6, this study review of the extant literature on CC identified several potential PCIaaS performance measures. Through a series of synthesis, consolidation, and categorisation, 35 potential PCIaaS performance measures emerged across nine dimensions of business value, incorporating the two categories of organisational performance to develop the PCIaaS organisational performance impact evaluation instrument. The instrument will be used in this study to provide an opportunity to verify the theoretical concepts from the literature and to develop a model to measure the organisational performance impact of PCIaaS in any organisation across industries in practical terms. Section 3.4 of Chapter Three discusses the rigour undertaken in this study in developing the PCIaaS performance measures. The next chapter presents the research methodology employed to explore this phenomenon of interest.

Chapter Three – Research Methodology

3.0 Introduction

This chapter presents the research methodology, illustrating the steps employed in the study to explore the organisational resources involved in exploiting PCIaaS to improve organisational performance. According to Kothari (2004, p. 8), "*research methodology is a way to systematically solve the research problem*". Kothari (2004) suggested that the researcher must know the research methods/techniques and the methodology

3.1 Research Objective and Research Questions

This study investigates the organisational performance impact of PCIaaS and the organisational resources and capabilities involved. Given the research objective, this study adopted RBV theory as its theoretical lens. The study developed and proposed a research model based on the indirect model of RBV. Also formulated and proposed were four research questions to achieve the research objective. Table 3-1presents the four research questions formulated in this study.

Table 3-1 Research Questions

Research questions
RQ1. What is the organisational performance impact of PCIaaS?
RQ2. What are the organisational factors influenced the organisational performance impact of PCIaaS?
RQ3. What are the contributions of PCIaaS IT personnel to the organisational performance impact of PCIaaS?
RQ4. What organisational capabilities are required to improve organisational performance through PCIaaS?

Research onion developed and proposed by Saunders et al. (2015) is widely used in research. The research onion illustrates the six layers of a research study: (1) research philosophy, (2) approach to theory development, (3) methodological choice, (4) research strategy, (5) time horizon, and (6) techniques and procedure. The research onion guides the researcher in conducting this study. The research methodology undertaken in this study will be discussed in the subsequent sections. The following section presents the research philosophy

3.2 Overview of Research Philosophy

This section presents a brief overview of the research philosophy underpinning any research study. Research philosophy is referred to by Saunders et al. (2015, p. 125) as "*a system of beliefs and assumptions about the development of knowledge*". However, Creswell (2007, p. 2) advised that "the *research design process in qualitative research begins with philosophical assumptions that the inquirers make in deciding to undertake a qualitative study*". Thus, seven philosophical assumptions guide qualitative research (Guba & Lincoln, 1994; Grix, 2002; Creswell, 2007; Saunders et al., 2015). Table 3-2 highlights the seven philosophical assumptions and questions as outlined by these researchers.

Table 3-2: Philosophical Assumptions and Questions in Qualitative Research

Assumptions	**Key Questions**			
	Guba & Lincoln (1994)	**Grix (2002)**	**Creswell (2007)**	**Saunders et al. (2015)**
Ontology	What is the form and nature of reality, and therefore what is there that can be known about it?	What is out there to know?	What is the nature of reality?	What is the nature of reality? What is the world like?
Epistemology	What is the nature of the relationship between the knower or would-be knower, and what can be known?	What and how can we know about it?	What is the relationship between the researcher and that being researched?	How can we know what we know? What is considered acceptable knowledge? What constitutes good-quality data? What kinds of contribution to knowledge can be made?
Methodology/ Methodological	How can the inquirer (would-be knower) go about finding out whatever he or she believes can be known?	How can we go about acquiring that knowledge?	What is the process of research?	
Methods		Which precise procedures can we use to acquire it?		
Sources		Which data can we collect?		
Axiology			What is the role of values?	What is the role of values in research? How should we treat our own values when we do research? How should we deal with the values of research participants?

Assumptions	Key Questions			
	Guba & Lincoln (1994)	Grix (2002)	Creswell (2007)	Saunders et al. (2015)
Rhetoric			What is the language of the researcher?	

Table 3-2 highlights the seven philosophical assumptions. These philosophical assumptions influenced this study's research process, research strategies, research questions, methods, data collection and analysis, and interpretation of the findings. However, Grix (2002) postulated that if researchers have explicit knowledge of the ontological and epistemological assumptions that underpin research, they will be able:

1) To understand the interrelationship of the key components of research (including methodology and methods).
2) To avoid confusion when discussing theoretical debates and approaches to social phenomena; and
3) To recognise others and defend their positions.

Grix (2002) noted that ontology and epistemology are central to social research. He described ontology as the "*image of social reality upon which a theory is based*" and "*the starting point of all research, after which one's epistemological and methodological positions logically follow (*Grix, 2002, *p.177)".* Ontology was the starting point of this research study, established by reviewing the extant literature on ITBV, CC, and RBV theory with the view of uncovering what is known and unknown about the research area. Epistemological can be subjective or objective. Table 3-3 highlights some of the seven philosophical assumptions, questions, and implications for practice.

Table 3-3: Philosophical Assumptions and Implications for Practice

Assumption	Question	Characteristics	Implications for Practice (Examples)
Ontological	What is the nature of reality?	Reality is subjective and multiple, as seen by participants in the study	Researcher uses quotes and themes in the words of participants and provides evidence of different perspectives
Epistemological	What is the relationship between the researcher and that being researched?	Researcher attempts to lessen the distance between himself or herself and that being researched	Researcher collaborates, spends time in the field with participants, and becomes an insider

Assumption	Question	Characteristics	Implications for Practice (Examples)
Axiological	What is the role of values?	Researcher acknowledges that research is value-laden and that biases are present	Researcher openly discusses values that shape the narrative and includes his or her own interpretation in conjunction with the interpretations of participants
Rhetorical	What is the language of the researcher?	Researcher writes in a literary, informal style using the personal voice and uses qualitative terms and limited definitions	Researcher uses an engaging style of narrative, and use first-person pronoun, and employs the language of qualitative research
Methodological	What is the process of research?	Researcher uses inductive logic to study the topic within its context and uses an emerging design	Researcher works with particulars (details) before generalisations, describes in detail the context of the study, and continually revises questions from experiences in the field

Source: Creswell (2007)

Researchers have classified these philosophical assumptions into different sets of basic beliefs. Guba & Lincoln (1994) define paradigms "*as the basic belief system or worldview that guides the investigator* (pg.105)". Researchers emphasized the importance of having a clear understanding of the philosophical paradigms and establishing a research paradigm in research (Guba & Lincoln, 1994; Creswell, 2007). For example, Guba and Lincoln (1994) argued that "*paradigm issues are crucial; no inquirer, we maintain, ought to go about the business of inquiry without being clear about just what paradigm informs and guides his or her approach* (*p.116*)".

Research paradigms, according to Creswell (2007), can be classified into four basic beliefs: (1) post-positivism, (2) constructivism, (3) advocacy/participatory, and (4) pragmatism. Similarly, Guba & Lincoln (1994) also classified research paradigms into four basic beliefs, (1) positivist, (2) post-positivist, (3) critical theory, and (4) constructivism. According to Guba & Lincoln (1994), positivism denotes a received view, while post-positivism represents the past few decades' efforts to respond in a limited way to the most problematic criticisms of positivism. Finally, critical theory is a blanket term denoting a set of several alternative paradigms, while constructivism is an alternative paradigm whose breakaway assumption is the move from ontological realism to ontological relativism. Table 3-4 presents some of the philosophical assumptions related to the four research paradigms outlined by Guba & Lincoln (1994).

Table 3-4: Basic Beliefs of Alternative Inquiry Paradigms

Paradigms	Philosophical Assumptions		
	Ontology	**Epistemology**	**Methodology**
Positivism	Naive realism – real reality but apprehendable	Dualist/objectivist; findings true	Experimental/manipulative verification of hypotheses; chiefly quantitative methods
Post-positivism	Critical realism – real reality but only imperfectly and probabilistically apprehendable	Modified dualist/ objectivist; critical tradition/community; findings probably true	Modified experimental/ manipulative; critical multiplism; falsification of hypotheses; may include qualitative methods
Critical Theory et al.	Historical realism – virtual reality shaped by social, political, cultural, economic, ethnic, and gender values; crystallised over time	Transactional/ subjectivist; value-mediated findings	Dialogic/dialectical
Constructivism	Relativism – local and specific constructed realities	Transactional/ subjectivist; created findings	Hermeneutical/dialectical

Source: Guba & Lincoln (1994)

Table 3-4 presents a comparison of four basic paradigms as it relates to three philosophical assumptions. Researchers have argued that, given the nature of IT research, the post-positivist approach is most appropriate for studying IT within organisations (Chukwudi et al., 2019). In addition, Crossan (2003) argued that Post-positivist approaches "*aim to describe and explore in-depth phenomena from a qualitative perspective*" (p. 46). The researcher adopts a qualitative post-positivist approach and reviewed extant literature across multiple domains to develop a conceptual research model to present an in-depth understanding of the organisational performance impact of PCIaaS and the resources and capabilities involved. In addition, Myers (1997, p. 7) also defined research method as "*a strategy of inquiry which moves from the underlying philosophical assumptions to research design and data collection*" (Myers, 1997). The following section presents the research strategy.

3.3 Research Strategy

There are several strategies for conducting a research study. Myers (1997) identified four qualitative research strategies: (1) action research, (2) case study research, (3) ethnography, and (4) grounded theory. In contrast, Saunders et al. (2015) identified eight choices of research strategy available to researchers: (1) experiment, (2) survey, (3) case study, (4) action research, (5) grounded theory, (6) ethnography, (7) archival research, and (8) narrative inquiry. Due to the inherent advantages of case study, it has become one of the most popular research methodologies, and qualitative research strategies used in IS research (Benbasat et al., 1987; Gable, 1994; Hitt & Brynjolfsson, 1996; Darke et al., 1998; Skok & Legge, 2001; Asan, 2003; Levina & Ross, 2003; Smith et al., 2007; Runeson & Host, 2009; Apulu & Latham, 2011). However, Benbasat et al. (1987, p. 370) argued that "*case study research is a viable IS research strategy*", most suited for an in-depth investigation of a social and contemporary phenomenon within its real-life context (Darke et al., 1998; Yin, 2011).

Researchers advised that a case study is most appropriate when little is known about a new phenomenon (Benbasat et al., 1987; Eisenhardt, 1989; Runeson & Host, 2009; Yin, 2011) like CC, including PCIaaS. Therefore, considering this study's objective, this study adopted a qualitative exploratory case study as the most appropriate research strategy to investigate the organisational performance impact of PCIaaS and analyse the interaction between PCIaaS, PCIaaS IT personnel, and organisational factors. Case study is most suited for this study as it provided the researcher with a deeper understanding of a new phenomenon (PCIaaS) in the use of IT infrastructure in organisations (Runeson & Host, 2009).

3.3.1 Qualitative Case Study

Researchers consider case studies as one of the most dominant qualitative research methods used in the area of IS research (Benbasat et al., 1987; Hitt & Brynjolfsson, 1996; Darke et al., 1998; Klein & Myers, 1999; Skok & Legge, 2001; Levina & Ross, 2003; Runeson & Host, 2009). Case study is "*well suited to understanding the interactions between information technology-related innovations and organisational contexts*" (Darke et al., 1998, p. 273), particularly when interest has shifted to managerial and organisational issues rather than technical and technological issues (Benbasat et al., 1987; Kaplan & Maxwell, 1994; Myers, 1997). For example, Benbasat et al. (1987, p. 383) suggested that "*case studies can provide the organisational context for the study of the relationship between strategy and information technology*".

The use of a case study enabled the researcher to focus "*on understanding the dynamics present within single settings*" (Eisenhardt, 1989, p. 534) and in its *"natural setting*" (Benbasat et al., 1987, *p.370*). It enabled the researcher to gain deeper insights that might not be possible with other less in-depth approaches (Rowley, 2002), particularly by enabling the researcher to use multiple methods of data collection (see Section 3.5) (Benbasat et al., 1987; Eisenhardt, 1989; Runeson & Host, 2009). As a result, the researcher was able to elicit qualitative information for producing an in-depth understanding of a phenomenon, PCIaaS (Eisenhardt, 1989; Yin, 2011; Runeson & Host, 2009). For example, using a case study approach provided the researcher with a rich understanding of the broad range of organisational factors in tertiary educational institutions and how they combine with PCIaaS IT personnel to develop three PCIaaS capabilities identified in this study. In addition, using multiple data collection methods such as skype provided the researcher with the understanding of PCIaaS IT personnel in OU working remotely from Iceland without using VPN. It also provided the researcher with a deeper and rich understanding of the skills/knowledge and the activities performed by PCIaaS IT personnel. The following section presents a discussion of the case study research protocol used in this study.

3.3.2 Case Study Protocol

A case study protocol is an essential part of every case study project that contains the instrument for the research (Yin, 2003, 2009). A robust case study protocol is also a significant way of increasing the reliability of case study research (Yin, 2003, 2009). Table 3-5 presents the case study protocol employed in this study.

Table 3-5: Case Study Protocol

Sections	Recommended Activities	Activities Performed
Overview of the Case Study Research	Background Information	RBV of ITBV
	Research Objective	The objective of this case study is to investigate the performance impact of PCIaaS
	Issues being investigated	(1) Performance impact of PCIaaS, (2) Activities performed and Skills/knowledge of IT personnel, and (3) organisational factors that influence the performance impact of PCIaaS
	Relevant readings	Literature on ITBV, RBV, CC, corporate documentation, interviews, and focus group.

Sections	Recommended Activities	Activities Performed
Field Procedures	Gaining access to key interviewees Having sufficient resources, e.g., recording devices and a quiet place to write notes privately Developing a procedure for calling for assistance/guidance Clear scheduling of data collection activities Provide for unanticipated events	Liaise with Head/Director of IT Services department and IT personnel for access to organisations – CIT (Head of IT Services department), OU (Technical Lead, Cloud Services), UCC – (Director of IT Services department and Senior Data centre Engineer) Use of personal audio recording device, Personal office of respondents and UCC BIS department conference room Regular discussions with research supervisors Based on Timeline as set by the researcher Provision made for delays in responding to and granting of interview appointments
Case Study Questions	Specific questions to be explored Potential sources of answers Evaluation	Use of interview guide covering the four research questions Use of focus group discussion, interviews, and documentation The evaluation will be based on the research model developed in this study
Case Study Report	Outline and format of the case study report Audience for the case study report	The outline and format of this thesis report will be in line with UCC requirements The audience for this thesis includes members of staff and students of UCC as well as IS researchers and practitioners

Source: Yin (2009)

Table 3-5 presents the research protocol that guides the researcher in the conduct of this research in a standardised manner and ensures uniformity in data collection and analysis (Sarker and Lee, 2002; Yin, 2003, 2009), which helped in enhancing the research's reliability and enables other researchers to repeat an earlier study (Shenton, 2004). The following section discusses the selection of the cases.

3.3.3 Selection of Cases

Technology changes and evolves rapidly, whereas the rate of change in the public sector organisations, including tertiary educational institutions, is very slow. Therefore, integrating technology into teaching and learning in tertiary educational institutions is critically important to producing graduates equipped for knowledge and a technology-based economy (Obiri-Yeboah et al., 2013). Hence the timelines of this exploration of the organisational performance impact of PCIaaS in tertiary educational institutions. As a result, the researcher conducted this study within specific boundaries. The cases were chosen based on the following pre-defined criteria:

1) Organisational type (tertiary educational institution),
2) Geographical terms (located in Ireland and the UK),
3) A phenomenon of interest (using PCIaaS), and
4) Availability of study participants (Subject matter experts).

In adherence to this selection criterion, emails were sent to public sector organisations in the UK and Ireland, soliciting their acceptance to participate in this study. As a result, the researcher identified four tertiary educational institutions in the UK and Ireland that met the above criteria and agreed to participate in the study: NUI Galway, CIT and UCC Cork, Ireland, and OU, UK. With the contact person's help, the researcher identified and contacted critical informants with knowledge of this study's research areas for an interview. As a result, the researcher exempted NUIG from the study due to insufficient study participants. Table 3-6 presents an overview of the chosen case studies.

Table 3-6: An Overview of the Three Cases

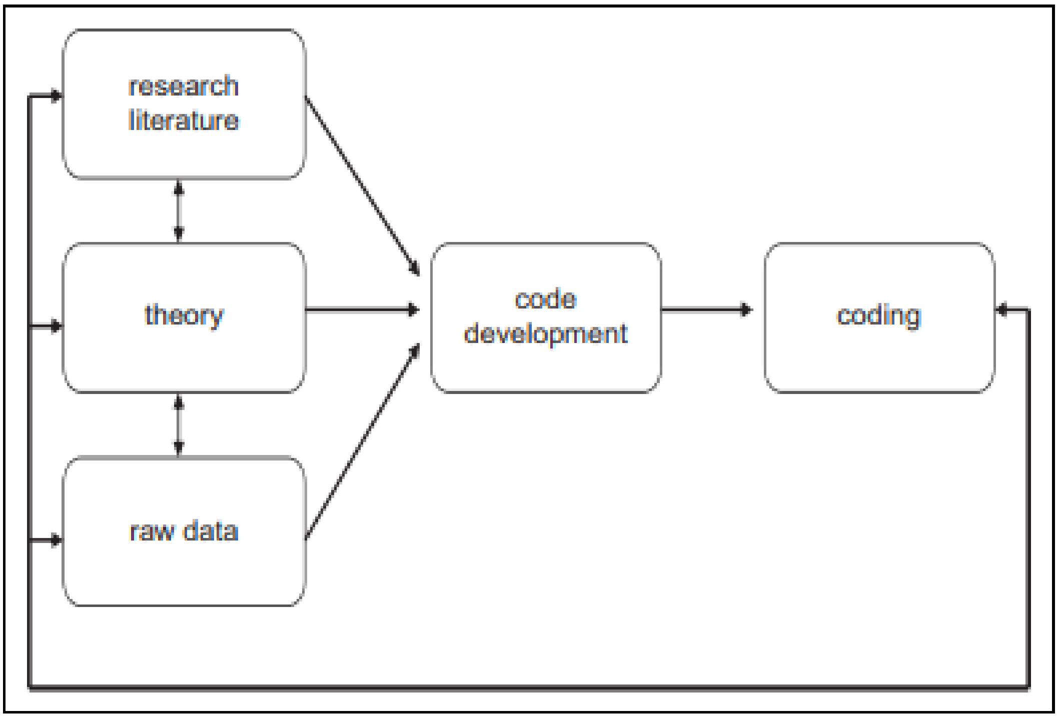
Institution	**CIT**	**OU**	**UCC**
Country	**Ireland**	**UK**	**Ireland**
Size	Staff – 1,500 Students – 13,000	Staff – 13,000 Students – 23,000	Staff – 2,500 Students – 20,000
Core Business	Third Level Education	Third Level Education	Third Level Education
Cloud Infrastructure	VMware ESXI VMware View Horizon VMware vCloud Director	VMware ESXI VMware vSphere VMware vCloud Director	VMware vSphere Microsoft HyperV
Services Provided	vServers vDesktop Lab vCloud Lab	vServers Tenanted Cloud-as-a-Service	v Servers
Main Customers/ Users of PCIaaS	IT Services Computing Dept BIS Dept Maths Dept Multimedia Dept	Central IT Services Departments & Colleges	IT Services Research Group Faculties/Academic Departments

Table 3-6 presents an overview of the three cases highlighting the name of the institutions, locality of the institutions, size, the profile of the PCIaaS infrastructure, and PCIaaS services provided. It also highlights the primary users of the PCIaaS services. The participating institutions are among the most prominent tertiary educational institutions in the UK and Ireland, using PCIaaS as their IT infrastructure platform. This study interviewed 14 subject matter experts across the three cases, consisting of the Directors of IT departments, sectional IT heads, PCIaaS IT personnel, departmental IT personnel, and at least one (1) representative from the academic departments.

In Section 2.6.3, this study developed a codebook, referred to as PCIaaS organisational performance impact evaluation instrument, to evaluate and analyse the organisational performance impact of PCIaaS in the three cases. The following section discusses the rigour undertaken by the researcher in developing the codebook.

3.4 Development of Codebook used in Evaluating PCIaaS Performance Impact

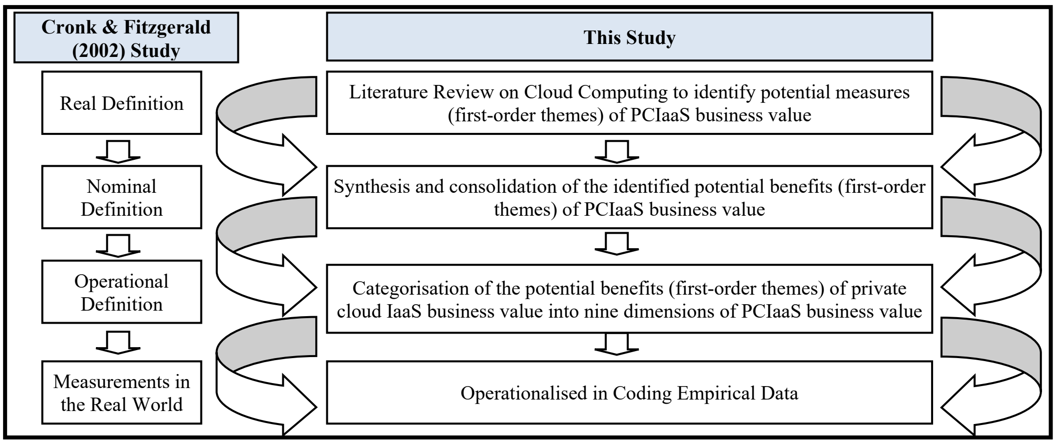
Some researchers have described the evaluation of ITBV as complex and multi-faceted (Cronk & Fitzgerald, 1999; Schryen, 2013) with the glut of measures of organisational performance (Schryen, 2013). However, empirical research on the organisational performance impact of PCIaaS is still in its infancy. DeCuir-Gunby et al. (2011, p. 138) advised that "*codebooks are essential to analysing qualitative research because they provide a formalised operationalisation of the codes*". According to DeCuir-Gunby et al. (2011, p. 138), "*a codebook is a set of codes, definitions, and examples used as a guide to help analyse interview data*". Therefore, this study draws on DeCuir-Gunby et al. (2011) to develop a PCIaaS performance measures codebook for measuring the organisational performance impact of PCIaaS. The codebook developed in this study enabled the researchers to gain clearer insights into the interview data (DeCuir-Gunby et al., 2011). Figure 3-1 presents the circular coding process, as suggested by DeCuir-Gunby et al. (2011).



Source: DeCuir-Gunby et al. (2011)

Figure 3-1: Circular Process of Coding

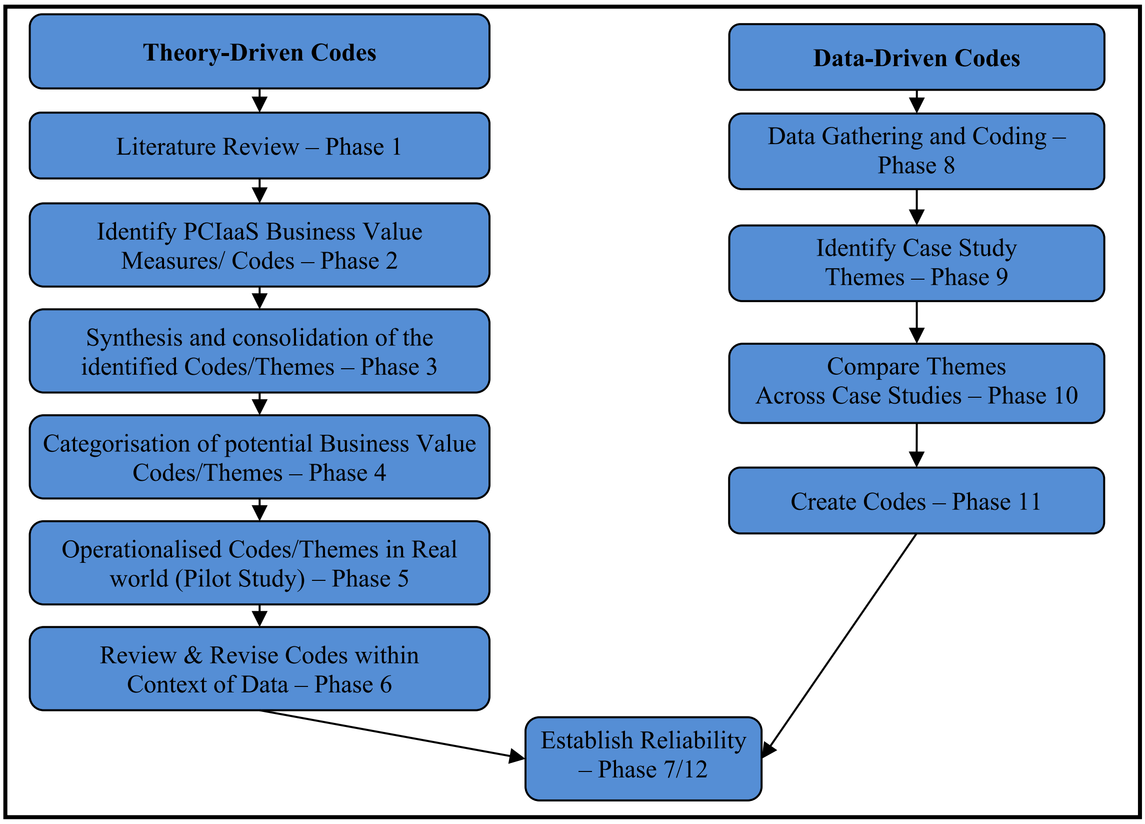
Figure 3-1 presents the circular coding process, highlighting the five main ingredients – (1) research literature, (2) theory, (3) raw data, (4) code development, and (5) coding. However, in this study adapted from Cronk & Fitzgerald (2002), four iterative steps for developing constructs and PCIaaS performance measures were (1) real definition, (2) nominal definition, (3) operational definition, and (4) measurements in the real world. These four iterative steps of constructs definition are missing in and strengthen DeCuir-Gunby et al.'s (2011) circular coding process. Figure 3-2 presents the methodology used in developing PCIaaS performance measures.



Source: Adapted from Cronk & Fitzgerald (2002)

Figure 3-2: Iterative Steps of Construct Definition

Cronk & Fitzgerald's (2002) iterative steps of constructs definition complements DeCuir-Gunby et al.'s (2011) circular process of coding by presenting a step-by-step process of how constructs are identified, manipulated, categorised, and operationalised. As a result, the researcher incorporates Cronk & Fitzgerald's (2002) iterative steps of constructs definition with DeCuir-Gunby et al.'s (2011) circular process of coding to develop a codebook development framework from literature and data. Figure 3-3 presents the 12 steps used in developing the codebook used in this study for evaluating the organisational performance impact of PCIaaS.



Source: Adapted from DeCuir-Gunby et al. (2011)

Figure 3-3: Steps for Developing Codebooks

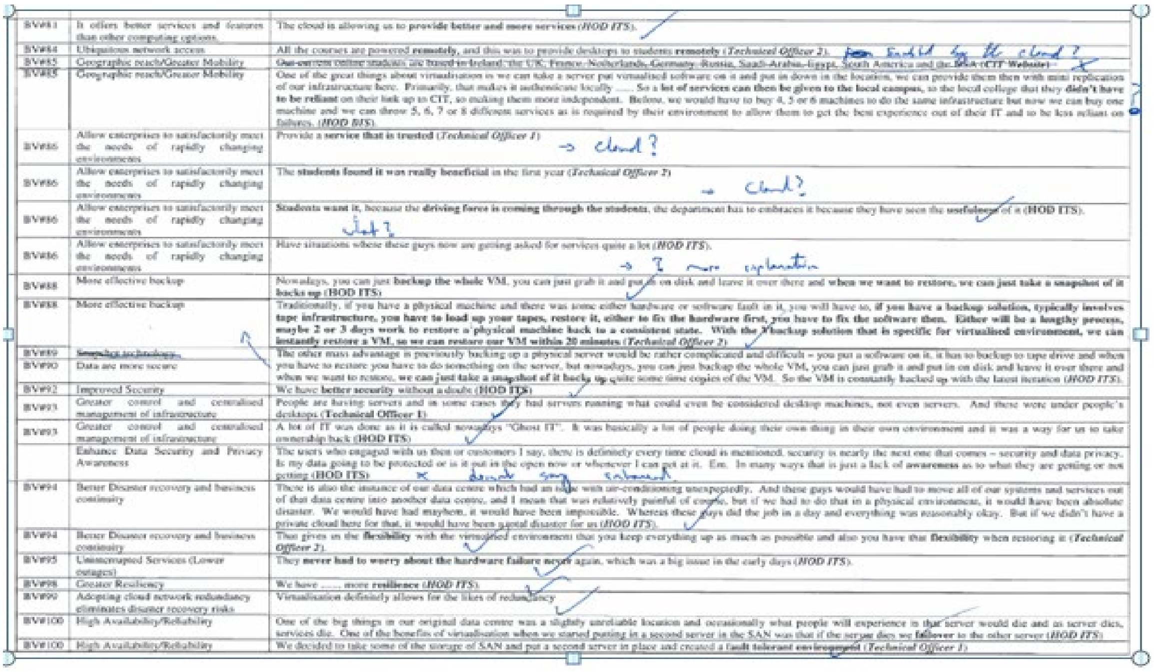
This study employs theory-driven and data-driven code in developing the codebook used in this study for analysing the performance measures of PCIaaS. However, the first step was to review extant literature in CC to develop the theory-driven codes to analyse PCIaaS performance measures. This study reviewed 45 journals on CC, as previously discussed in Section 2.6.3. The second step in code development was to identify potential PCIaaS performance measures (theory-driven codes). Through a thorough review of 45 journals, this study identified 305 potential PCIaaS performance measures (theory-driven codes) used in developing the deductive a priori codes. The third step involved the synthesis and consolidation of the 305 potential PCIaaS performance measures. First, the researcher identified some similarities and those with similar meanings combined, after which 252 appearances finally emerged. Next, the 252 potential PCIaaS performance measures were synthesised and consolidated, after which a partial list of 106 potential PCIaaS performance measures emerged from this process.

The fourth step involved categorising the 106 PCIaaS performance measures (first-order themes) into nine different categories (dimensions of business value) (second-order themes). The researcher then assigned a label to the PCIaaS performance measures in the respective groups. Some of the labels were later revised and reworded, but all reflected the nominating journal papers' central idea. The 106 PCIaaS performance measures went through several stages of iterations, revisions, synthesises and consolidation. A partial list of 76 potential PCIaaS performance measures emerged from this process. After several iterations, revisions, syntheses, and consolidation, 35 potential PCIaaS performance measures emerged. The sixth phase was to review and revise the codes and ensure that the theory-driven codes were reliable and consistent.

The codebook for PCIaaS was a starting point for analysing the data collected, providing the guidelines that helped organise and analyse the data collected in this study. The reliability of the theory-driven codes was established by consolidating and synthesising the codes, identifying and eliminating duplicates, and merging similar codes. In addition, this study established the reliability by conducting a rigorous review of the coding in consultation with my two researcher supervisors, i.e., a recheck of the data's consistency. The review process took approximately 90 minutes per week per reviewer over about ten weeks. As a result, a final list of 35 potential PCIaaS performance measures emerged across the nine business value dimensions. The breakdown of the number of items in each dimension are as follows: (1) six items in cost reduction, (2) three items better utilisation of resources, (3) three items improvement in flexibility, agility, and responsiveness, (4) three items in enhancement of products and services, (5) three items in research, development and innovation, (6) seven items in positive working environment, (7) six items in productivity improvement and labour efficiency, (8) five items in business risk reduction, and (9) two items in improved competitiveness and growth.

The final phase is to establish the reliability of the codebook. The researcher tested and validated the usefulness, applicability, and reliability of the codebook using Moy Park, an organisation based in Belfast, Northern Ireland. The researcher conducted a face-to-face interview with the Director of IT services and one of the IT personnel, transcribed, coded and analysed using the codebook. As a result, the researcher made some slight modification to the codebook.

However, the final process for establishing the reliability of the codebook was after the collection, coding, and analysis of the data gathered from the three cases: CIT, OU, and UCC. After the transcription, coding, and analysis of the data gathered using the codebook, a whiteboard session was organised with my two supervisors, lasting approximately 60 minutes per week over five weeks after the data collection and coding. This process checked to ensure that the supporting quotes' consistency and reliability rigorously matched each code. Some labels were modified, reworded, and discarded through this process, while some were reassigned to different codes. Figure 3-4 presents a sample of the coding reliability process.



BV#83	It offers better services and features than other computing options	The cloud is allowing us to **provide better and more services** (*HOD ITS*).
BV#84	Ubiquitous network access	All the courses are powered **remotely**, and this was to provide desktops to students **remotely** (*Technical Officer 2*).
BV#85	Geographic reach/Greater Mobility	~~Our current online students are based in Ireland, the UK, France, Netherlands, Germany, Russia, Saudi Arabia, Egypt,~~ South America and the USA (*CIT Website*)
BV#85	Geographic reach/Greater Mobility	One of the great things about virtualisation is we can take a server put virtualised software on it and put in down in the location, we can provide them then with mini replication of our infrastructure here. Primarily, that makes it authenticate locally ..... So a **lot of services can then be given to the local campus**, so the local college that they **didn't have to be reliant** on their link up to CIT, so making them more independent. Before, we would have to buy 4, 5 or 6 machines to do the same infrastructure but now we can buy one machine and we can throw 5, 6, 7 or 8 different services as is required by their environment to allow them to get the best experience out of their IT and to be less reliant on failures. (*HOD BIS*)
BV#86	Allow enterprises to satisfactorily meet the needs of rapidly changing environments	Provide a **service that is trusted** (*Technical Officer 1*)
BV#86	Allow enterprises to satisfactorily meet the needs of rapidly changing environments	The **students found it was really beneficial** in the first year (*Technical Officer 2*)
BV#86	Allow enterprises to satisfactorily meet the needs of rapidly changing environments	**Students want it**, because the **driving force is coming through the students**, the department has to embraces it because they have seen the **usefulness** of it (**HOD ITS**).
BV#86	Allow enterprises to satisfactorily meet the needs of rapidly changing environments	Have situations where these guys now are getting asked for services quite a lot (*HOD ITS*).
BV#88	More effective backup	Nowadays, you can just **backup the whole VM**, you can just grab it and put it on disk and leave it over there and **when we want to restore, we can just take a snapshot of it backs up** (**HOD ITS**)
BV#88	More effective backup	Traditionally, if you have a physical machine and there was some either hardware or software fault in it, you will have to, **if you have a backup solution, typically involves tape infrastructure, you have to load up your tapes, restore it, either to fix the hardware first, you have to fix the software then. Either will be a lengthy process, maybe 2 or 3 days work to restore a physical machine back to a consistent state. With the backup solution that is specific for virtualised environment, we can instantly restore a VM, so we can restore our VM within 20 minutes.** (*Technical Officer 2*)
BV#89	~~Snapshot technology~~	The other main advantage is previously backing up a physical server would be rather complicated and difficult – you put a software on it, it has to backup to tape drive and when you have to restore you have to do something on the server, but nowadays, you can just backup the whole VM, you can just grab it and put in on disk and leave it over there and when we want to restore, **we can just take a snapshot of it backs up** quite some time copies of the VM. So the VM is constantly backed up with the latest iteration (*HOD ITS*).
BV#90	Data are more secure	
BV#92	Improved Security	We have **better security** without a doubt (**HOD ITS**)
BV#93	Greater control and centralised management of infrastructure	People are having servers and in some cases they had servers running what could even be considered desktop machines, not even servers. And these were under people's desktops (**Technical Officer 1**)
BV#93	Greater control and centralised management of infrastructure	A lot of IT was done as it is called nowadays "Ghost IT". It was basically a lot of people doing their own thing in their own environment and it was a way for us to take ownership back (**HOD ITS**)
	Enhance Data Security and Privacy Awareness	The users who engaged with us then or customers I say, there is definitely every time cloud is mentioned, security is nearly the next one that comes – security and data privacy. Is my data going to be protected or is it put in the open now or whenever I can get at it. Em. In many ways that is just a lack of **awareness** as to what they are getting or not getting (**HOD ITS**)
BV#94	Better Disaster recovery and business continuity	There is also the instance of our data centre which had an issue with air-conditioning unexpectedly. And these guys would have had to move all of our systems and services out of that data centre into another data centre, and I mean that was relatively painful of course, but if we had to do that in a physical environment, it would have been absolute disaster. We would have had mayhem, it would have been impossible. Whereas these guys did the job in a day and everything was reasonably okay. But if we didn't have a private cloud here for that, it would have been a total disaster for us (*HOD ITS*).
BV#94	Better Disaster recovery and business continuity	That gives us the **flexibility** with the virtualised environment that you keep everything up as much as possible and also you have that **flexibility** when restoring it (*Technical Officer 2*).
BV#95	Uninterrupted Services (Lower outages)	They **never had to worry about the hardware failure never** again, which was a big issue in the early days (*HOD ITS*).
BV#98	Greater Resiliency	We have ...... more **resilience** (*HOD ITS*).
BV#99	Adopting cloud network redundancy eliminates disaster recovery risks	Virtualisation definitely allows for the likes of redundancy
BV#100	High Availability/Reliability	One of the big things in our original data centre was a slightly unreliable location and occasionally what people will experience is that server would die and as server dies, services die. One of the benefits of virtualisation when we started putting in a second server in the SAN was that if the server dies we **failover** to the other server (*HOD ITS*)
BV#100	High Availability/Reliability	We decided to take some of the storage of SAN and put a second server in place and created a **fault tolerant environment** (*Technical Officer 1*)

Figure 3-4: Establishing Coding Reliability

Figure 3-4 highlights some of the markings on the codebook by one supervisor, accepting some coding while asking for explanations in others. The researcher made use of multiple methods of data gathering. The following section discusses the method of data collection undertaken in this study.

3.5 Data Collection

The researcher mainly relied on the qualitative data gathered to understand and explain the organisational performance impact of PCIaaS and the resources and capabilities involved (Myers, 1997). The researcher used the following data collection methods – (1) focus group discussion/interview and (2) in-depth face-to-face interview. When it was not convenient for the participants to participate using any of the above two methods, data were collected using the following (1) documentation (e.g., the job description of PCIaaS IT personnel as shown in Appendix 13, Appendix 14, Appendix 15, and Appendix 16), (2) Skype video and chat interview (see Appendix 17), (3) telephone interview, and (4) email interviews (see Appendix 10 for CIT, Appendix 11 for OU, and Appendix 12 for UCC).

Prior studies have also conducted interviews using electronic mediums such as telephone, Skype, and emails (Levina & Ross, 2003; Hitt & Brynjolfsson, 1996; Piva et al., 2006; Smith et al., 2007). Several researchers have used job content analysis in identifying the skills/knowledge required by IT personnel (Todd et al., 1995). Similarly, Cardy & Selvarajan (2006) identified four frameworks for identifying and developing the competence of employees, including two traditional approaches (job-based and future-based) and two alternative approaches (person-based and value-based). However, this study adopts the job based traditional approach, which identifies competencies from analysing the job description. This research also used the interview guide as a data collection method

3.5.1 Interview Guide

The interview guide covers three of the research questions, including (1) organisational performance impact of PCIaaS, (2) activities performed and the skills/knowledge of IT personnel, and (3) organisational factors. The interviews focus on the area(s) the participants deemed applicable to them, reflecting differences in the participants' general background and knowledge of the three research areas.

As a starting point for the collection of data, this study adopted the five taxonomies of organisational factors suggested in prior studies (Cao, 2008, 2010; Cao et al., 2011; Wiengarten et al., 2013) and the generic taxonomy of skills/knowledge suggested by Lee et al. (1995) used and validated in several other studies (Byrd & Turner, 2000; Tesch et al., 2003; Kumar, 2004; Byrd et al., 2005; Tesch et al., 2008; Anwar & Masrek, 2014). The researcher added the fifth taxonomy of skills/knowledge due to the growing importance of legal and regulatory skills/knowledge to IT personnel.

This study leveraged some of the dimensions and measures of ITBV, as suggested by Kraemer et al. (1994) and which has also been validated, adopted, adapted, and used by several researchers (Tallon et al., 2000; Tallon & Kraemer, 2003; Radhakrishnan et al., 2008; Tallon & Pinsonneault, 2011; Tallon, 2011) as a starting point to investigate the performance impact of PCIaaS. However, the researcher added the dimension of business risk reduction to the dimensions and measures suggested and used by Kraemer et al. (1994). Appendix 7, Appendix 8, and Appendix 9 present the interview guide for organisational factors, PCIaaS IT personnel, and organisational performance.

3.5.2 Data Collection Protocol

A data collection protocol designed based on Guillemette et al. (2017) guides the data collected for this study. This study implemented a 3-phase collection of data from three case studies. Phase one (1) involves collecting data using a focus group interview and face-to-face, semi-structured interview. Due to the convenience and financial limitation of travelling to the UK to conduct interviews, the researcher used email, Skype, and telephone interviews for study participants in OU, UK. In contrast, interviews with study participants in Ireland were conducted using face-to-face interviews and focus group discussions. In addition, the researcher requested the job description of PCIaaS IT personnel and conducted follow-up interviews using email and telephone interviews. Table 3-7 presents the data collection protocol used in this study.

Table 3-7: Data Collection Protocol

Phase	Type of Data Source	Details	Justification/Main Input Provided
Phase 1	Focus Group Interview	CIT – (3 participants) ➢ Head, IT Services Department ➢ Technical Officer (1) Cloud Services, IT Services Department ➢ Technical Officer (2) Cloud Services, IT Services Department	The performance impact of PCIaaS Activities performed and set of competencies, skills, and knowledge requirements of IT personnel Characteristics of organisational factors that influence the performance impact of PCIaaS
	Face-to-face Interviews Skype Interviews Telephone Interview	CIT – (1 participant) ➢ (1 Interview) Head of BIS Department UCC – (5 participants) ➢ (1 Interview) Director of IT Services Department ➢ (1 Interview) Head of Platform Group, IT Services Department ➢ (1 Interview) Head of Enterprise Applications Group, IT Services Department ➢ (1 Interview) Senior Datacentre Engineer, Platform Group, IT Services Department ➢ (1 Interview) System Administrator, BIS Department OU – (5 participants) ➢ (1 Interview) Director of Infrastructure Services, IT Services Department ➢ (1 Interview) Technical Lead, Cloud Services, IT Services Department ➢ (1 Interview) Systems Administrator, Cloud Services, IT Services Department ➢ (1 Interview) Web/Digital Officer, Sainsbury Library, Saïd Business School/Bodleian Libraries ➢ (1 Interview) Team Leader, Microsoft Access and Dynamics Team, Software Solutions Maintenance, Oxford Central IT Services	
Phase 2	Documentation ➢ IT personnel Job Description	UCC ➢ (Job Description) System Engineer, Cloud Services, IT Services Depart. OU ➢ (Job Description) Technical Lead, Cloud Services, IT Services Department	The activities performed and set of skills requirements of IT personnel
Phase 3	Emailed Interview Skype Interview	CIT ➢ (1 Follow-up Interview) Technical Officer (1) Cloud Services, IT Services Department OU ➢ (3 Follow-up Interview) Technical Lead, Cloud Services, IT Services Department	To gather more information about their perception of the performance impact of PCIaaS To gather more information about their perception of the activities performed and set of skills requirements of IT personnel

Source: Adapted from Guillemette et al. (2017)

A total of 14 participants participated in this study, including four from CIT, five from OU, and five from UCC. CIT has two PCIaaS IT personnel responsible for the management of the institution's PCIaaS environments. The two PCIaaS IT personnel and the institution's Directors/Heads of the IT Services department participated in the focus group discussion. Also interviewed is the Head of the BIS department. OU has three PCIaaS IT personnel responsible for managing the institution's PCIaaS environments, of which two of the IT personnel participated in the interviews.

Also interviewed are the institution's Director of Infrastructure and subject matter experts in two of the institution's departments/colleges, including the Web/Digital Officer, Said Business School/Bodleian Libraries Team Leader, Microsoft Access and Dynamics Team Central IT Services. The Central IT Services functions as the institution's central nervous system on inter-departmental/college IT-related matters. UCC has two PCIaaS IT personnel but collected data from one of them (the Senior Data Centre Engineer), while the other opted out of the interview.

This study also collected data from departmental IT personnel in the BIS department. In addition, the researcher also collected data from the Director of the IT Services department, the Platform Group Head, and the Enterprise Applications Group Head. Unfortunately, due to family and official commitments, some participants could not participate in this study, including the HOD of the Computing Department and the Director of the CC programmes in the Computing Department, CIT, and the Research Systems Manager INFANT, UCC. Table 3-8 highlights the characteristics and hours of participants' interviews.

Table 3-8: Characteristics and Hours of Case Study Participants Interview

S/No	Case	Job Title	Initials	Years of Experience		Department/College	Participant Code Name	Method	Interview Duration	Pages Transcription
				Professional	Job					
1	CIT	Head of Department	JM	18	3	IT Services	HOD ITS	Focus Group Discussion	02:37	58
2		Technical Officer (1)	AK	20	16	IT Services	Technical Officer 1			
3		Technical Officer (2)	EC	10	5	IT Services	Technical Officer 2			
4		Head of Department	CM	10	2	Accounting & Information Systems	HOD BIS	Interview	01:07	24
5	UCC	Senior Data centre Engineer	BC	20	1	IT Services (Platform Delivery)	SDE	Interview	01:00	22
6		Director of IT Services	GC	20	4	IT Services	DIR ITS	Interview	01:00	22
7		Head of Platform Group	BO	20	3	IT Services (Platform Delivery)	HPG ITS	Interview	01:13	28
8		Head of Enterprise Applications Group	JB	38	20	IT Services	HEAG ITS	Interview	01:05	23
9		System Administrator	PS	40	8	BIS	SABIS	Interview	01:09	25
10	OU	Web/Digital Officer	JP	18	4	Said Business School/ Bodleian Libraries	WDOSBS	Interview	01:07	24
11		Director of Infrastructure Services	MF	21	6	Cloud Services, IT Services	DIRIS	Interview	01:33	34
12		Technical Lead	AK	22	12	Cloud Services, IT Services	TLCS	Interview	01:45	39
13		Systems Administrator	ML	15	3	Cloud Services, IT Services	SACS	Interview	01:25	33
14		Team Leader	IH	20	5	Microsoft Access and Dynamics Team, Central IT Services	TLMADT	Interview	01:05	23
Total									**16:06**	**355**

The researcher digitally recorded the Focus group discussion, face-to-face interviews, telephone interviews and Skype video interviews. The researchers sort the advance consent of the participants that "*recording facilities will be employed during the group discussion and obtain each member's agreement to this procedure*" (Powell & Single, 1996, p. 502). The digital recordings were done "*as a means of providing a complete description of the interviewees' responses and comments*" (Darke et al., 1998, p. 283). As a result, the researcher was able to "*concentrate fully on asking questions and responding to the interviewees' answers*" (Meyer, 2001, p. 338) and "*maintain the level of accuracy and richness of data*" gathered (Meyer, 2001, p. 339). However, one participant in UCC (Senior Data centre Engineer) objected to the digital recording of his interview. However, the researcher took written notes of the interview, lasting about an hour for later analysis. The Senior Data centre Engineer also provided the researcher with written answers to the interview questions through email and details of his job description to complement the interview. The Technical Lead, Cloud Services in OU, also sent details of his job description to complement the interviews. The following section presents the data analysis method undertaken in this study.

3.6 Data Analysis

The researcher played a key role not only in transcribing the recordings verbatim but only "*in preparing, entering or importing, analysing, and interpreting text*" (McLellan et al., 2003). The focus group discussion, face-to-face interviews, and telephone interviews with 14 participants amounted to just over 16 hours of audio content. The researcher transcribed the digitally recorded focus group discussion, face-to-face interviews, and telephone interviews verbatim. The transcription was an arduous process, but it was worthwhile because it allowed for a thorough analysis of every interviewee's words. The transcribed face-to-face interviews and focus group discussion amounted to about 355 pages with a word count of 124,800. The follow-up interviews with the Technical Lead, Cloud Services in OU, using Skype video calls and chat, amounting to an additional 2.30 hours of data collection. The transcription of the Skype Chats and email responses from study participants amounted to several pages of qualitative data.

The researcher leveraged several data analysis techniques to analyse and interpret the research data (Hitt & Brynjolfsson, 1996; Levina & Ross, 2003; Apulu & Latham, 2011). The data collected were subjected to rigorous analysis and interpretation to make the information meaningful (Levina & Ross, 2003; Kaplan & Duchon, 1988; Asan, 2003). The approach incorporated both the qualitative data analysis technique and the frequency counting technique.

Content analysis assumes that (1) word frequency can be considered as an indicator of cognitive centrality (Duriau et al., 2007), and (2) groups of words reveal underlying themes that can be interpreted as reflecting the association between the underlying concepts (Duriau et al., 2007). Most qualitative data analysis techniques share some common characteristics, i.e., coding, categorisation, classification, summarisation, data reduction, concept-based, and identifying themes, patterns, and propositions (Kaplan & Duchon, 1988; Levina & Ross, 2003). Table 3-9 presents the characteristics of each of the data analysis techniques used in this study.

Table 3-9: Characteristics of Data Analysis Techniques

Data Analysis Techniques	Characteristics
Qualitative Data Analysis Techniques	
Content Analysis	➢ Text-based analysis ➢ Coding of data ➢ Categorisation of data ➢ Classification of data ➢ Summarisation of data ➢ Tabulation of data
Narrative Analysis	➢ Coding of data ➢ Categorisation of data ➢ Text-based analysis ➢ Uses narrative texts as data ➢ Interpretive approach ➢ Interested in context ➢ Based upon recurrent patterns, themes ➢ Analysis of events is linear, chronological, and thematic ➢ Organise the information emerging from the data alone storylines, events, actions, and places

The researcher used the codebook developed in this study in coding and analysing the interview data gathered from the study participants across the three case studies. This study used NVivo Qualitative Data Analysis (QDA) software. Figure 3-5 presents the sample of the coding using QDA software.

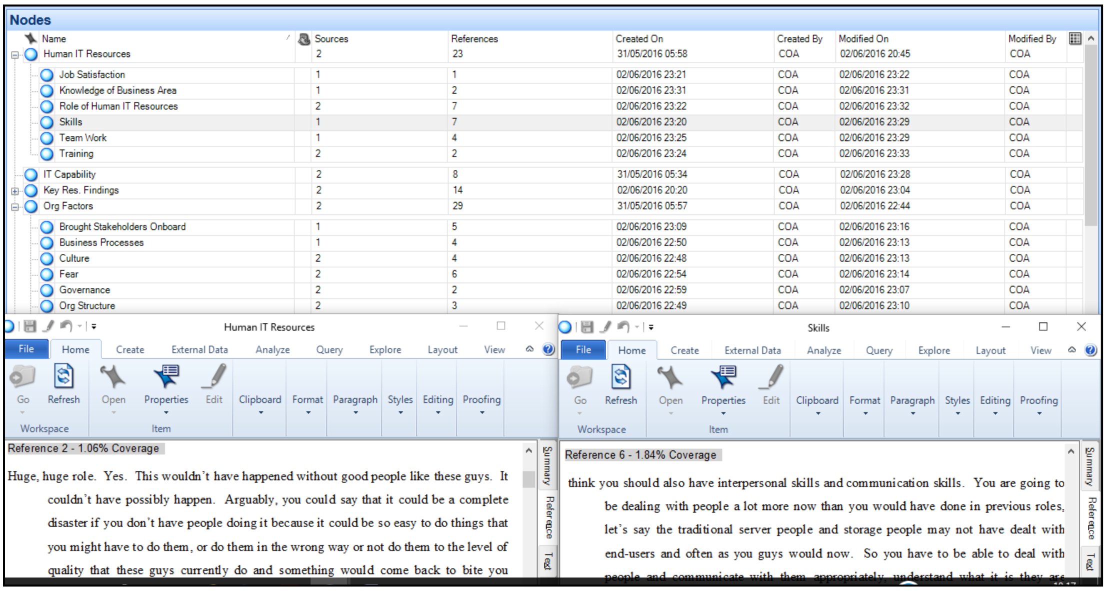


Figure 3-5: Sample of NVivo Software Interview Coding

This use of NVivo facilitates reducing the large amounts of data collected in this study into themes, data display and identifying patterns and relationships for ease of analysis. The study also made use of other data coding techniques, including the use of analytical memo. Analytical memo was a helpful technique in identifying and labelling new themes that were not in the theory-driven codes developed in this study.

After the first three interviews, the researcher analysed the data gathered to identify areas not adequately covered, and adequate measures were taken in a subsequent interview to add the missing information. The outcome of the analysis enabled the researcher to modify the interview method in subsequent interviews. After the transcription, follow-up interviews enabled the researcher to clarify some of the interviews' transcription issues. The researcher filtered the focus group and interviews data through the 35 theory-driven codes. Any segments of the data that fitted into theory-driven code were categorised into the corresponding PCIaaS performance measures and dimensions. Figure 3-6 presents an example of the data coding and categorisation undertaken in this study.

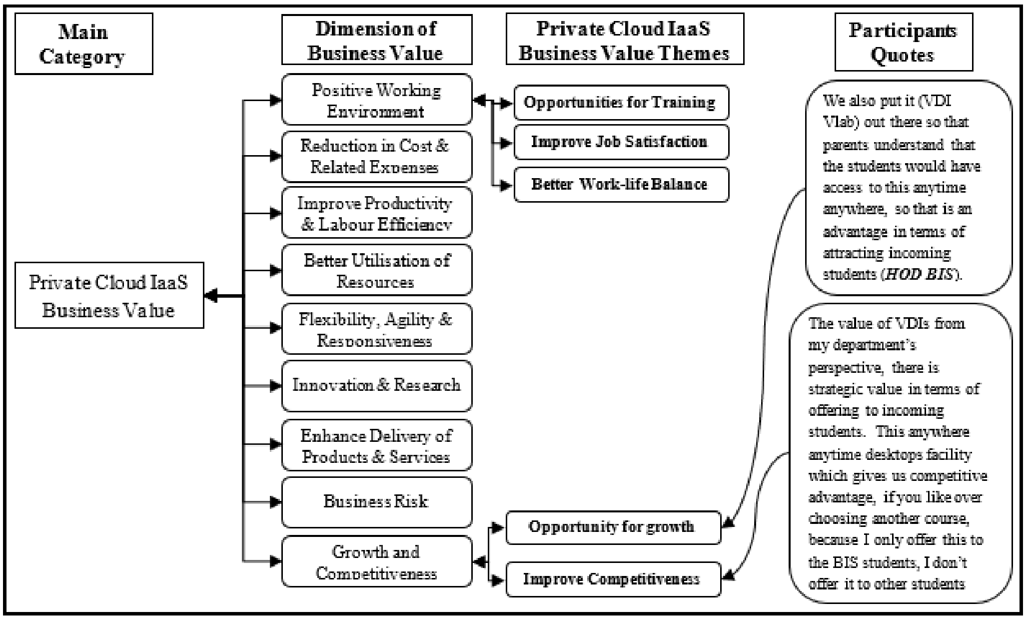
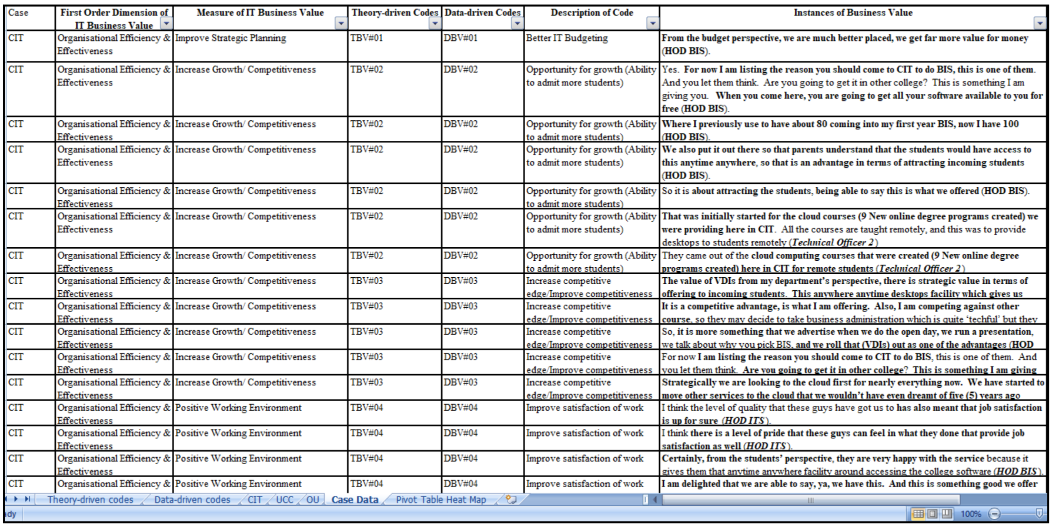


Figure 3-6: An Example of the Data Coding and Categorisation Process

The coding was exported into Microsoft Excel for data analysis purposes after completing coding using NVivo QDA software. Figure 3-7 presents a sample of the Microsoft Excel codebook.



Case	First Order Dimension of IT Business Value	Measure of IT Business Value	Theory-driven Codes	Data-driven Codes	Description of Code	Instances of Business Value
CIT	Organisational Efficiency & Effectiveness	Improve Strategic Planning	TBV#01	DBV#01	Better IT Budgeting	From the budget perspective, we are much better placed, we get far more value for money (HOD BIS).
CIT	Organisational Efficiency & Effectiveness	Increase Growth/ Competitiveness	TBV#02	DBV#02	Opportunity for growth (Ability to admit more students)	Yes. For now I am listing the reason you should come to CIT to do BIS, this is one of them. And you let them think. Are you going to get it in other college? This is something I am giving you. When you come here, you are going to get all your software available to you for free (HOD BIS).
CIT	Organisational Efficiency & Effectiveness	Increase Growth/ Competitiveness	TBV#02	DBV#02	Opportunity for growth (Ability to admit more students)	Where I previously use to have about 80 coming into my first year BIS, now I have 100 (HOD BIS).
CIT	Organisational Efficiency & Effectiveness	Increase Growth/ Competitiveness	TBV#02	DBV#02	Opportunity for growth (Ability to admit more students)	We also put it out there so that parents understand that the students would have access to this anytime anywhere, so that is an advantage in terms of attracting incoming students (HOD BIS).
CIT	Organisational Efficiency & Effectiveness	Increase Growth/ Competitiveness	TBV#02	DBV#02	Opportunity for growth (Ability to admit more students)	So it is about attracting the students, being able to say this is what we offered (HOD BIS).
CIT	Organisational Efficiency & Effectiveness	Increase Growth/ Competitiveness	TBV#02	DBV#02	Opportunity for growth (Ability to admit more students)	That was initially started for the cloud courses (9 New online degree programs created) we were providing here in CIT. All the courses are taught remotely, and this was to provide desktops to students remotely (*Technical Officer 2*)
CIT	Organisational Efficiency & Effectiveness	Increase Growth/ Competitiveness	TBV#02	DBV#02	Opportunity for growth (Ability to admit more students)	They came out of the cloud computing courses that were created (9 New online degree programs created) here in CIT for remote students (*Technical Officer 2*)
CIT	Organisational Efficiency & Effectiveness	Increase Growth/ Competitiveness	TBV#03	DBV#03	Increase competitive edge/Improve competitiveness	The value of VDIs from my department's perspective, there is strategic value in terms of offering to incoming students. This anywhere anytime desktops facility which gives us
CIT	Organisational Efficiency & Effectiveness	Increase Growth/ Competitiveness	TBV#03	DBV#03	Increase competitive edge/Improve competitiveness	It is a competitive advantage, is what I am offering. Also, I am competing against other course, so they may decide to take business administration which is quite 'techful' but they
CIT	Organisational Efficiency & Effectiveness	Increase Growth/ Competitiveness	TBV#03	DBV#03	Increase competitive edge/Improve competitiveness	So, it is more something that we advertise when we do the open day, we run a presentation, we talk about why you pick BIS, and we roll that (VDIs) out as one of the advantages (HOD
CIT	Organisational Efficiency & Effectiveness	Increase Growth/ Competitiveness	TBV#03	DBV#03	Increase competitive edge/Improve competitiveness	For now I am listing the reason you should come to CIT to do BIS, this is one of them. And you let them think. Are you going to get it in other college? This is something I am giving
CIT	Organisational Efficiency & Effectiveness	Increase Growth/ Competitiveness	TBV#03	DBV#03	Increase competitive edge/Improve competitiveness	Strategically we are looking to the cloud first for nearly everything now. We have started to move other services to the cloud that we wouldn't have even dreamt of five (5) years ago
CIT	Organisational Efficiency & Effectiveness	Positive Working Environment	TBV#04	DBV#04	Improve satisfaction of work	I think the level of quality that these guys have got us to has also meant that job satisfaction is up for sure (*HOD ITS*).
CIT	Organisational Efficiency & Effectiveness	Positive Working Environment	TBV#04	DBV#04	Improve satisfaction of work	I think there is a level of pride that these guys can feel in what they done that provide job satisfaction as well (*HOD ITS*).
CIT	Organisational Efficiency & Effectiveness	Positive Working Environment	TBV#04	DBV#04	Improve satisfaction of work	Certainly, from the students' perspective, they are very happy with the service because it gives them that anytime anywhere facility around accessing the college software (*HOD BIS*).
CIT	Organisational Efficiency & Effectiveness	Positive Working Environment	TBV#04	DBV#04	Improve satisfaction of work	I am delighted that we are able to say, ya, we have this. And this is something good we offer

Figure 3-7: Sample of the Microsoft Excel Codebook

Due to the large number of PCIaaS performance measures in this study, a rating classification metric was developed and leveraged to gauge the analysis of the occurrences of supporting quotes based on their frequency value.

3.6.1 Classification and Categorisation Metrics

This study leveraged the rating classification metric in grouping the 39 PCIaaS performance measures, comprising of the 35 performance measures from literature and four that emerged from the data into three broad categories based on the supporting quotes' frequency: (1) highly supported, (2) less supported, and (3) not supported. The research made use of a heatmap to highlight the three different categories. Figure 3-8 presents the rating classification metrics for the PCIaaS performance measures and the colour code for each category.

Rating Metric

Highly Supported	Less Supported	Not Supported
=> Median => Mean	=< Median – >0 =< Mean – >0	0

Figure 3-8: PCIaaS Performance Measures Rating Classification Metrics

The PCIaaS performance measures with occurrences of quotes above the median/mean value (=>median/mean) were grouped in the high support category. The PCIaaS performance measures equal or smaller than the median/mean value but greater than zero (=<median/mean–>0) were grouped in the less supported category, while the PCIaaS performance measures with no occurrences of supporting quote were grouped in the not supported category. This study found that the median value was more representative than the mean value. Hence, the decision of the researcher in applying the median value in categorising the PCIaaS performance measures.

Furthermore, the dimensions of PCIaaS business value consist of two groups: most dominant and most relevant. The most dominant group is based on the frequency value of all nine dimensions, while the most relevant is the mean value for each dimension. Three categories of PCIaaS business value dimensions emerged across the most dominant and most important groups based on their ranking: highly significant (First to the third position), moderately significant (fourth to the sixth position), and less significant (seventh to the ninth position). The researcher assigned colours to each of the categories. Figure 3-9 presents the rating classification metrics for the PCIaaS business value dimensions and the colour code for each category.

Rating Metric

Highly Significant	Moderately Significant	Less Significant
First to Third Position	Fourth to Sixth Position	Seventh to Nineth Position

Figure 3-9: PCIaaS Business Value Dimensions Classification Metrics

The classification and categorisation metric provided a more in-depth view and analysis in identifying the most important PCIaaS performance measures and PCIaaS business value dimension in this study.

Furthermore, having identified the activities performed by the PCIaaS IT personnel and the organisational factors that impacted the performance impact of PCIaaS, this study adopts a multivariate approach to determine the organisational capabilities development visible across the three cases. The researcher arranged the attributes and characteristics of the two organisational resources into three categories: (1) research and innovation capabilities, (2) market sensing capabilities, and (3) integration capabilities. The following subsection presents the discussion of within-case and cross-case analysis.

3.6.2 Within-Case Analysis

The researcher conducted a within-case analysis of the empirical findings of each of the three case studies. The "*Within-case analysis typically involves detailed case study write-ups for each site. These write-ups are often simply pure descriptions, but they are central to the generation of insight*" (Eisenhardt, 1989, p. 540). The within-case analysis helped the researcher cope with the vast volume of data gathered in this research study (Eisenhardt, 1989). The within-case analysis also enabled the researcher "*to become intimately familiar with each case as a standalone entity*" (Eisenhardt, 1989, p. 540). As Eisenhardt (1989, p. 540) advised, "*the process allows the unique patterns of each case to emerge before investigators push to generalise patterns across cases*" (Eisenhardt, 1989). Thus, the within-case analysis gives the researcher "*a rich familiarity with each case which, in turn, accelerates cross-case comparison*" (Eisenhardt, 1989, p. 540). The within-case analysis enabled the researcher to identify the dynamics in the contribution of organisational factors to the performance impact of PCIaaS. For example, the role of governance and decision-making structure with respect to PCIaaS was very different in each case, i.e., centralised (CIT and UCC) versus federated (OU).

3.6.3 Cross-Case Analysis

The cross-case analysis enabled the researcher "*to go beyond initial impressions, especially through the use of structured and diverse lenses on the data*" (Eisenhardt, 1989, p. 541). The researcher conducted the cross-case analysis to "*capture the novel* *findings which may exist in the data*" (Eisenhardt, 1989, p. 541) and to improve the accuracy and reliability of the study (Eisenhardt, 1989). The researcher conducted a cross-case analysis to identify and compare similarities, differences, themes, and lessons learnt for specific interview questions across the three case studies.

The cross-case analysis also helps the researcher elucidate the individual case studies' strengths and uniqueness for specific interview questions across the three case studies. For example, any gaps identified in answering a particular question, the researcher conducted additional interviews or sent emails for follow-up questions to study participants to elicit more information. The cross-case analysis also helps the researcher search for patterns, compare and understand the similarities and dissimilarities between and across the three case studies (Eisenhardt, 1989). As a result, it enabled the researcher to look at the data in many divergent ways (Eisenhardt, 1989).

The researcher made use of the three strategies for conducting a cross-case analysis as suggested by Eisenhardt (1989): (1) select dimensions and then look for within-group similarities coupled with intergroup differences, (2) select pairs of cases and then list the similarities and differences between each pair, and (3) divide the data-by-data source. The second strategy enabled the researcher "*to look for the subtle similarities and differences between cases*" (Eisenhardt, 1989, p. 540). The second strategy also helped break simplistic frames, leading to a more sophisticated understanding and the emergence of new categories and concepts that the researcher did not anticipate. The third strategy involved the researcher looking at the different data sources, while the third strategy enabled the researcher to "*exploits the unique insights possible from different types of data collection*" (p. 541). For example, the researcher gathered more information from study participants that agreed to digital recording than from the study participant that objected. However, the researcher used follow-up emails questions and obtained the participant's job description to fill the gaps in the interview. In addition, the cross-case analysis enabled the researcher to understand that business vision and objectives are central to exploiting the potential of PCIaaS in improving operational effectiveness and strategic positioning and the role of multiple resources such as PCIaaS IT personnel, educational technology champions, IT leadership, and stakeholders in formulating business vision and objectives for PCIaaS.

3.7 Research Validity and Reliability

The researcher employed four techniques to establish the validity and reliability of this research study, as presented in Table 3-10.

Table 3-10: Research Validity and Reliability Techniques Employed

Validity and Reliability Criteria	Techniques Employed	The Phase of Research in which Tactic Employed
Construct validity	- Developed a theoretically grounded conceptual research model based on extensive literature review on RBV of ITBV - Developed PCIaaS Organisational Performance Impact Evaluation Instrument based on extensive literature review - Leveraged multiple sources of evidence (focus group discussion, interviews, and documentation) - Triangulation of several data sources - Establish a chain of evidence using rigorous coding	Literature Review, Data Collection/ Data analysis
Internal validity	- Rigorous coding techniques - Employed Within-case Analysis - Employed Cross-case Analysis	Data Analysis
External validity	- The use of three case studies in two countries allows for generalisation - Sampling adequacy, appropriate sample of participants with the best knowledge of the research topic	Research Design
Reliability	- Developed Case Study Research Protocol to ensure replicability or repeatability - Developed Data Collection Protocol to ensure replicability or repeatability	Research Design/Data Collection

Source: Adapted: Yin (2009)

The researcher employs five techniques in ensuring construct validity, three techniques for internal validity, and two techniques each in ensuring external validity and the reliability of the study. In ensuring construct validity, the researcher relied on multiple sources of evidence to corroborate evidence and facts and to ensure that the findings are convincing and accurate (Yin, 2009), triangulation of the different sources of evidence to corroborate fact and finding (Rowley, 2002; Yin, 2009). The researcher went through rigour in developing the codebook used in this study for evaluating the performance impact of PCIaaS by triangulating two models or frameworks for construct development (Cronk & Fitzgerald, 2002; DeCuir-Gunby et al., 2011).

3.8 Chapter Summary

This study's exploratory case study design incorporates multiple qualitative data gathering methods to provide an in-depth insight into the performance impact of PCIaaS. The researcher identified several gaps in the literature on ITBV, CC, and RBV theory. The researcher clearly and intelligently formulated the research objectives from the identified gaps, and four research questions developed and proposed to fill the identified gaps. This study conducted a review of extant literature in RBV theory and adopted the indirect model of RBV as a framework for its conceptual research model, consisting of three main variables: organisational resources, capabilities, and performance. This study adopts a codebook approach to guide the coding and analysis of the interview data collected on the performance impact of PCIaaS (DeCuir-Gunby, 2011). The researcher developed the codebook from literature in developing the PCIaaS organisational performance impact evaluation instrument. In addition, grounded in the extant literature across multiple domains (RBV, ITBV, CC), the researcher operationalised each variable. As a result, a conceptual research model for investigating the organisational performance impact of PCIaaS and the resources and capabilities involved was developed and proposed as the theoretical lens of this study.

In addition, this study adopted multiple-case studies to overcome a single case study's generalisability limitation (Eisenhardt & Graebner, 2007) involving some of the most prominent and most renowned tertiary educational institutions in the UK and Ireland using a pre-determined selection criterion. The primary sources of qualitative data gathering are documentation, focus group discussion, and interviews. In addition, data were also gathers using electronic mediums such as telephone, Skype, and emails. The data gathering methods enabled the researcher to gain insights into the organisational performance impact of PCIaaS and the resources and capabilities involved. The data collected were transcribed, and within-case and cross-case analyses conducted. As a result, this study identified the pathways from organisational resources to capabilities and performance. In addition, this study makes several contributions to literature and practice. The within-case analysis and findings are discussed in Chapters four, five and six, while Chapter seven presents the cross-cases analysis. The next chapter presents the within-case analysis and findings of CIT, Cork.

Chapter Four – Cork Institute of Technology

4.0 Introduction

This chapter presents the within-case analysis and findings of the organisational performance impact of private cloud IaaS (PCIaaS) in CIT. The institution was founded in 1973 but formerly known as the Regional Technical College (RTC) and renamed CIT in 1997. The institution is one of the most prominent Institutes of Technology in Ireland. It comprises the main campus and three external campuses, situated in different locations in the County and City of Cork. The main campus is in Bishopstown in Cork City, while the three external campuses are in various locations around the City and County of Cork. CIT Crawford College of Art and Design is at Sharman Crawford Street in Cork City, the CIT Cork School of Music is in Union Quay in Cork City, and the National Maritime College of Ireland is in Ringaskiddy, Co. Cork. The main campus of CIT has two faculties (Engineering and Science, and Business and Humanities). CIT has about 15,000 students, comprising on-premise and online students and approximately 1,425 staff members, including about 824 academic staff.

The institution offers degree, certificate and professional programmes in Art and Design, Business, Engineering, Humanities, Music, Maritime Studies, and Science and IT. And it is one of the few Institutes of Technology in Ireland delegated with authority to award PhDs in collaboration with other institutions of higher learning around the world. The institution is also extensively involved in research and innovation; its research centres include the Rubicon Business Incubation Centre, the Genesis Enterprise Support Programme, the NIMBUS Research Centre, and the CIT Extended Campus. The NIMBUS Centre is a dedicated research centre located on the main campus; it houses about 80 researchers. NIMBUS Research Centre aims to showcase its research potential and demonstrate its ability to translate innovative research into economic benefit. The institution earned the prestigious *Sunday Times* Institute of Technology of the Year Award in 2007 and 2010.

The institution's private cloud IaaS (PCIaaS) environments, according to Technical Officer (2), *"are predominantly VMware"* consisting of "*three on-premise"* environments, (1) Production, (2) View, and (3) VCloud. Figure 4-1 presents the profile of CIT PCIaaS environments showing the institution's cloud technologies, the services provided, and the primary users of the services.

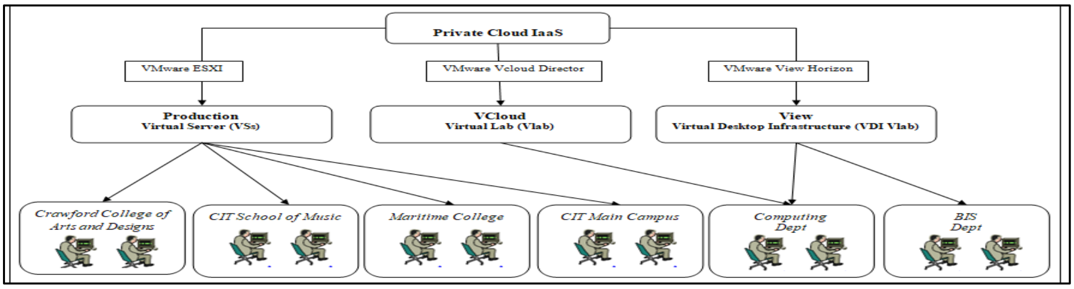


Figure 4-1: Profile of CIT PCIaaS Environments

Figure 4-1 highlights the institution's three PCIaaS environments and their users. The Production environment is the institution's first PCIaaS environment. According to Technical Officer (1), who happens to be the longest-serving PCIaaS IT personnel amongst the focus group interview participants, "*we have cloud infrastructure for our Production environment for 8 to 9 years now*". The environment runs on VMware ESXI and used for provisioning 300 virtual servers (vServers) to members of the institution across the main campus in Bishopstown, Cork City and three external campuses, Crawford College of Arts and Design, Cork School of Music, and the Maritime College. The institution uses the vServers for AD servers, DHCP servers, and WDS servers. Unlike the institution's first PCIaaS environment, its second and third PCIaaS environments are used for teaching and learning in academic departments including, Computing or Computer Science, BIS, Maths, and Multimedia.

The institution's second PCIaaS environment is the View environment, which runs on VMware View Horizon. VMware Horizon is a desktop virtualisation host platform that provides end-users on-demand access to vDesktops, applications, and online services. According to Technical Officer (1), the institution's View environment "*hosts about 500 desktops and is used by about 1000 students*", is accessible to students internally on the CIT campus and remotely anytime anywhere. CIT started using the environment to provision virtual computer laboratories (vDesktop lab) in 2011. The environment was developed and used for provisioning vDesktop labs to students of the Computing or Computer Science department but extended to other departments such as the BIS, Maths and Multimedia departments.

The institution's third PCIaaS environment, referred to as VMware vCloud Director, runs on VMware vCloud Director and is used solely by the Computing or Computer Science department students. The environment hosts more than 30 virtual infrastructure laboratories (vCloud labs) to teach students large IT infrastructure. Like the vDesktop lab, the vCloud lab is accessible to students internally on the CIT campus and remotely anytime, anywhere. The following section presents the analysis and discussion of the organisational performance impact of PCIaaS in CIT.

4.1 CIT: RQ1 – Analysis and Findings of Organisational Performance

This section presents the analysis and findings of the organisational performance impact of PCIaaS in CIT. The study investigated and analysed the organisational performance impact of PCIaaS using the evaluation instrument (Table 2-14), consisting of 35 PCIaaS performance measures across nine dimensions of business value and two organisational performance categories. As a result, this study identified additional two PCIaaS performance measures in the data collected, including (1) attracting potential students/reputational image and (2) business process efficiency. In addition, the analysis of the organisational performance impact of PCIaaS mirrored the three core components of the evaluation instrument: PCIaaS performance measures, PCIaaS business value dimensions, and organisational performance categories.

Firstly, Section 4.1.1 compared the frequency of the PCIaaS performance measures identified in CIT using the PCIaaS performance measures classification and categorisation metrics previously discussed in Section 3.6.1.1. Secondly, Section 4.1.2 compared are the frequency and mean value of the PCIaaS business value dimensions identified in CIT using the PCIaaS business value dimensions classification and categorisation metrics discussed in Section 3.6.1.1. Finally, Section 4.1.3 compared the frequency value of the PCIaaS organisational performance categories.

4.1.1 Analysis of PCIaaS Performance Measures

Table 4-1 presents the analysis of PCIaaS organisational performance impact across 39 PCIaaS performance measures in CIT, showing their frequency distribution and categories.

Table 4-1: CIT – Analysis of PCIaaS Performance Measures

Rank	PCIaaS Performance Measures	Freq	Percent	Category
1	High availability and reliability^	10	6.71	H
2	Improve satisfaction of work^	9	6.04	H
3	Create training and development opportunities^	8	5.37	H
4	Reduce the amount of space^	8	5.37	H
5	Rapid responsiveness to business needs^	7	4.70	H
6	Improve/enhance user experience^	6	4.03	H
7	Development of new classes of products, apps & services^	6	4.03	H
8	Cost-effective and affordable enterprise-class IT services^	6	4.03	H
9	Centralisation and consolidation^	5	3.36	H
10	Efficient and better utilisation of IT resources^	5	3.36	H
11	Research repository and collaboration^	5	3.36	H
12	Better business continuity and disaster recovery^	5	3.36	H
13	Increase/improve competitiveness^	5	3.36	H
14	Rapid turnaround time for new products development^	5	3.36	H
15	Provides opportunities for flexibility and autonomy^	5	3.36	H
16	Ease and simplicity of IT management^	5	3.36	H
17	Better and higher quality of services^	5	3.36	H
18	Lower IT staff costs	4	2.68	H
19	Improved infrastructure/data security	4	2.68	H
20	Create opportunity for potential growth	4	2.68	H
21	IT staff efficiency	4	2.68	H
22	Improve standard and modernity of IT infrastructure	4	2.68	H
23	Higher and better performance IT resources	3	2.01	L
24	Free up time to focus on core business	3	2.01	L
25	Attracting potential students/reputational image	3	2.01	L
26	Business process efficiency*	2	1.34	L
27	Allow employees to work remotely*	2	1.34	L
28	Improve productivity*	2	1.34	L
29	Lower/eliminate software costs*	2	1.34	L
30	Less worry/flexibility applying system-wide upgrades/update*	2	1.34	L
31	Greater resilience*	1	0.67	L
32	Accelerate/lower IT barriers to innovation*	1	0.67	L
33	Collective problem-solving*	1	0.67	L
34	Lower cost of failure*	1	0.67	L
35	Lower IT management/ maintenance expenses/costs*	1	0.67	L
36	Reduce costs of cooling and power – energy savings*	0	0.00	N
37	Go green/reduced carbon footprint*	0	0.00	N
38	Better work-life balance*	0	0.00	N
39	Eliminate bureaucratic bottlenecks*	0	0.00	N
	Grand Total	**149**	**100**	
	Mean	**3.82**	**2.56**	
	Median	**4.00**	**2.68**	
	Highly Supported Category (H)			**22**
	Less Supported Category (L)			**13**
	Not Supported Category (N)			**4**

Legend: ^ Top 10 PCIaaS Performance Measures, * Bottom 10 PCIaaS Performance Measures

Table 4-1 highlights the frequency distribution of the business value dimensions and PCIaaS performance measures in CIT and the corresponding categories of PCIaaS performance measures. The total frequency distribution is 149, while the mean and median are 3.85 (2.56%) and 4 (2.68%), respectively. The result shows that 35 of the PCIaaS performance measures were supported, including 22 in the highly supported category and 13 in the less supported category. The remaining four PCIaaS performance measures were in the not supported category. Also identified are the 17 PCIaaS performance measures in the top ten group and the 14 measures in the bottom ten group. The following section discusses the 22 PCIaaS performance measures in the highly supported category in hierarchical order, as the researcher deems them as the most important to the study participants in CIT.

4.1.1.1 High Availability and Reliability

PCIaaS has improved the institution's IT infrastructure availability and reliability previously housed in undedicated and unreliable server rooms. A sudden or unexpected crash of servers resulting in the loss of services can severely affect the institution's business operations. However, PCIaaS provides fault-tolerant, stable, and robust IT infrastructure, trusted and liked by the business users, which enabled the institution to provide high availability and reliability IT infrastructure to community members. Almost all the study participants in CIT attested to its high availability and reliability to its IT infrastructure and services. For example, the HOD IT Services noted, "*one of the big things in our original data centre was a slightly unreliable location and occasionally what people will experience is that the server would die and as the server dies, services die. One of the benefits of virtualisation, when we started putting in a second server in the SAN, was that, if the server dies, we failover to the other server*". The HOD BIS department also attested to the stability of the institution's IT Services when she noted, "*it is stable, it is stable (referring to* vDesktop *lab). If it were not stable, there would be queues on my door, given out. So occasionally I hear that there are some problems, but nothing major*". High availability and reliability emerged as the most dominant PCIaaS performance measures across the nine dimensions of business value.

4.1.1.2 Improve Satisfaction of Work

The skills, knowledge, and personal development achieved, coupled with the pride of delivering the institution's PCIaaS that is fit for purpose, was a significant source of workplace satisfaction to the institution's IT personnel. The perceived usefulness of PCIaaS in solving some of the institution's business problems invigorated and elated members of the institution. As the HOD stated, "*one of the things I definitely see with (the) cloud is that people are energised a lot more by it, people get excited very quickly, and they just think they want to be cloudified. And they think this is going to solve the problem*". Congruently, the provisioning and use of the vDesktop lab is also a great source of satisfaction to the students and top management, e.g., the BIS department. For example, the HOD of the BIS department noted, "*I am delighted that we are able to say, yes, we have this. And this is something good we offer our students*". It is worth noting that improved work satisfaction emerged as the second most dominant PCIaaS performance measure across the nine dimensions.

4.1.1.3 Created Training and Development Opportunities

PCIaaS created training and development opportunities for CIT employees. The beneficiaries of the training and development opportunities created by PCIaaS included the institution's PCIaaS IT personnel (two technical officers), departmental IT technicians, lecturers, and students. PCIaaS IT personnel completed additional education and training with VMware. The departmental IT technicians also got training on how to manage and support the institution's PCIaaS environments. Lecturers and students also got training on delivering and receiving lectures remotely in a virtualised environment. One key finding is that the training and development opportunities created by PCIaaS have helped enhance the competitiveness and employability of the institution's PCIaaS IT personnel in the labour market. The HOD, IT Services department, expressed this opinion when he noted, "*I think personal development is the human resources part of it. Related to that is that these guys are significantly more valuable commodities in the market now. The level of skills that they have, the level of experience and professionalism just means that there would be other companies looking at them*". It is worth noting that training and development opportunities created by PCIaaS emerged as the third most dominant PCIaaS performance measure.

4.1.1.4 Reduce the Amount of Space

CIT experienced restrictions in available space for physical computing laboratories due to its rapidly growing population. PCIaaS reduced the institution's sole dependency on physical computing laboratories, enabling it to better utilise its available space by reducing the number of physical computing laboratories and eliminate the restriction of available space for physical computer laboratories. As the

HOD of the BIS department noted, "*So, previously, we used to give the students access to rooms, so that they can work on group projects together, we do not have that facility to the same kind level anymore. So, the vDesktop allows them to work on the groups projects that have significant projects work they need access to the laboratory facilities for*". The provisioning and use of free anytime anywhere vDesktop lab to students enabled the institution to meet and satisfy students' computer laboratory needs and demands. Reducing the amount of space and equipment ranked third as the most dominant PCIaaS performance measure (see Table 4-1).

4.1.1.5 Rapid Responsiveness to Business Needs

With the increasing emphasis on new technology in education, PCIaaS enhanced CIT's ability to swiftly respond and meet the needs of members of the institution's community, particularly the technological needs of the institution's students. PCIaaS also provides on-demand and real-time access to IT resources, thereby eliminating the lengthy procurement cycle previously involved in purchasing IT resources. In addition, PCIaaS enabled the institution to rapidly and easily spin up new VMs based on needs and demands. Consequently, the institution can now respond rapidly in meeting business needs and requirements. For example, Technical Officer (2) noted, "*it also allows for fast provisioning within the Production environment for VMs and also in the VDI environment for desktops being available to students. You can provision them much quicker and get a vLab available at a much faster pace than we are meeting physical Lab*". In addition, rapid responsiveness to business needs emerged as the fifth most dominant PCIaaS performance measure in CIT.

4.1.1.6 Improve/Enhance User Experience

Improving student experience is a top strategic priority to the top management of CIT. In search of the interview data held with the HOD BIS departments, the phrase 'students experience' appeared seven times. The key objectives for providing students with anytime, anywhere vDesktop lab are to improve students' experience, transform teaching and learning, and support student success. The HOD BIS department expressed this opinion when she noted, "*We look after our students, and student experience is important to us, and we are conscious of cost for our students as well. So, BIS needs a lot of software, and we are going to give it to them. This (vDesktop) has definitely improved students' experience*".

4.1.1.7 Development of New Classes of Products, Applications and Services

PCIaaS enabled CIT to develop several new products, applications, and services for administrative purposes and educational purposes. The institution also took advantage of the high-performance supercomputers provisioned through PCIaaS to develop a BI platform. This opinion was expressed by Technical Officer (1) when he noted, "*Developing big is certainly one of the biggest things, and they would be able to like, I think BI and admin infrastructures are examples of systems that are six-plus servers in size. We would never have been able to do infrastructures on that ever in the past"*. The benefit of having a BI platform will enhance the institution's ability to provide better and accurate decision-making.

The most notable innovation in CIT was the institution ability to leverage PCIaaS to facilitate the creation and development of several uniquely new cloud-based education degree programmes in the Computing or Computer Science department. Some of these programmes were MSc Cloud Computing, MSc Software Architecture and Design, MSc Information Security, MSc in Information Design and Development and BSc (Hons) Cloud Computing. The institution also leveraged its PCIaaS vCloud and View environments to develop two vLabs environments (vCloud and vDesktop). For example, Technical Officer (2) noted, "*they (referring to vCloud and vDesktop Labs) came out of cloud computing courses (about nine new 100% online degree programmes were created) that were created here in CIT for remote students"*. The vCloud is a cloud technology generally used by public cloud providers in provisioning 'Cloud-as-a-Service' to the public.

However, vCloud is used in CIT to provide students of the computing department with virtualised laboratory infrastructure (vCloud lab) for teaching and experimenting with large IT infrastructure. Large IT infrastructure is akin to a small or medium-sized organisation's entire network, consisting of several servers, client PCs, networking devices, and all the required software. A single vDesktop lab is akin to a physical desktop computer. The Computing or Computer Science department's uniquely new cloud-based education degree programmes, including the vCloud and vDesktop Labs, are the most significant performance measures and perhaps the most critical performance impact of PCIaaS in CIT. The vDesktop lab, although initially meant for the computing department, was extended, and embedded into the program design of other technology-intensive programmes in other departments, to the BIS department, and later to other departments such as Maths and Multimedia.

The vDesktops lab enabled the institution to derive lots of performance impact across almost all dimensions of business value. These were: (1) increased the institution competitiveness and potential for growth, (2) eliminate/reduce software cost for students, (3) reduce the amount of space, (4) improve the satisfaction of work, and (5) improve the student experience, (6) rapid responsiveness in the provision of the computing laboratory for students, and (7) enhance practical and technical collaboration. Furthermore, the new cloud-based education degree programmes, including the vCloud and vDesktop Labs, advanced the institution's VLE, and more importantly, better prepared the institution to handle the paradigm shift toward remote working and teaching and learning caused by the Covid-19 pandemic.

4.1.1.8 Cost-Effective and Affordable Enterprise-class IT Services

Due to budget constraints, IT hardware's affordability was a significant problem for the institution before PCIaaS. Technical Officer (1) noted, "*quite a long time, we were at a point in our IT environment where we were not able to buy hardware*". PCIaaS offers CIT a more affordable way of purchasing hardware to modernise its ageing legacy IT infrastructure and more value for money. PCIaaS also provides a cost-effective and affordable way of delivering enterprise-class IT services for administrative and academic purposes.

PCIaaS also made the development of several new products and services economically possible, such as (1) the institution's BI platform, (1) vCloud lab, and (3) vDesktop Labs. The vCloud and vDesktop Labs are the institution's infrastructure laboratory and computing laboratory used in the Computer Science department and several other departments such as BIS, Maths, and Multimedia. The size of the institution's three PCIaaS environments consists of about 300 vServers, 30 vClouds, and 500 vDesktops. One vCloud lab represents a small or medium-sized company's entire IT infrastructure. Providing such a vast IT infrastructure for computing laboratory environments under the traditional IT environment would not be financially feasible. According to the Technical Officer (1), "*To do that in a traditional environment. There is no way you can install that per student for every student for a class of 30 students*". Congruently, the HOD IT Service expressed this opinion when he noted, "*we would* *not have been able to afford the number of services that we currently do if we were to buy physical infrastructure for everything. So, from the budget perspective, we are much better placed. We get far more value for money*".

4.1.1.9 Centralisation and Consolidation

PCIaaS facilitated the institution's entire IT infrastructure's centralisation in a central location, eliminating each faculty/department's need to invest in their individual IT infrastructure. Consequently, this has reduced the silos of IT infrastructure and systems and consolidated the institution's entire IT infrastructure in a well-secured central location. For example, the HOD IT Service noted, "*some of those peripheral services started to come back to the centre fairly quickly, and it actually got to the point where central IT is becoming much and much stronger because of the cloud*".

The consolidation and centralisation of the institution's IT infrastructure have changed the institution's structure and that of its IT departments. It has also reduced the need for more departmental IT staff and changed many IT personnel's roles. For example, the HOD of the IT Services department noted, "*It (PCIaaS) has changed our organisational structure as well. We need a lot more people in the centre now, and we do not need as many out in the faculties as a result now. We would always need people in the faculties. Of course, but the balance is shifting now to central IT. You know, it might have been more in the faculties, and less at the centre, and the cloud has flipped that, and it helped really for our organisational structure is changing as a result of this*".

4.1.1.10 Efficient and Better Utilisation of IT Resources

Before CIT adopted PCIaaS, the institution's IT hardware was underutilised. PCIaaS enables the institution to host multiple servers in a single ESX server, thereby allowing better hardware utilisation. Multiple participants expressed this opinion. For example, the HOD IT Services department noted, "*So, the old statistic of a server we were only using 6-10% of its capacity. We are now sweating the assets much better, so our value for money is much better now*". The opinion expressed here by the HOD of the IT Services department indicates that PCIaaS enabled the institution to utilise its hardware resources better than traditional IT.

4.1.1.11 Research Repository and Collaboration

The institution's vDesktop lab is a single or multi-user virtual laboratory environment that enables students to, individually or in group, perform practical experiments and collaborate in an online (virtual) environment in ways that were impossible before. For example, the HOD BIS department noted, "*it (vDesktop lab) allows them (students) to work on group projects in a way that would not otherwise be possible*", thereby providing students opportunities for flexibility and autonomy to learn at their own pace as previously discussed in Section 4.1.1.15. The HOD BIS department also noted, "*So, they (BIS students) are now getting the anytime anywhere option (vDesktop lab). So, they do their projects from home, and they can work on group projects together from their homes. Some of them live quite a distance. So that is what it gives them*".

4.1.1.12 Better Business Continuity and Disaster Recovery

PCIaaS has dramatically enhanced the institution's disaster recovery and business continuity. The potency of these capabilities was proven when there was an unexpected failure in the institution's primary data centre, an event that had the potential of halting the entire business operation of the institution. The institution would not have been able to avert such a potential catastrophe if not for its PCIaaS. The HOD IT Services expressed this opinion when he noted, "*There is also the instance of our data centre which had an issue with air-conditioning unexpectedly. And these guys would have had to move all of our systems and services out of that data centre into another data centre, and I mean that was relatively painful, of course, but if we had to do that in a physical environment, it would have been an absolute disaster. We would have had mayhem; it would have been impossible".* The HOD IT Services also noted that "*if we did not have a private cloud here for that, it would have been a total disaster for us".* The HOD IT Services went further to acknowledge the efforts of the PCIaaS IT personnel in the disaster recovery by noting that "*these guys did the job in a day, and everything was reasonably okay*".

4.1.1.13 Increase/Improve Competitiveness

Despite PCIaaS being a publicly available technology, CIT leveraged the technology in combination with other organisational resources and capabilities to develop unique new cloud-based teaching and learning encompassing several cloud-based degree programmes, including the vCloud and vDesktop Labs. The institution derived strategic value and competitive advantage from providing vDesktop lab to the institution's students, an offering simultaneously by other competitors. The HOD BIS department expressed this opinion when she noted, "*the value of VDIs from my department's perspective, there is strategic value in terms of offering to incoming students. The anywhere anytime desktops facility gives us a competitive advantage, if you like over choosing another course because I only offer this to the BIS students, I do not offer it to other students*". The HOD BIS department also noted, "*I believe it has given me a competitive advantage against other places*".

4.1.1.14 Rapid Turnaround Time for New Products Development

Design change at any stage of project implementation can have severe consequences on any project's deliverables, particularly the project budget and completion timeline. PCIaaS has reduced the turnaround time for project delivery by eliminating about 95% of several redundant stages, which has helped enhance faster delivery of projects and new product development. In addition, PCIaaS has also enhanced the ability to respond to and accommodate unexpected changes in business needs swiftly. For example, the HOD noted, "*the velocity, the amount of time you can turn something around, like a BI project, really quickly whereas before there is a procurement stage, there is a rack and stack stage, there is a configuration stage, and then there is a design and build, every project is now, in that section of what you guys would have had to go otherwise, I think we have knocked 95% of it because of cloud. So, it is transformative*".

4.1.1.15 Provide Opportunities for Flexibility and Autonomy

PCIaaS provides greater flexibility and autonomy to the institution's members, including the PCIaaS IT personnel, lecturers, and students. Lecturers and students alike now have the facility and flexibility to work from home, in ways hitherto impossible. The cloud-based educational degree programmes and the virtual computing and infrastructure laboratories (vCloud and vDesktop Labs) provide lecturers and students with the flexibility and facilities to work and learn from home or anywhere in the world. For example, the HOD BIS department noted, "*So, some of the lecturers are using it to help them work from home rather than working within the college. It gives them (lecturers) flexibility that is what it gives them around locations*". The HOD BIS department also noted, "*from the students' perspective, it gives them the flexibility; it allows them to work on group projects in a way that would not* *otherwise be possible*". Apart from the lecturers and students, PCIaaS also provides the BIS department with the flexibility of administering and allocating computer laboratories to students.

4.1.1.16 Ease and Simplicity of IT Management

PCIaaS provides IT personnel with the ease and simplicity of managing and administering the institution's entire IT infrastructure. PCIaaS enabled the institution's IT infrastructure to be managed, administered, and updated centrally from one console. The ease and simplicity of managing and administering the institution's IT infrastructure and systems offered by PCIaaS is a significant performance measure. For example, Technical Officer (1) noted, "*it is almost like once you get all these services up and running barring a bit of management of personally executed service, they pretty much run themselves. I think that is where the major advantage is because they do not need the care and attention of physical servers".*

4.1.1.17 Better and Higher Quality of Service

PCIaaS has a transformative effect on the delivery of IT Services in CIT. PCIaaS enables the institution to deliver better and higher quality and quantity of IT services trusted by users. For example, the HOD IT Services noted, "*the cloud is allowing us to provide better and more services*". The HOD also noted, "*these guys [the two technical officers] are delivering services at a level [meaning quality] and at a quantity that we could never have dreamt about before cloud came about, so it has a transformative effect on us (CIT) from that perspective*".

CIT comprises the main campus and three external campuses situated in different locations in the City and County of Cork. PCIaaS also enabled the institution to provide higher and better IT services to the three external campuses in previously impossible ways. As the HOD IT Services stated, "*We got three external campuses here in CIT. We got the Crawford College of Arts and Designs, School of Music, and the Maritime College. Each of these is part of CIT. One of the great things about virtualisation is that we can take a server, put virtualised software on it and put it down in the location. We can provide them with mini replication of our infrastructure here. Primarily, that makes it authenticate locally [......] So, a lot of services can then be given to the local campus, to the local college that they did not have to be reliant on their link up to CIT. So, making them more independen*t".

4.1.1.18 Lower IT Staff Costs

PCIaaS enabled the institution to save money on the number of IT personnel employed by enabling the institution to offer more services with fewer IT personnel. The institution has just two technical officers responsible for managing and supporting the institution's PCIaaS environments consisting of more than 30 vClouds, 500 vDesktops, and 300 vServers. Based on the estimated workforce suggested by the HOD of the IT Services department, the institution would have required between ten and 20 IT personnel to manage and support such an enormous size of IT infrastructure under the traditional IT environment. The HOD IT Services department also noted, "*two, just two of them (IT personnel). If we had to try and stand up all the services, these guys had stood up. It is hard to quantify. We would at least need ten of these guys. We might be somewhere between ten and 20, just for these"*. The reduction in IT staff cost also leads to improved product productivity (increased quantity of service) and PCIaaS IT personnel's labour productivity. Improve productivity emerged in the less supported category.

4.1.1.19 Improve Infrastructure and Data Security

Ghost IT practices were rampant in CIT before the adoption of PCIaaS. Technical Officer (1) expressed this opinion when he noted that "*people who are having servers, and in some cases, they had servers running what could even be considered desktop machines, not even servers. And these were under people's desktops*". PCIaaS enables the Central IT Services department to have complete responsibility, ownership, and greater control and management of its IT infrastructure, improving its IT infrastructure and data security. The HOD, IT Services department, expressed this opinion when he noted, "*A lot of IT was done as it is called nowadays 'ghost IT'. It was basically many people doing their own thing in their environment, and it (PCIaaS) was a way for us to take ownership back*".

4.1.1.20 Opportunity for Potential Growth

PCIaaS has also offered CIT opportunities for growth. For example, cloud-based teaching and learning are a transformational innovation and revolutionary change in the educational industry. According to the HOD Computing department, in a brief chat with the researcher, several students from different parts of the world have registered for the newly developed cloud-based educational degree programmes. He, however, hesitated to provide the researcher with the exact number of registered students. Cloud-based teaching and learning enable lecturers and students to teach and learn virtually irrespective of their geographical location (anywhere) and time (anytime). In addition, Section 4.1.1.4 revealed that vLabs reduced or eliminated the restriction of available space for physical computing and infrastructure laboratories for students. As a result, providing the institution with growth potential.

The institution's cloud-based teaching and learning have transformed the traditional way of teaching, including lectures and hands-on laboratories in courses in Computing or Computer Science and BIS departments. Instead of physical computer and infrastructure laboratories for practical, the institution now relies on vCloud and vDesktop Labs. Therefore, the institution is no longer restricted by physical space in students' admission, thus enhancing its revenue-generating ability and growth potential. The scalability and the on-demand expansion of the virtual computing and infrastructure laboratories have also given the institution the capacity to admit more students and opportunities for growth. For example, the HOD BIS department noted, "*VDI is allowing me to scale where I previously used to have about 80 coming into my first year BIS, now I have 100. So, I can get them in a lab environment because I do not need the labs to be free for group projects because the students can do their group project seating in the canteen with their own laptops"*.

4.1.1.21 IT Staff Efficiency

PCIaaS has significantly improved IT staff efficiency by eliminating redundant work processes. PCIaaS has reduced the massive amount of time and effort previously expanded in building servers and services. A new server can be built and easily configured in a matter of minutes compared to a couple of days in the institution's previous traditional IT environment. Congruently, PCIaaS IT personnel can now work on multiple services simultaneously in ways previously impossible. Technical Officer (1) expressed this opinion when he noted, "*I could do 6 or 7 services at the same time whereas previously, I could only do one or two just sitting there and waiting for whatever it is to happen to finish off and then hope that if something did go wrong, I would have to go back to scratch. At least in a virtual environment, if I had to go back to scratch, that is fine. It was only a couple of hours of waste. I have not wasted a couple of days*".

4.1.1.22 Improve Standard and Modernity of IT Infrastructure

As revealed in Section 4.1.1.8, before PCIaaS, the institution could not afford new IT hardware. This finding indicates that the institution's legacy IT infrastructure was outdated. However, PCIaaS enables the institution to improve the standard and modernity of its IT infrastructure and services to industry standards. An opinion expressed by Technical Officer (1) when he noted, "*It (PCIaaS) enabled us to keep up with the pace of the actual industry and even in some points exceed what the industry does is how our infrastructure is here*". Such improvement enabled the institution to leverage the potential of PCIaaS to shape and develop new ways of teaching and learning, e-collaborative practical learning, and research in ways hitherto impossible.

4.1.2 Analysis of PCIaaS Business Value Dimensions

Table 4-2 presents the analysis of PCIaaS organisational performance impact across nine PCIaaS business value dimensions, showing the most dominant and the most relevant dimensions of business value and their categories.

Table 4-2: CIT – Analysis of the Most Dominant and Relevant Dimensions

Dimension of Business Value	No of PCIaaS Performance Measures	Most Dominant		Most Relevant	
		Freq (%)	Rank	Mean (%)	Rank
Better Utilisation of Resources	3	18 (12.08%)	3	6.00 (4.03%)	1
Improvement in Flexibility, Agility and Responsiveness	3	17 (11.41%)	5	5.67 (3.80%)	2
Business Risks Reduction	5	22 (14.77%)	2	4.40 (2.95%)	3
Enhancement of Products and Services	3	12 (8.05%)	7	4.00 (2.68%)	4
Increase Competitiveness & Growth	3	12 (8.05%)	7	4.00 (2.68%)	4
Research, Development & Innovation	3	12 (8.05%)	7	4.00 (2.68%)	4
Positive Working Environment	7	24 (16.11%)	1	3.43 (2.30%)	7
Productivity Improvement and Labour Efficiency	6	18 (12.08%)	3	3.00 (2.01%)	8
Cost Reduction	6	14 (9.40%)	6	2.33 (1.57%)	9

Legend: 1st – 3rd: Highly Significant, 4th – 6th: Moderately Significant, 7th – 9th: Less Significant

Table 4-2 shows the ranking of the most dominant and the most relevant PCIaaS business value dimensions across three categories: highly significant, moderately significant, and less significant. Both categories show differences in the ranking of the business value dimensions. Four dimensions of business value decreased in their ranking while five dimensions increased in their ranking. The top six most dominant dimensions of business value were: (1) positive working environment, (2) reduction of business risks, (3) better use of resources, (4) productivity improvement and labour efficiency, (5) improvement in flexibility, agility, and responsiveness, and (6) cost reduction. Conversely, the top six most relevant dimensions of business value were: (1) better utilisation of resources, (2) improvement in flexibility, agility, and responsiveness, (3) business risks reduction, (4) improve competitiveness and growth, (5) enhancement of products and services, and (6) research, development, and innovation.

However, the dimensions of better utilisation of resources and business risk reduction emerged in the highly significant category in the most dominant and most relevant groups. The dimension of improvement in flexibility, agility, and responsiveness is almost as important as the top two PCIaaS business value dimensions, emerging in the moderately significant category in the most dominant group and the highly significant category in the most relevant group. In contrast, cost reduction is the least visible, emerging in the moderately significant category in the most dominant group and the less significant category in the most relevant group.

4.1.3 Analysis of PCIaaS Organisational Performance Categories

Table 4-3 presents the analysis of PCIaaS organisational performance impact across the two organisational performance categories, as shown in Appendix 19.

Table 4-3: CIT – PCIaaS Organisational Performance Categories

Organisational Performance Categories	Freq (%)
Operational Effectiveness	128 (85.91)
Strategic Positioning	21 (14.09)
Total	**149 (100%)**

Table 4-3 highlights the frequency value of the two PCIaaS organisational performance categories. Operational effectiveness emerged as the most dominant organisational performance impact of PCIaaS in CIT, accounting for about 128 (85.91%), while strategic positioning is less prevalent, accounting for only 21 (14.09%). Eight of the dimensions enhanced the institution's operational effectiveness, while two dimensions enhanced its strategic positioning. The dimension of research, development, and innovation contributed to operational effectiveness and strategic positioning while increase competitiveness and growth enhanced its strategic positioning.

4.1.4 Summary and Findings: Organisational Performance Impact of PCIaaS

Firstly, Table 4-1 presents the analysis of the PCIaaS performance measures in CIT, highlighting the three categories of PCIaaS performance measures: highly supported, less supported, and not supported. Also highlighted are the top and bottom ten groups of PCIaaS performance measures. The result shows that 22 PCIaaS performance measures were in the highly supported category. This study also shows that 17 PCIaaS performance measures emerged in the top ten PCIaaS performance measures, while 14 PCIaaS performance measures emerged in the bottom ten. This study also identified additional two PCIaaS performance measures in the data collected.

Secondly, Table 4-2 presents the analysis of the PCIaaS business value dimensions in CIT, outlining the most dominant and the most relevant dimensions of business value. Also highlighted were the three categories of PCIaaS business value dimensions: highly significant, moderately significant, and less significant. The analysis revealed that better utilisation of resources and business risk reduction emerged in the highly significant category in the most dominant and most relevant groups.

Finally, Table 4-3 presents the analysis of PCIaaS organisational performance categories. The result shows that the topology of operational effectiveness is the most dominant, while strategic positioning is less dominant. The following sections present the analysis of the two organisational resources involved in exploiting the potential of PCIaaS to improve performance commencing with the influence of organisational factors in CIT.

4.2 CIT: RQ2 – Analysis and Findings of Organisational Factors

This section presents the analysis of the organisational factors that influenced the realisation of the performance impact of PCIaaS in CIT. Table 4-4 presents the organisational factors identified in CIT across four dimensions.

Table 4-4: CIT – Categorisation and Frequency of Organisational Factors

Dimensions	Organisational Factors	Freq (%)
Organisational Strategy	Education and Training*	14 (31.11%)
	Business Vision and Objectives***	5 (11.11%)
	Educational Technology Champions	4 (8.89%)
	Marketing and Advertising	3 (6.67%)
	Appropriate Strategy & Policy Changes	2 (4.44%)
	Total	**28 (62.22%)**
Organisational Power & Politics	Stakeholder Support/Resistance**	8 (17.78%)
	Top Management Support and Commitment***	5 (11.11%)
	Total	**13 (28.89%)**
Organisational Culture	Institutional Culture and Environment	3 (6.67%)
	Total	**3 (6.67%)**
Organisational Structure	Governance and Decision Making^	1 (2.22%)
	Total	**1 (2.22%)**
Grand Total		**45 (100%)**

Legend: * Most Visible, ** Second Most Visible, *** Third Most Visible ^Least Visible

Table 4-4 presents the visible organisational factors that impacted the performance impact of PCIaaS in CIT. The dimension of organisational strategy has the highest number of organisational factors and supporting quotes, accounting for five factors and 28 (62.22%) of the supporting quotes. Organisational power and politics have the second highest number of organisational factors and supporting quotes, accounting for two organisational factors and 13 (28.89%) supporting quotes. In contrast, the organisational structure is the least visible, with only 1 (2.22%) supporting quotes. Finally, the dimension of organisational processes has no organisational factor.

Furthermore, education and training emerged as the most visible organisational factors, accounting for 14 (31.11%) supporting quotes. In contrast, governance and decision-making are the least visible organisational factors, with 1 (2.22%) supporting quotes. The second most visible organisational factors were stakeholder support and resistance, accounting for 8 (17.78%) of the supporting quotes. Business vision and objectives and top management support and commitment emerged as the third most visible organisational factors, each account for 5 (11.11%). Finally, the least visible organisational factor is governance and decision making, accounting for 1 (2.22%) of the supporting quotes. Table 4-5 highlights the influence of the nine organisational factors identified in CIT across the four dimensions, showing their impact on the institution's ability to exploit PCIaaS to improve its performance.

Table 4-5: CIT – Analysis of Organisational Factors Strengths and Weaknesses

Dimensions	Organisational Factors	Impact
Organisational Strategy	Education and Training	+
	Business Vision & Objectives	+
	Appropriate Strategy & Policies Changes	+
	Educational Technology Champions	+
	Marketing and Advertising	+
Organisational Power & Politics	Top Management and Commitment	+
	Stakeholder Support	+
Organisational Structure	Governance and Decision-Making	+
Organisational Culture	Institutional Culture and Environment	+

Legend: + Positive Impact, - Negative Impact, ± Varied Impact

According to the analysis, all nine organisational factors identified in CIT positively impacted its ability to exploit PCIaaS in improving its organisational performance. No empirical evidence suggests that any of the nine organisational factors hindered the success or the institution's ability to exploit PCIaaS to improve performance. The lack of inhibiting factors to the institution's ability to exploit PCIaaS indicates that all the organisational factors in CIT were strategically valuable to the institution. The following section presents the discussion of each of the organisational factors.

4.2.1 Education and Training

Education and training were vital in realising the optimal performance impact of PCIaaS in CIT and essential in overcoming some of its challenges in integrating PCIaaS into its operations and processes, including lack of awareness, knowledge gap, and fear of, and resistance to, change. First, key members of the institution, including the top management, were unaware of the potential of PCIaaS for cloud-based teaching and learning. The institution's educational technology champions educated key members of the institution, which was vital in gaining their support and trust. For example, Technical Officer (1) noted, "*those people* (educational technology champions) *pushed the technology before in some cases top management were willing to embrace it. But once they have pushed it forward and shown how good it was, they showed it to other people, well that is good, I can trust that now*".

Second, the institution's existing IT personnel lack the cloud computing-related skills/knowledge to fit into PCIaaS IT personnel's role and to manage, maintain and support the institution's PCIaaS environments, (1) Production, (2) vCloud, and (3) View. Consequently, two existing IT personnel completed additional education and training courses with VMware to acquire the cloud vendor's specific cloud computing-related technical skills/knowledge needed for all three environments. For example, Technical Officer (2) noted that "*certainly, training in the chosen infrastructure you use, so we are predominantly VMware. [Technical Officer (1)] and I have had training in the View environment; we got training in the vCloud Director. We had training recently, all provided by VMware".* The importance of cloud vendor's specific training was further reinforced by the Technical Officer (2) when he noted, "*definitely, the vendor that you use to provide the cloud environment would definitely recommend that the technicians would have specific vendor training for the environment that they have chosen*". Similarly, Technical Officer (1) noted that "*I did get training before we rolled out virtualisation"* and *"I got training directly with VMware on the product, and it showed the benefits of it*".

Third, the departmental IT technicians lack the skills/knowledge to support the PCIaaS service in the academic departments, thereby impacting the lecturers' ability to use the new virtual environment for teaching and learning. Again, the education and training provided to the departmental IT technician equipped them with the skills/knowledge to support PCIaaS services in their respective departments, thereby eliminating fear, building trust, enhancing usability, and alleviating resistance to change. For example, the HOD of the IT Services department noted, "*At the very beginning, some of the lecturers were a little bit resistant to bringing it into the normal day to day teaching simply because one of the people that were looking after it did not know very much about it themselves, neither did the lecturers that teach on it. So, there was a gap of, as you said, knowledge*".

Fourth, using the new virtual environment for teaching and learning was intimidating for many lecturers who preferred to use the traditional teaching and learning methods. As a result, some were resistant to change. However, the training provided to these lecturers using the new virtual environment for teaching and learning helped overcome resistance to change. The HOD of the IT Services department expressed an opinion when he noted, *"the only area where we have seen a small bit of resistance is educating staff on how to use a slightly newer environment with a different way of teaching. So, they are used to going to a lecture theatre with a laptop when we went to the cloud. They are now using remote services tools to present things out to students who are suiting at home and who are just logging onto their pcs and see the* *presentation come up in the software that has been used. And it is the training and teaching aspect of that. Some people take to it very easily and understand it, while others find it harder to understand and go with it and prefer the conventional way of doing things. That is just a matter of training and less resistance".*

The HOD, IT Services department further reiterated the importance of education and training in mitigating resistance and improvement in their daily work when he noted that "*what we found here is that when somebody throws something they have never used before, they are all crossed that they are going to be resistant to it. (This is because) they have not been given proper instructions on how to use it. We found here that once people get instructions on how to use things, they all let go, that is great as long as I cannot see any difference to my work*". The HOD of the IT Services department further added that, "*resistance has lessened, the more people are made familiar with technologies ahead of having the teaching".*

Fifth, education and training was also a key factor in the success of change management. The training provided to departmental IT technicians, lecture, and students enhanced the smooth transition from traditional learning and teaching to a more modern way of learning and teaching in the cloud. In addition, managing the people's side of change is vital to the success of any technological change. Therefore, the education and training provided by the institution's PCIaaS IT personnel were also critical to the success of the institution's change management or technological change.

The education and training provided by the PCIaaS IT personnel as part of the change management process helped ensure the successful extension of vDesktop to other departments. For example, the HOD of the BIS department noted, "*I think that* (referring to the training provided to students and lecturers of BIS department) *was important for them* (referring to the PCIaaS IT personnel) *to do. Honestly, I was very keen at the time, I do not think I was in this role, but I was keen at the time that we would not just get the technology right, that the people in the change management side of it would be looked at as well. So, the lecturers also attended that* (training session)*".*

Finally, the institution's PCIaaS IT personnel's training and briefing sessions to the lecturers and students were vital to integrating the vDesktops lab into academic departments' programme design. The HOD of the BIS department added by stressing the importance of the training provided by the PCIaaS IT personnel to the lecturers of the BIS department when she noted "*the lecturers also attended that, so now when lecturers are dealing with students, they are able to say to them, you know you can do that project, but you can do it from home, or you can do whatever, and they are able to advise them on how to do it and the applied element to it as well. So, they gave the instructions now. I do not think we need to do it anymore. We do it for first years, and then it is done*". The above opinions highlight the importance of training as part of the change management process in mitigating against resistance and enhancing system usability.

4.2.2 Business Vision and Objectives

Business vision and objectives are essential in the realisation of the optimal performance impact of PCIaaS in CIT. Some of the institution's vision and objectives for PCIaaS identified in this study include: (1) better utilisation of IT hardware; (2) affordability of IT hardware; (3) business risks reduction; (4) speed of provisioning; (5) availability and reliability, and (6) development of cloud-based teaching and learning. For example, Technical Officer (1) noted that "*for quite a long time, we were at a point in our IT environment where we were not able to buy hardware. We had hardware that was useful but underutilised*". Apart from the vision of leveraging the potential of PCIaaS to solve internal business challenges, the institution has a strategic vision to leverage PCIaaS to sense, seize, and pursue new and emerging opportunities and transform the traditional way of teaching and learning. This opinion was expressed by Technical Officer (1) when he noted, *"…again the cloud course. You know a couple of people thought can we do a cloud course. Can we teach people this is learning? Can we teach people in the cloud? Can we teach people the cloud"?* Cloud-based teaching and learning are a new way of teaching and learning, and new and emerging business opportunities yet to be exploited by several tertiary educational institutions.

4.2.3 Appropriate Strategy and Policy Changes

The institution's ability to realise the performance impact of PCIaaS depends on the formulation of appropriate policy changes that will help integrate PCIaaS into the fibre of the institution's business operations and maximise ITBV. Some strategy and policy changes already identified in CIT were the (1) cloud-first policy and (2) cloud migration policy. For example, the HOD IT Services department noted that "*strategically we are looking to the cloud-first for nearly everything now. We have* *started to move other services to the cloud that we would not have even dreamt of five (5) years ago"*. The institution's cloud-first policy aimed to accelerate the migration of legacy systems and develop new systems for PCIaaS. Its cloud-first policy and cloud migration policy helped provide better and higher quality IT services to its members and adapt rapidly to the educational environment changes.

4.2.4 Top Management Support and Commitment

The institution's top management support and commitment to integrating PCIaaS into the institution's operations and processes were vital in realising the optimal performance impact of PCIaaS. They were receptive to new technology and innovation, showed a positive attitude to change, and commitment to driving and championing its change management process. For example, the HOD BIS department noted, "*I suppose there is something about an attitude to change, in terms of the change management coming from (top) management. That is one of them. I think the attributes of (top) management that are happy to take this on is something that is a change for them and a change for their students*".

Willingness to invest in students' experience was a top priority for the institution's top management. Due to its small size, its top management has a close relationship with its students and is willing to invest in new technology to enhance students' experience. The funding provided by the institution's top management was critical in extending the vDesktop lab, which was developed for and used in the computing department, and later in other departments. For example, the HOD BIS department noted, "*We look after our students, and student experience is important to us, and we are conscious of cost for our students as well. So, BIS needs a lot of software, and we are going to give it to them*". The HOD of the BIS department further stressed the importance of attached to the students' welfare and experience by the institution's top management when she noted, "*it is about a caring sense of the students' experience and how much we are willing to invest in the students' experience and give them a better experience. I think we are quite close to the students as an organisation because we are quite a small organisation, so maybe size is a factor here. And that makes us invest money to give that facility to the students*".

4.2.5 Stakeholder Support

Introducing change, innovation, and new technologies into everyday practice is challenging and problematic. Stakeholder support and trust are vital to the success of any change initiative. This study identifies three instances of '*lack or no resistance*' and five instances of '*trust*' in the focus group interview transcript held with the Director of IT Services and the two technical officers.

There was no resistance from the institution's students and departments integrating PCIaaS into teaching and learning. For example, Technical Officer (2) noted, "*I do not think there was any resistance from the students*". Technical Officer (2) also noted, "*I do not think we found any resistance with the departments*". However, the students were the main driver for integrating PCIaaS into teaching and learning. For example, the HOD IT Services noted, "*It is definitely a scenario where because students want it because the driving force is coming through the students, the department has to embrace it because they have seen the usefulness of it*".

4.2.6 Governance and Decision-Making

Strong governance and decision-making provided by the institution's central IT Steering committee played a significant role in the centralised provisioning of PCIaaS. According to the HOD IT Services department, "*Governance and decision-making have probably made it easier for this [cloud] to come in".* The HOD IT Services department added by stressing the critical importance of governance and decision making and the pivotal role played by the central IT steering committee when he noted that *"If every single department were allowed to do their own thing, then cloud would not have gained the traction in CIT that it has. So, if the department of computing wanted to do their own thing and the department of BIS wanted to do something else, from a governance perspective, they will not really be allowed to do that because we have a central IT Steering committee that represents the entire institute. So, the appropriate governance meant that the cloud could be as successful as it has been*".

4.2.7 Institutional Culture and Environment

The institution was willing to embrace innovation and new technology to drive organisational change. For example, Technical Officer (2) noted, "*I think the fact that it is an educational environment; we were always looking at new ways to deliver".* The institutional culture and environment was also receptive to testing and experimenting with new technologies and innovation. This opinion was also echoed by Technical Officer (2) when she noted, *"I think that was of great benefit to us as a whole that we can embrace new technology for test mode and try them*". Experimenting with new technologies facilitated innovations and were a recipe for sustainable organisational change and competitiveness.

The institution had a flexible culture that could change quickly. For example, according to the HOD IT Services, "*I think our culture has changed as a result of it (PCIaaS)"*. In addition, there was evidence of the institution's ability to embrace cultural change throughout the implementation, even if it was a forced change. As a result, the institution now has a high-quality work culture that has helped enhance the reliability and availability of its PCIaaS environments. According to the HOD IT Services: "*And culturally, that has brought a change about that was forced really on us in many ways, but I think there is far more appreciation for things like quality, for planning because I think these guys can see how wrong it could go because quite literally, we got tons and tons of services, but they are all converging into one place. So, there is a risk associated with that as well. And it just means that culturally you cannot afford to be of the highest quality*".

4.2.8 Educational Technology Champions

Educational technology champions played a significant role in crafting the institution's vision for PCIaaS, particularly in developing cloud-based teaching and learning. Interestingly, the strategic business vision was conceived at the departmental level by a visionary lecturer in a position of authority and influence. He called for the investigation of cloud-based teaching and learning and shared his vision with his peers. This opinion was expressed by Technical Officer (1) when he noted, "*forward-thinking people, people who are willing to embrace the new. I say (**redacted**) was one of them. When I started up here, when we started the cloud, he was one of those forward-thinking people. He was a lecturer in the department of computing, specifically in the role of Head of the School Academy, and because of that, he had a certain degree of influence with which he can leverage. And he thought it was a good idea to investigate this"*.

Interestingly, one of the institution's PCIaaS IT personnel was among the educational technology champions. Technical Officer (1) expressed this opinion when he noted, "*as himself and I were moved to central, we brought along what we had started. So, he was forward-thinking, let us have a look at this, let us see what this can do for our department, and it ended up becoming an IT thing*". This set of people then became the institution's educational technology champions. Leveraging their strategic and visionary leadership, academic influence, and power, they actively and vigorously promoted and sold their vision to other institution members. The educational technology champions were motivators, influencers, strong collaborators, relationship builders, knowledge sharers, and change agents. They were also instrumental in pushing their vision and in getting the buy-in of the institution's top management and other key stakeholders.

4.2.9 Marketing and Advertising

The strategic business vision for cloud-based teaching and learning led to the development of several new classes of cloud-based educational degree programmes, including the development of the institution's virtual infrastructure and computing laboratories (vCloud and vDesktop Labs). Cloud-based teaching and learning are probably the first in Cork City and County, the Munster region, and Ireland. To improve the institution's market positioning in attracting prospective students, the institution leveraged this unique positioning as a unique selling proposition to the market, advertising, brand, which differentiated the institution from other institutions. For example, the HOD BIS department noted, "*it is something (*vDesktop *lab) that we advertise when we do the open day, we run a presentation, we talk about why you pick BIS, and we roll that out as one of the advantages*".

As part of its marketing and advertising strategies, the institution used product innovation, cost leadership, and differentiation to convince prospective students and their parents of the benefits of sending their children to CIT. For example, the HOD of the BIS department noted, "*for now, I am listing the reason you should come to CIT to do BIS. This (vDesktop lab) is one of them. And you let them think. Are you going to get it in other colleges? This (vDesktop lab) is something I am giving you. When you come here, you are going to get all your software available to you for free*". The HOD of the BIS department also noted, "*We also put it (vDesktop lab) out there so that parents understand that the students would have access to this anytime anywhere*". The marketing and advertising strategies enabled the institution to attract more students, increase its ability to admit more students, and gave the institution a competitive advantage over other institutions.

4.2.10 Summary and Findings: Organisational Factors

In conclusion, this section relates to the influence of organisational factors in CIT. This study identified nine organisational factors across four of the five dimensions of organisational factors. The study also shows that education and training are the most visible organisational factors, while governance and decision-making are the least visible organisational factors. The study also shows that stakeholder support and resistance is the second most visible, while business vision and objectives and top management support and commitment are the third most visible organisational factors. The study also shows that organisational strategy is the most visible dimension of organisational factors, while organisational structure is the least visible dimension. Finally, the dimension of organisational processes has no organisational factor.

Furthermore, all nine organisational factors identified in CIT positively impacted its ability in exploiting PCIaaS. However, organisational strategy played the most enabling role, accounting for five of the nine organisational factors. This finding indicates that the institution has strategy-driven capabilities. Organisational power and politics played the second most enabling role, accounting for two of the organisational factors. This finding also indicates that power and politics are critical in exploiting PCIaaS to improve performance.

4.3 CIT: RQ3 – Analysis and Findings of PCIaaS IT Personnel

PCIaaS has broken down the silos within the IT department, which traditionally consists of different skills. For example, Technical Officer (2) noted, *"typically, IT groups are divided between three or four different people or different groups. With a cloud that is nearly merging together now. There is no distinct separation. The technicians need to know a little bit about everything"*. Similar opinion was also expressed by the HOD of the IT Services department when he noted, "*generally, you [IT personnel] have to be an all-rounder now*". The role of PCIaaS IT personnel compared to their previous role has significantly changed. As the Head of IT Services department stated, "*it (PCIaaS) changed a lot of roles within the IT department in particular*". PCIaaS IT personnel perform both technical and business management activities. Consequently, due to their increased public-facing role and involvement in socio-technical teamwork, they need business management skills/knowledge.

PCIaaS IT personnel in CIT played a significant role in the institution's ability to exploiting the potential of PCIaaS to improve performance. The Head of the IT Services department and the Head of the BIS department acknowledged that the institution's PCIaaS IT personnel's activities were crucial to exploiting PCIaaS for performance. For example, the Head of the IT Services department noted that PCIaaS IT personnel "*are the single most critical factor for cloud for us*". He further added that "*the largest part of the success that we derived from our PCIaaS to the people definitely*".

4.3.1 Profiles of Activities Performed by PCIaaS IT Personnel

This section presents the analysis and discussion of the activities performed by PCIaaS IT personnel in CIT through which they contributed to the performance impact of PCIaaS. Table 4-6 presents the profiles of activities of PCIaaS IT personnel in CIT.

Table 4-6: CIT – Profiles of Activities of PCIaaS IT Personnel

Categories	Profile of Activities	Frequency (%)
Operational Orientation	Architecture Builder*	16 (48.48%)
	Project Coordinator	3 (9.09%)
	System Provider**	10 (30.30%)
	Total	**29 (87.88%)**
Strategic Orientation	Partner^	2 (6.06%)
	Technological Leader^	2 (6.06%)
	Total	**4 (12.12%)**
Grand Total		**33 (100.00%)**

Legend: * Most Visible, ** Second Most Visible, ^Least Visible

Table 4-6 outlines the profiles of activities performed by PCIaaS IT personnel in CIT. It shows that the profile of architecture builder is the most dominant. Closing following is the profile of the system provider. The least profiles of activities performed are project coordinator, partner, and technological leader. The dominance of the profiles of architecture builder and system provider is not surprising. They are the daily activities performed by PCIaaS IT personnel, while the technological leader, partner, and project coordinator profiles are seldomly performed daily. Section 4.3.1.1 to Section 4.3.1.5 discusses each of the five profiles of activities.

4.3.1.1 Architecture Builder

The activities performed by PCIaaS IT personnel in CIT under the profile of architecture builder were: (1) building and managing the PCIaaS environment; (2) managing and planning systems development and implementation; (3) supporting hardware and software installation, configuration, and maintenance; (4) producing technical documentation, and (5) crisis management. They prided themselves on building and managing PCIaaS environments that were reliable and available, fit for purpose, and trusted by users. For example, Technical Officer (1) noted that

> "*Taking the time and effort to configure things right and do things properly and having pride in the work is what makes a really, really good cloud infrastructure. So, it is really important to get that. Otherwise, you have an average cloud infrastructure. And then people are going (to say), well, this is not any better than what we had before. That is why you have cases where people say it [cloud] got no value. It is how well you look after it*".

This opinion was also corroborated by the HOD IT Services when he noted that the PCIaaS IT personnel took "*pride in configuring, installing, managing, taking your time, and doing it really, really well. And I think that if you do not do that really well, you let the whole infrastructure fall down*". The ineffective and inefficient management of PCIaaS environments is a recipe for disaster, particularly the management of VMs. Virtualisation is the underlying technology in cloud computing and thus PCIaaS. If not effectively and efficiently managed can lead to VM-sprawl. VM-sprawl has considerable consequences on the PCIaaS environment's health. Section 4.3.2.1 (Technical Competencies) presents the importance of virtualisation skills in preventing VM-sprawl.

Both technical officers participated in the daunting task of producing system design and configuration documentation detailing how the institution's PCIaaS was built and configured. The HOD IT Services noted, "*We all got into a room for a week and sat down and worked through reconfiguring the storage, talking to the network, talking to the blade, talking to the operating systems, talking to the VM. We restructured that, and we …. came up with a set of naming conventions, procedures, and documentation. Everybody hates it, but it was a really important part of this".* The HOD IT Services further stressed the importance of systematic documentation of the institution's PCIaaS when he noted that they "*have every part of the cloud infrastructure well documented so that anyone who can pick up the document and know-how this environment is built, and how to build this particular part of it. Because a lot of what happens is that some parts you would only come back to once a year, and people's memory are short. So, when you have, it documented it helps*". Documenting and preserving how the institution's PCIaaS environments were built and configured contributes to existing literature and enhances organisational knowledge. Knowledge stored in people's memory can easily be forgotten, particularly over a long period. Such knowledge can even be lost permanently in the unfortunate event of an employee's death or departure from the institution.

The activities performed by the institution's PCIaaS IT personnel also included supporting hardware and software installation, configuration, and maintenance. For example, Technical Officer (1) noted that some of the activities he performs are to "*create, manage, and maintain CIT's Production VMware vSphere Environment and VMware Horizon View Environment, this involves creating VM's, upgrading vSphere, and managing backups of the environment. I also manage the storage system the virtual environment uses to store the VM's*". Keeping the hardware and software up to date is essential for the systems to run effectively and ensure the institution's PCIaaS environments' cybersecurity.

The institution's PCIaaS IT personnel participated in crisis management, such as backups and systems restoration. They also participated in real-life disaster recovery and business continuity, particularly in averting a potential disaster that would have befallen the institution if there was an unexpected failure in the air-conditioning units in one of the institution's data centres. The activities performed by the institution's IT personnel helped in minimising significant interruption and potential threats to the institution's business operations. As the HOD of IT Services noted, "*there is also the instance of our data centre which had an issue with air-conditioning unexpectedly. And these guys would have had to move all of our systems and services out of that data centre into another data centre*". The activities performed by PCIaaS IT personnel under this profile are among the most fundamental contributions to the institution's ability to exploit PCIaaS, as acknowledged by the Head of the IT Services department.

4.3.1.2 Systems Provider

The activities performed by PCIaaS IT personnel in CIT under the systems provider's profile included providing reliable IT services to meet business needs. As previously discussed in Section 4.1.1.2 (Improve Satisfaction of Work), members of the institution's community were enthusiastic and energised by PCIaaS and eager to cloudify. Therefore, the institution's PCIaaS IT personnel ensured that the PCIaaS services provided to business users meet their needs and requirement within the limit of the available resources. For example, Technical Officer (1) expressed this opinion when he noted, "*We are having people come to us because they have a need and they see this as a solution, they come to us to see if we can provide the solution*". This opinion was also corroborated by the Head of the IT Services department when he noted, "*We have people coming to these guys now and just say I want 10 VMs, or I want vDesktop, or I want a new Storage Area Network (SAN), or I want this, that, or the other"*. As a system provider, the institution's PCIaaS IT personnel also have to interrogate business users and "*peel back the layers and figure out what actually they want to achieve* ". The Head of the IT Services department expressed this opinion. PCIaaS IT personnel also provide vCloud and vDesktop labs to students in the Computing, BIS, Maths and Multimedia departments.

4.3.1.3 Project Coordinator

The primary activities performed by PCIaaS IT personnel in CIT under the project coordinator's profile included coordinating, providing guidance on IT-related projects, and relationship management. This study indicates that the institution's PCIaaS IT personnel's activities under the project coordinator profile were critical in leveraging PCIaaS to develop new products and services. As SMEs, the institution's PCIaaS IT personnel worked closely with business users to implement projects and design new, appropriate IS solutions to business problems. For example, the HOD of the IT Services department noted, "*These guys are interrogating in more details what the business is trying to achieve and what it is their end game is, and then trying to design or architect a solution that is appropriate to that. Sometimes, you are pulling back the layers and finding do they really need that, what you are trying to achieve. There is another group here that has done the same thing here with less resources and have done it in a different way*". Congruently, Technical Officer (2) also noted that the IT personnel also "*define the requirements of the people requesting the VMs, the* *requirements of the environment, what they want out of it, how long they want it for*". Performing the project coordinator activities also required constant communication and engagement with the business users, project management skills/knowledge, and knowledge of the institution's business area.

4.3.1.4 Partner

The primary activities performed by PCIaaS IT personnel in CIT under the partners' profile were (1) training and educating end-users and (2) providing expert advice. End-user training and education performed by PCIaaS IT personnel were vital to the institution's ability to integrate and exploit the potential of PCIaaS to improve its operations and processes. In addition, training was one of the institution's tools to overcome resistance (Section 4.2.5 discusses Stakeholder Support). As the institution's SMEs for PCIaaS, this study suggests that they were in the best position to provide those training. The institution's PCIaaS IT personnel provided training to the departmental IT technicians and their students and lecturers.

Furthermore, the training and briefings provided by the institution's PCIaaS IT personnel to the students and lecturers of the BIS department had a positive effect on the BIS Department's ability to integrate vDesktop into its programme design. It also played a pivotal role in the acceptance and usability of the vDesktop lab in the BIS department. For example, the Head of the BIS department noted, "*When we brought it in first, the training, briefing for the students, so that was critical. We sat down and specced out what would be required on the vDesktop platform to ensure that we were getting everything we wanted*". The Head of the BIS department continued adding that "*So, the staff were very open to hearing comments and taking on board our views. I had a particular concern about students having problems with it, and so they did a session with each group of students explaining how it works and what it would mean and helped the students with accessing it, not to do with any problems. So that runs very smoothly. Their services have been very positive from our perspective*".

4.3.1.5 Technological Leader

The primary activities performed by IT personnel in CIT under the technological leader's profile were (1) exploring and experimenting with new and emerging technologies and (2) exploring and identifying opportunities to exploit new technological innovation for new and emerging business opportunities. The aim of the first experiment conducted by the institution's PCIaaS IT personnel was to investigate the usefulness of PCIaaS to solve internal business problems and challenges. For example, Technical Officer (1) noted, "*I supposed a little experiment was tried. We installed a single server ESX onto a server to allow us to host more than one (1) server on it. What we found was extremely useful. We found that it solved a lot of problems we had. We can take down servers, we can virtualise it, and we can keep its life going*". One of the institution's PCIaaS IT personnel (Technical Officer 1) is also amongst the educational technology champions that conceived and investigated the vision for developing cloud-based educational programmes. Technical Officer (1) expressed this opinion when he noted, "*as himself and myself were moved to central, we brought along what we had started with me. So, he was forward-thinking, let us have a look at this, let us see what this can do for our department, and it ended up becoming an IT thing*". The institution's vision for cloud-based teaching and learning led to the development of several cloud-based educational degree programmes, including vCloud and vDesktop Labs in the Computer Science department.

4.3.2 Skills/Knowledge of PCIaaS IT Personnel

This section presents the analysis and discussion of the skills/knowledge of the PCIaaS IT personnel in CIT. Table 4-7 presents the requisite skills/knowledge of PCIaaS IT personnel identified in CIT across the two dimensions of competencies.

Table 4-7: CIT – Skills/Knowledge of PCIaaS IT Personnel

Dimension of Competencies	Skill & Knowledge	Freq (%)
Technical Competencies	Vendor(s) Cloud Infrastructure	4 (12.12%)
	Virtualisation	4 (12.12%)
	Networking	3 (9.09%)
	Storage Area Network (SAN)	3 (9.09%)
	Troubleshooting/Problem Solving	1 (3.03%)
	Total	**15 (45.45%)**
Business Management Competencies	Interpersonal and Communication	6 (18.18%)
	Teamwork	5 (15.15%)
	Business Domain	3 (9.09%)
	Project Management	2 (6.06%)
	Analysis and Judgment	2 (6.06%)
	Total	**18 (54.55%)**
Grand Total		**33 (100%)**

Table 4-7 highlights the ten skills/knowledge of PCIaaS IT personnel identified in CIT, comprising five technical competencies and five business management competencies. Also identified as the top four skills/knowledge of PCIaaS IT personnel in CIT in hierarchical order: (1) interpersonal and communication, (2) teamwork, (3) vendor(s) cloud infrastructure, and (4) virtualisation. However, business management competencies have a higher frequency than technical competencies. The following section discusses each of the dimensions of the competencies (skills/knowledge) of the institution's PCIaaS IT personnel.

4.3.2.1 Technical Competencies

Based on the data gathered from the HOD IT Services department and the two PCIaaS IT personnel in CIT, PCIaaS IT personnel required a different set of technical skills/knowledge to perform their duties responsibilities. However, one of the key findings in CIT was that education and training were fundamental to PCIaaS IT personnel's ability to perform their activities. Despite the years of experience in the IT profession and the existing skills/knowledge of the institution's existing IT personnel, they lack the skills/knowledge to fit into their new role. Therefore, they were sent for additional training to acquire cloud computing skills, particularly skills/knowledge on the chosen vendor's cloud infrastructure.

The dimension of technical competencies identified in CIT consists of five skills/knowledge: (1) vendor(s) cloud infrastructure, (2) virtualisation, (3) networking, (4) SAN, and (5) troubleshooting/problem-solving. PCIaaS IT personnel need skills/knowledge in the chosen PCIaaS infrastructure. Both technical officers expressed this opinion in CIT. For example, Section 4.2.1 revealed that PCIaaS IT personnel in CIT attended additional training with VMware on the vendor's cloud infrastructure and virtualisation. Section 4.1.1.3 also revealed that the education and training offered development opportunities for PCIaaS IT personnel.

PCIaaS IT personnel must have virtualisation skills, including the skills to manage VMs, which are fundamental in preventing VM-sprawl. If allowed to occur, VM-sprawl could have tremendous implications for the health of cloud computing environments. For example, Technical Officer (2) noted, "*There is a term sprawl that if it is not sufficiently and correctly managed, it would just multiply. The convenience of provisioning VMs and that it can be done so quickly is that you would get demand* *in requests for VMs, and if that is not tightly managed, you get a VM-sprawl that you have many VMs and people do not know where they came from, what they are needed for, what they have been used for, and how they have been backed up*". Technical Officer (2) continued by stressing the importance of virtualisation skills in managing, organising, and preventing VM-sprawl when she noted, "*So that is something that needs to be looked out for in (the) virtualised environment. And is having organisational skills and within the cloud team is helpful to manage the VM-sprawl*".

PCIaaS IT personnel needs to have networking and SAN skills/knowledge to manage and support PCIaaS. For example, Technical Officer (2), "*networking skills are quite important*" and "*SAN knowledge is very important*". According to the Technical Officer (1), PCIaaS IT personnel "also *need to be able to visualise the connections between the Hypervisor, Storage, and Network*".

4.3.2.2 Business Management Competencies

Business management competencies are critical to the institution's PCIaaS IT personnel. The skills/knowledge in this dimension consist of the following: (1) interpersonal and communication, (2) teamwork, (3) business area, (4) project management, and (5) analysis and judgement. Knowledge of the institution's business area was critical to PCIaaS IT personnel's ability to perform their activities effectively. Multiple study participants, including Technical Officer (2) and the HOD of the IT Services department, expressed this opinion. For example, Technical Officer (2) noted, "*I think it [business domain knowledge] helps when a certain department comes looking for a solution that you know their overall goal, what they want from the solution. I think that helps you help them design what they want, and then technically, we can design what we think best suit their needs. So overall, if you know the overall goal of a project, what would be their achievement, it does help, and you would be able to understand each business area*".

Communication, interpersonal skills, and knowledge are essential skills/knowledge for PCIaaS IT personnel. PCIaaS IT personnel are now more client-facing than in their previous roles. Thus, they require strong communication and interpersonal skills to effectively engage with people from diverse backgrounds and professions, including team members, the broader institution's community, vendors, and other third parties.

In addition, in performing their daily activities, PCIaaS IT personnel constantly deal with business users to understand their needs and requirements, analyse users' requirements, and provide solutions to meet their needs. Therefore, PCIaaS IT personnel must speak the business's language and that of the IT profession by translating, communicating, and explaining technical terms in a non-technical way to business users. Participants of the focus group discussion unanimously expressed this opinion. For example, the HOD of the IT Services department stated that "*You are going to be dealing with people a lot more now than you would have done in previous roles, let us say the traditional server people and storage people may not have dealt with end-users and often as you guys would now. So, you have to be able to deal with people and communicate with them appropriately, understand what it is they are asking for and try to deliver that back appropriately*".

The institution's PCIaaS is a highly controlled environment. Managing and supporting a PCIaaS environment requires teamwork. The consequences of any one member who is not willing to work would be problematic to other team members and could lead to catastrophic outcomes in the PCIaaS environments. This opinion was expressed by Technical Officer (1) when he noted that "*if that teamwork or that cooperation is not there, if there is one person that is really unwilling to sit down with you and work out the problem, then you are going to have a problem in that area*". An opinion also corroborated by Technical Officer (2) she noted, "*you simply cannot work alone, like once you have decided on a piece of work, and maybe there is a specific technical piece of work to do, you cannot do that anyhow, but there is certainly, there is nothing you would do that has not been discussed with your team*".

The institution's transition from its legacy infrastructure and the migration of legacy systems to PCIaaS require lots of project work. Therefore, PCIaaS IT personnel needs project management and requirements management skills/knowledge to manage projects and design solutions that meet the end-user and system requirements. Technical Officer (2) noted, "*you get people arriving with solutions, that would be maybe like 6 or 7 VMs involved in an overall solution for a certain section of* (the) *business. So, to kind of project manage that and to kind of really define the requirements of the people requesting the VMs, the requirements of the environment,* *what they want out of it, how long they want it for, there is a bit of [project] management in that as well*".

4.3.3 Summary and Finding: PCIaaS IT Personnel

The institution's PCIaaS IT personnel performed the five profiles of activities to contribute to the performance impact of PCIaaS. Architecture builder was the most visible, followed by systems provider. The project coordinator profile was the third most visible activity, while partner and technological leader profiles were the least visible. The study shows that the activities performed by PCIaaS in all the profiles of activities aimed at integrating and incorporating PCIaaS into the institution's business operations and processes, apart from the technological leader profile, which revealed that they investigated, experimented, and explored the usefulness of PCIaaS in solving some of the challenges faced by the institution in its IT infrastructure.

This study also identified ten skills/knowledge consisting of five technical competencies and five business management competencies. This finding showed that the technical competencies and business management competencies were equally crucial to PCIaaS IT personnel in CIT. The researcher concluded that PCIaaS IT personnel required both competencies to better contribute to PCIaaS's performance impact. However, the analysis also shows that training in the chosen vendor(s) cloud infrastructure was critical in obtaining the skills/knowledge in technical competencies. PCIaaS IT personnel contributed to the institution's ability to exploit PCIaaS to improve organisational performance by leveraging their skills/knowledge in performing their activities. The following section discusses the capabilities that enabled the institution to exploit PCIaaS for organisational performance.

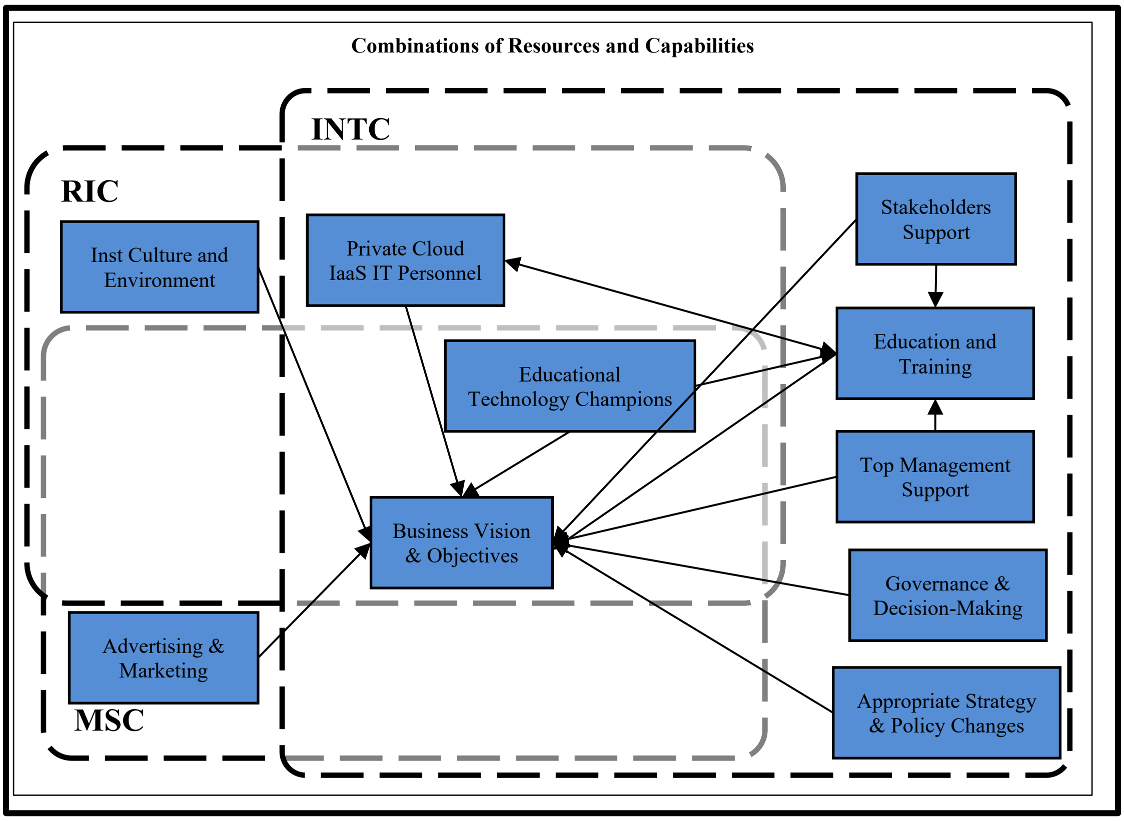
4.4 CIT: RQ4 – Analysis and Findings of Organisational Capabilities

This section presents the analysis and findings of RQ4, which investigate the organisational capabilities visible in the two organisational resources investigated in RQ2 and RQ3 as presented in Section 4.2 and Section 4.3. Table 4-8 presents the three capabilities identified in CIT and the combination of resources that make up each capability.

Table 4-8: CIT – Composition of PCIaaS Capabilities

Resources	Organisational Factors/Activities	RIC	MSC	INTC
Organisational Factors	Education and Training			X
	Business Vision and Objectives	X	X	X
	Appropriate Strategy and Policy Changes			X
	Educational Technology Champions	X	X	X
	Marketing and Advertising		X	
	Stakeholder Support			X
	Top Management Support and Commitment			X
	Governance and Decision-Making			X
	Institutional Culture and Environment	X		
PCIaaS IT Personnel	Architecture builder			X
	Systems Provider			X
	Partner			X
	Project coordinator			X
	Technological leader	X		

Table 4-8 highlights the three PCIaaS capabilities identified in CIT and the combinations of the resources that contributed to developing the capabilities. It highlights the importance of business vision and objectives and educational technology champions across the three capabilities. Figure 4-2 presents the capabilities identified in CIT, illustrating the combination of resources and the graphical representation of the links between the resources and the capabilities.



NOTE: Research and Innovation Capabilities (RIC), Integration Capabilities (INTC), Market Sensing (MSC)

Figure 4-2: CIT – Combination of Organisational Resources and Capabilities

Figure 4-2 highlights the combinations of resources that resulted in the development of three PCIaaS capabilities in CIT: (1) research and innovation, (2) integration, and (3) market sensing. These PCIaaS capabilities are discussed in the subsequent sections beginning with research and innovation capabilities in Section 4.4.1.

4.4.1 Research and Innovation Capabilities

Three organisational factors and the institution's PCIaaS IT personnel contributed to its research and innovation capabilities: (1) the institutional culture and environment, (2) PCIaaS IT personnel, and (3) educational technology champions. Some of the critical traits exhibited by these combinations of resources include the motivation to pursue and test new technologies and the creativity to transform these capabilities into innovative new products and services. The motivation to test new technologies did not just happen in a vacuum but was reminiscent of the institution's environment and culture. For example, Section 4.2.7 reveals that CIT has an environment and culture that proactively encourages testing new technology and innovation to improve a higher quality service delivery. A culture that proactively tests new technology and innovation improves innovativeness and propensity to discover new products and services. Therefore, it is not surprising that all three of the institution's PCIaaS environments (Production, vCloud, and View) were born out of its innovative culture.

Section 4.3.1.5 revealed that the institution's first PCIaaS environment, the production environment, was a product of the experiment performed by its PCIaaS IT personnel to investigate and test the viability of PCIaaS in solving some of the internal business challenges faced by the institution and its existing legacy IT infrastructure. Some of these challenges include resource utilisation, affordability, and data security. Similarly, Section 4.2.8 reveals that educational technology champions call for the investigation of cloud-based teaching and learning. This aspect of the institution's research and innovation capabilities was an essential precursor to its market sensing capabilities. In addition, the creative cloud-based teaching and learning were instrumental in preparing the institution to handle the transition to online teaching and learning necessitated by the Covid-19 pandemic.

4.4.2 Market Sensing Capabilities

Three organisational factors contributed to the institution's market sensing capabilities: (1) educational technology champions, (2) business vision and objectives, and (3) marketing and advertising. Its market sensing capabilities revolutionised and transformed traditional teaching and learning methods, resulting in several cloud-based educational degree programmes, including the two virtual laboratories (vCloud and vDesktop labs).

Section 4.2.8 and Section 4.2.2 revealed that the PCIaaS educational technology champions are the crux of the institution's vision for cloud-based teaching and learning. They crafted and articulated the strategic vision of cloud-based teaching and learning, an innovative approach to the delivery of teaching and learning. Cloud-base teaching and learning not only transformed the traditional way of teaching and learning by removing geographical barriers (location and time) but also enabled the institution to sense, seize, and pursue new and emerging business opportunities in the educational industry, yet to be exploited by many institutions around the world. Ultimately, Section 4.1.1.7 revealed that the cloud-based teaching and learning experimentation resulted in several new educational degree programmes and two vLabs (vDesktops and vCloud).

Section 4.2.9 revealed that the institution used advertising and marketing in exploiting the institution's global positioning in cloud-based teaching and learning. The institution leveraged cost leadership and product differentiation as the core of its advertising and marketing messaging strategies in promoting its unique positioning and competitive advantage over its competitors. These messaging strategies aimed to attract prospective students to CIT. In addition, Appendix 18 also revealed that these new and innovative cloud-based degree programmes were well publicised and regarded as ground-breaking, industry-led, and first of their kind in the world.

Section 4.1.1.13 revealed that the institution believes it enjoys a competitive advantage in attracting potential students, particularly over other Cork City and County institutions. The institution enjoys a unique strategic positioning and first-mover advantage being among the first institution in the world offering cloud-based degree programmes and the first and only institution in Cork and possibly Ireland providing free anywhere anytime vCloud and vDesktop Lab to its students. With vLabs, the institution no longer relies on physical computers and infrastructure laboratories but the vCloud and vDesktop Lab. The cloud-based degree programmes and the vLabs enhances the institution's competitiveness and offer growth potential.

4.4.3 Integration Capabilities

Six organisational factors contributed to CIT's ability to integrate innovation (PCIaaS) into its operations and processes. First, the institution's vision and objectives for PCIaaS were twofold. Firstly, Section 4.2.2 revealed that the institution's vision and objectives for PCIaaS aimed to test and investigate the viability of integrating PCIaaS to solve its internal business challenges as articulated by PCIaaS IT personnel. Secondly, Section 4.3.1.5 also revealed that the institution's second vision and objectives for PCIaaS aimed to test and investigate the viability of integrating PCIaaS to transform teaching and learning and sense, seize, and pursue new business opportunities in the educational industry.

However, like any technological change, achieving the institution's vision and objectives for integrating PCIaaS into the institution's operations and processes was not without challenges. These key challenges included skills/knowledge gap, fear, and passive resistance to change. Section 4.2.1 outlines the critical role played by education and learning in overcoming these challenges. The section emphasised the mutual willingness to learn coming from all members of the institution, including (1) educational technology champions, (2) PCIaaS IT personnel, (3) stakeholders, and (4) top management. First, the section highlights the critical role of the educational technology champions in educating both peers and top management on the viability of cloud-based teaching and learning and getting their support. Second, two of the institution's PCIaaS IT personnel underwent continuous training with VMware for each of the institution's three PCIaaS environments to acquire vital cloud computing-related technical skills/knowledge specific to the vendor's cloud infrastructure. They thus became the subject matter experts (SMEs) of the technology for the Production environment and the academic and educational potential of the View and vCloud environments. The skills/knowledge acquired were critical to PCIaaS IT personnel's ability to perform the five profiles of activities. Third, the institution's PCIaaS IT personnel played significant roles in educating and training other members of the institution, particularly the departmental IT technicians, lecturers, and students (Section 4.2.1). The education and training provided enabled lecturers and students of the BIS department to improve teaching and learning delivery.

Section 4.2.5 highlights the vital role of stakeholder support in integrating PCIaaS into its operations and processes. The intensified support for and members of the institution receptivity to new technology and innovation contributed significantly to integrating PCIaaS into its business operations and processes. For example, students were the driving force behind the integration of PCIaaS into teaching and learning. Institution members were also energised and willing to be 'cloudified'. The term 'cloudify' is essential here, as it signifies both a willingness among stakeholders to integrate cloud-based products and services and the collaborative nature of the transformation of the institution's operations and processes.

Section 4.2.6 outline the role of governance and decision-making as a mechanism of authority that eased the transition from the institution's legacy IT systems to centralised provisioned PCIaaS and enabled PCIaaS to gain traction in CIT. Section 4.2.6 also outlines the vital role of the institution's central IT Steering Committee in the centralised provisioning of PCIaaS in CIT, particularly in barring individual departments pursuing separate integration agendas. The central IT Steering Committee's decision helped eliminate wasteful investment and enabled the institution to reap centralisation and consolidation benefits.

Section 4.2.3 highlights that the formulation of appropriate strategy and policy changes enhanced the institution's ability to integrate PCIaaS into its operations and processes. For example, the institution's cloud-first policy and cloud migration policy mandate the use of PCIaaS for all new product development and the migration of legacy systems to PCIaaS. The primary goal was to enhance the institution's ability to provide better and higher quality IT services to its members. Section 4.2.4 highlights the top management support, commitment and receptiveness to new technology and innovation. Their commitment to driving, leading, and championing organisational change was vital to the extension of vDesktop to other departments, e.g., the BIS department. Coupled with their positive attitude to change, caring attitude for students' welfare, and willingness to invest in enhancing student experience was critical to integrating PCIaaS into its business operations and processes. Top management was committed to the extension and integration of vDesktop, initially designed for the computing department, to several other departments across the institution. First to the BIS department, and later to other departments, including Maths and Multimedia departments. The BIS department subsequently derived several benefits from integrating vDesktop into its program design, including an enhanced student experience, reduced cost, and enabling lecturers to work from home.

4.3.4 Summary and Findings: Organisational Capabilities

This section highlights the capabilities that enabled CIT to leverage PCIaaS to improve its organisational performance. According to the observation, organisational factors are the major contributor to organisational capabilities. The unique and distinct combinations of the institution's resources and capabilities were vital in developing the three capabilities that enabled the institution to exploit PCIaaS, including (1) research and innovation capabilities, (2) market sensing capabilities, and (3) integration capabilities.

Each of these capabilities contributed differently to the performance impact of PCIaaS. Research and innovation capabilities serve as the doorway of PCIaaS into the institution intersecting the three capabilities. The institution's research and innovation capabilities are of two folds, (1) to integrate PCIaaS to solve internal business problems and challenges, and (2) exploit the potential of PCIaaS to transform, sense, seize, and pursue new and emerging business opportunities. The latter is the bedrock of the institution's market sensing capabilities.

4.5 Chapter Summary

This chapter presented the within-case analysis of the organisational performance impact of PCIaaS in CIT and the organisational resources involved: (1) organisational factors and (2) PCIaaS IT personnel. First, this study identified 35 PCIaaS performance measures in CIT, consisting of 22 in the highly supported category and 13 in the less supported category. The remaining four PCIaaS performance measures were in the not supported category. Also identified were the top ten performance measures in CIT. Two PCIaaS business value dimensions emerged in the highly significant category across the most dominant and most relevant groups in CIT. In addition, operational effectiveness emerged as the most dominant category of the organisational performance impact of PCIaaS in CIT, while strategic positioning is less dominant.

Second, all nine organisational factors identified in CIT positively impacted its ability to exploit PCIaaS to improve its organisational performance. Also identified were the skills/knowledge employed by the institution's PCIaaS IT personnel in performing the activities categorised across the five profiles of activities. However, architecture builder is the most visible profile of activities, followed by systems provider. Project coordinator is the third most visible profile of activities. Finally, partner and technological leader are the least visible profile of activities. Both dimensions of competencies consist of five skills/knowledge each. However, business management competencies are the most dominant in CIT based on the frequency of supporting quotes, while technical competencies are the less dominant.

Third, the institution's organisational capabilities stem from the activities performed by its PCIaaS IT personnel and the enabling environment created by organisational factors in exploiting the potential available in PCIaaS to improve its organisational performance. Three capabilities emerged from the combinations of PCIaaS IT personnel and organisational factors: (1) research and innovation capabilities, (2) market-sensing capabilities, and (3) integration capabilities. The combination of the profiles of activities of PCIaaS IT personnel and organisational factors combined in developing the three capabilities. PCIaaS IT personnel through the activities profile of the technological leader combined with three organisational factors (institutional culture and environment, educational technology champions, and business vision and objectives) combined in developing research and innovation capabilities. The three organisational factors that combined in developing market sensing capabilities include educational technology champions, business vision and objectives, and marketing and advertising. All other organisational factors apart from marketing and advertising and institutional culture and environment combined with the five profiles of activities apart from technological leader contributed to integration capabilities. The three organisational factors that combined in developing market sensing capabilities enabled the institution to exploit the potential of PCIaaS in enhancing its strategic positioning. The following chapter presents the within-case analysis of the organisational performance impact of PCIaaS in OU and the resources and capabilities involved.

Chapter Five – Oxford University

5.0 Introduction

This section presents the within-case analysis and findings of the organisational performance impact of private cloud IaaS (PCIaaS) in OU. The institution has no known foundation date but is considered one of the oldest, most prominent, and high-ranking universities globally. However, it is on record that teaching and learning began there in 1096. The university has produced several notable scholars, 28 Nobel laureates, 27 Prime Ministers of the UK, many heads of state and government worldwide. OU is a renowned institution and has consistently ranked within the top 10 universities globally across several world-renowned ranking organisations and journals. OU operates a "*collegiate research university system*" consisting of about 45 constituent colleges. All the colleges that make up the University of Oxford are self-governing institutions, each controlling its affairs, structure, and finances.

The institution's PCIaaS "*started by virtualisation of hardware, moved on to using vCloud Director, which allows for tenants to manage their own resources*". The institution's PCIaaS is predominantly VMware. This opinion was confirmed by the Technical Lead, Cloud Services, during an interview when he spoke about OU PCIaaS as consisting of "*all VMware: vCloud Director, vSphere, ESXi*". OU PCIaaS provides two types of cloud services to users in some of the 45 colleges and departments that make up the institution. The capacity of each of the PCIaaS services consists of "*around 300 in the private cloud. [And] a further 700 virtualised, but not run in a tenanted private cloud environment (i.e., vCloud Director)"*. An opinion expressed by the Systems Administrator, Cloud Services. Figure 5-1 presents the profile of OU PCIaaS environments, showing the institution's cloud technologies, the services provided, and the primary users of the services.

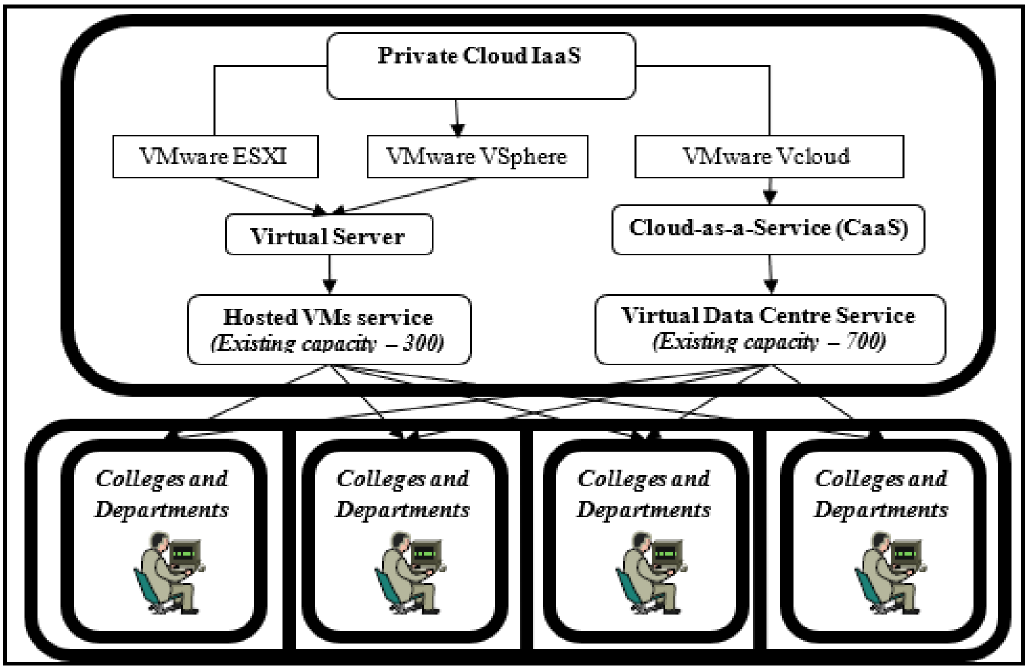


Figure 5-1: Profile of OU PCIaaS Environments

Figure 5-1 highlights the primary users of the PCIaaS in OU as the admin staff, research groups, and local IT staff in the colleges and departments that make up the institution. The Technical Lead, Cloud Services, noted that the main customers of PCIaaS in OU were the "*admin staff, research groups, local IT staff in colleges and departments*". The tight walls demarcating the departments and colleges is a metaphor for the institution's governance and decision making structure discussed in Section 5.2.6. The following section presents the analysis and discussion of the organisational performance impact of PCIaaS in OU.

5.1 OU: RQ1 – Analysis and Findings of Organisational Performance

This section presents the analysis and findings of the organisational performance impact of PCIaaS in OU. The study investigated the organisational performance impact of PCIaaS using 35 PCIaaS performance measures across nine dimensions of business value and two typologies of organisational performance. In addition, this study identifies additional three PCIaaS performance measures in the data collected, (1) attracting potential students/reputational image, (2) better work-life balance, and (3) elimination of bureaucratic bottlenecks.

Firstly, In section 5.1.1, the frequency of the PCIaaS performance measures identified in OU was compared using the PCIaaS performance measures classification and categorisation metrics previously discussed in Section 3.6.1.1. Secondly, in Section 5.1.2, the researcher compared the frequency and mean value of the PCIaaS business value dimensions identified in OU, using the PCIaaS business value dimensions classification and categorisation metrics discussed in Section 3.6.1.1. Finally, in Section 5.1.3, the frequency value of the two PCIaaS organisational performance categories was compared.

5.1.1 Analysis of PCIaaS Performance Measures

Table 5-1 presents the analysis of PCIaaS organisational performance impact across 39 PCIaaS performance measures in OU, illustrating their frequency distribution and categories.

Table 5-1: OU – Analysis of PCIaaS Performance Measures

Rank	PCIaaS Performance Measures	Freq	Percent	Category
1	Cost-effective and affordable enterprise-class IT services^	18	8.04	H
2	Better business continuity and disaster recovery^	17	7.59	H
3	IT staff efficiency^	17	7.59	H
4	Development of new classes of products, apps & services^	14	6.25	H
5	Improved infrastructure/data security^	13	5.80	H
6	Rapid turnaround time for new products development^	12	5.36	H
7	Create training and development opportunities^	11	4.91	H
8	Rapid responsiveness to business needs^	10	4.46	H
9	Greater resilience^	9	4.02	H
10	Ease and simplicity of IT management^	9	4.02	H
11	Higher and better performance IT resources^	9	4.02	H
12	Efficient and better utilisation of IT resources	8	3.57	H
13	Improve standard and modernity of IT infrastructure	7	3.13	H
14	High availability and reliability	7	3.13	H
15	Improve productivity	6	2.68	H
16	Centralisation and consolidation	5	2.23	H
17	Lower IT staff costs	5	2.23	H
18	Research repository and collaboration	5	2.23	H
19	Reduce the amount of space	4	1.79	H
20	Accelerate/reduce IT barriers to innovation	4	1.79	H
21	Improve satisfaction of work	4	1.79	H
22	Eliminate bureaucratic bottlenecks	4	1.79	H
23	Attracting potential students/reputational image	4	1.79	H
24	Allow employees to work remotely	4	1.79	H
25	Free up time to focus on core business	4	1.79	H
26	Less worry/flexibility applying system-wide upgrades/update	3	1.34	L
27	Better work-life balance	3	1.34	L
28	Provides opportunities for flexibility and autonomy	3	1.34	L
29	Better and higher quality of services	2	0.89	L
30	Reduce costs of cooling and power – energy savings*	1	0.45	L
31	Lower IT management/ maintenance expenses/costs*	1	0.45	L
32	Go green/reduced carbon footprint*	1	0.45	L

Rank	PCIaaS Performance Measures	Freq	Percent	Category
33	Improve/enhance user experience*	0	0.00	N
34	Collective problem-solving*	0	0.00	N
35	Business process efficiency*	0	0.00	N
36	Increase/improve competitiveness*	0	0.00	N
37	Create opportunity for potential growth*	0	0.00	N
38	Lower/eliminate software costs*	0	0.00	N
39	Lower cost of failure*	0	0.00	N
	Grand Total	**224**	**100**	
	Mean	**5.74**	**2.56**	
	Median	**4.00**	**1.79**	
	Highly Supported Category (H)			**25**
	Less Supported Category (L)			**7**
	Not Supported Category (N)			**7**

Legend: ^ Top Ten Performance Measures, * Bottom Ten Performance Measures

There were 224 occurrences of supporting quotes for PCIaaS performance measures in OU. The mean value and median value of supporting quotes are 5.77 (2.56%) and 4 (1.79%), respectively. The results also show that the supported PCIaaS performance measures in OU were 32, including 25 in the highly supported category, and seven in the less supported category, while the remaining seven are in the not supported category. Also identified are the 11 PCIaaS performance measures in the top ten list and the bottom ten PCIaaS performance measures. This study also identified three additional PCIaaS performance measures in the data collected. The following subsections discuss each of the PCIaaS performance measures in the highly supported category.

5.1.2.1 Cost-Effective and Affordable Enterprise-class IT Services

PCIaaS provided a cost-effective and affordable way of delivering secure, reliable, and enterprise-class IT services to support business users and provide new ways to teach, learn, and conduct research. Cost-effective is one of the main reasons for establishing the institution's PCIaaS and the main selling point for convincing the various departments and colleges to move from their legacy IT infrastructure to PCIaaS. The Director of Infrastructure Services expressed this opinion when he noted, "*the private cloud service was established to provide a cost-effective means of encouraging departments and colleges to move away from their silos of hardware onto a virtualised infrastructure. So yes, it has created cost savings generally for the university*". PCIaaS is a more cost-effective way of provisioning IT Services in OU than the traditional IT infrastructure. Cost-effective and affordable enterprise-class IT Services emerged in the first position of the top ten performance measures in OU.

5.1.1.2 Better Business Continuity and Disaster Recovery Capability

PCIaaS provides failover that allowed the primary data centre to automatically failover to the secondary data centre, thereby minimising downtime and eliminating any disruption in the institution's business operations. Congruently, PCIaaS has dramatically improved the institution's RTO and RPO. The Director of Infrastructure Services expressed this opinion when he noted, "*their RTO is easier to fulfil, the RTO is short if it is on IaaS than say the traditional data, even if it is over two data centres on physical hardware*".

PCIaaS has also improved the institution's business continuity and disaster recovery potency. For example, the institution swift recovery from an unexpected power failure in one of the institution's data centres, an event that could have halted the institution's entire business operations in the past. As the System Administrator, Cloud Services, stated, "*we have had power problems in one of data centres not being able to migrate box, and the data centre automatically failover to the second data centre successfully. There was one instance when it was, actually, zero downtime because we knew in advance that we had problems in the data centre, so we were able to migrate everything across to the second data centre, so the end-user did not know of any downtime*". If the situation had happened with the institution's legacy IT infrastructure, it would have spelt disaster for the institution. As a result, better business continuity and disaster recovery emerged third in the top ten list of PCIaaS performance measures.

5.1.1.3 IT Staff Efficiency

PCIaaS has improved IT personnel's efficiency across the institution by reducing the time and effort previously spent building and configuring physical servers and services and automated services and less hardware maintenance. The Director of Infrastructure Services expressed this opinion when he noted, "*Centrally, our staff provide the IaaS, and others are responsible for then configuring the resources as they wish. But even within the departments and colleges*". The Director of Infrastructure continued by adding that "*it is far more efficient to configure a set of VMs and a bunch of virtual discs than it is to physically install in a data centre. So, the time to configure server* *and storage is always a great deal less, and the lead-time and so on is a great deal less than if you are doing it in a more traditional way*".

It is far more efficient for IT personnel to manage VMs than to manage physical servers. For example, the institution has three PCIaaS IT personnel managing and supporting 1000 VMs, whereas it is almost impossible for three IT personnel to manage and support 1000 physical servers. IT staff efficiency (reduction in time to person a task) results in improvements in other performance measures, including increased productivity, lower IT staff costs, and an increase in the number of services. Ease and simplicity of IT management emerged in the ninth position of the top ten PCIaaS performance measures in OU.

5.1.1.4 Development of New Classes of Products, Applications and Services

Multiple participants in OU believe that PCIaaS facilitated the development of several new systems, applications and services used for administrative, academic, and research purposes. For example, the Director of Infrastructure Services noted, "*our IaaS provides a platform for a number of applications*". The development of such a wide range of systems would not have been possible using the institution's legacy IT infrastructure for multiple reasons, including bureaucratic bottlenecks (see Section 5.1.1.22) and cost. For example, the Team Leader, Microsoft Access and Dynamics Team, Software Solutions Maintenance, Oxford Central IT Services, noted, "*definitely, we could not have offered a greater range of products and services because the cost would be a lot*". Some of the new classes of systems, applications and services identified in OU include (1) innovation server, (2) DIT environment, (3) Oxford sequel server, (4) web-based contact management system (CMSs), (5) Phoneman (https://help.it.ox.ac.uk/chorus/phoneman), (6) the institution's website, (7) World War One crowdsourcing project (http://www.oxfordatwar.uk/), (8) OU Apple's iTunesU Podcasts (https://www.ox.ac.uk/itunes-u or http://podcasts.ox.ac.uk) also referred to as OU Apple Podcasts (Lecture capture/podcasting services), and (9) Nomads in Oman (http://www.nomadsinoman.com/).

The researcher identified the above systems from the multiple interviews conducted with the study participants in OU. For example, without naming the specific systems, the Director of Infrastructure Services also noted, "*our infrastructure as a service provides a platform for a number of applications delivered to the libraries, for* *example, Bodleian Libraries and [.......] to the museum as well*". However, an interview with the Web/Digital Officer, Said Business School/ Bodleian Libraries identified some of these systems when he noted that "*we used it (PCIaaS) in deploying Web CMSs, contact management systems, for and used by academic staff*". When the researcher questioned the Web/Digital Officer, Said Business School/ Bodleian Libraries, on the PCIaaS system development project he participated in, he responded: "*So yes, one specific project is a project called Nomads in Oman".*

Several other systems were developed, including "*Phoneman, that provides University telephone directory information to end-users*", "*the University website is in an IaaS datacentre, as is the infrastructure of two colleges and the lecture capture/podcasting service I mentioned earlier".* He further added, "*also, a set of servers that provide infrastructure backend to a managed Apple Mac service, (used for) providing services for registering/deregistering client Macs, provisioning software to them etc*". The Technical Lead Cloud Services expressed the above opinions.

Some of these newly developed systems are used solely internally by the institution's members, while institution members and the general public use others. The latter are repository systems for storing data for teaching and learning and research purposes, as discussed in Section 5.1.1.18. These systems offer the institution immense value. For example, some of the external-facing systems such as the institution's Apple's iTunesU Podcasts and its corporate website have helped in enhancing its popularity, corporate image, and its ability to attract potential students (See Section 5.1.1.23). Section 5.1.1.20 also revealed that the innovation server and DIT environment accelerated and lowered the IT barrier to innovation by providing a platform for developing and testing new applications.

Furthermore, Section 5.1.1.18 revealed that the institution uses external-facing systems such as Nomads in Oman, World War One crowdsourcing solution, and the Apple Podcasts for teaching and learning and research purposes. The institution also migrated its data previously stored across different databases to a central repository known as the Oxford sequel server. The web-based CMS, used by academic staff, helps in the efficient and effective management and storing of any information relating to contacts and customers in the institution. Phoneman is a web interface telephone directory used for managing the institution's phone extensions, Chorus users and accounts, and group working and collaboration. This PCIaaS performance measure emerged in the fourth position of the top ten PCIaaS performance measures in OU.

5.1.1.5 Improve Infrastructure and Data Security

Before PCIaaS, several of the institution's departments and colleges server (communication) rooms were housed in inappropriate, undedicated, and high-risk areas, and therefore not suitable for running mission-critical systems. The practice of 'shadow IT' was also rampant in the institution, which risked exposing its IT infrastructure and systems, including data vulnerable to hackers. Successful attacks on the institution's IT infrastructure could generate negative publicity about the institution. However, PCIaaS has dramatically reduced those types of security risks and vulnerabilities. The institution's PCIaaS is centrally located in a safe, secured, and dedicated data centre known to the institution. The institution now has centralised management and greater control of its IT infrastructure, which has helped improve its data visibility. PCIaaS IT personnel also provides secured backup of the institution's data and information. Technical Lead, Cloud Services expressed this opinion when he noted,

> "*The data is all centrally stored on SANs that we manage, backup, and we know where the data is any one time, and we know where it is backed up to, and it is not spread around the university. I do not know if you come across this concept, shadow IT. Where you know, data is on a server under the desk in the Professor's room or wherever, you do not really know who is managing it or whether it is secured any of that sort of thing. So, we hope to avoid or reduce that by having this central service. We know where all our data is. Our data is in the private cloud, it is on our two SANs, and they are in Oxford. By extension, the security is improved as well because we know where it is. I think there is certainly risk with 'shadow IT', the personal data is held in places where it is not secured, and we help to reduce that*".

However, this study identifies three types of security risks in the data gathered in OU. These were: (1) hardware risks, (2) information security risks, and (3) staffing risks. While PCIaaS has reduced security risks associated with hardware, IT staff competency risks remain. The departmental IT technicians may lack the technical expertise to configure their VMs properly or to manage IT infrastructure and data security on the cloud (tenanted clouds) to prevent breaches. As a result, it might be necessary for the departmental IT technicians to undergo the same training completed by the institution's IT personnel. Improve infrastructure/data security emerged in the fifth position of the top ten PCIaaS performance measures.

5.1.1.6 Rapid Turnaround Time for New Products Development

One of the main reasons OU adopted PCIaaS was to eliminate the inefficiency associated with accessing IT resources. Before the institution's PCIaaS, the procurement cycle for new hardware needed for project implementation or new applications typically took weeks or months. PCIaaS has eliminated the lengthy procurement cycle and significantly reduced the waiting time for servers to just a couple of hours, consequently reducing the deployment time for new applications or project implementation. In addition, PCIaaS has also reduced the lengthy time spent building and configuring physical servers.

Business users now have easy and immediate access to IT resources, which has also helped improve the turnaround time for projects implementation and eliminated downtime in project implementation. For example, Technical Lead, Cloud Services noted, "*If you are going to deploy new VMs projects for research groups, very quickly in a matter of hours, so they do not have to sit around waiting for things to happen*". Rapid turnaround time for new product development is in the sixth position of the top ten performance measures in OU.

5.1.1.7 Create Training and Development Opportunities

PCIaaS created training and development opportunities for the three current PCIaaS IT personnel and the additional new members to be added to the team. The Director of Infrastructure Services noted this when he stated, "*yes, I do think that is the case. And we recently expanded the team that is responsible for the provision of cloud services, and that provides development opportunities for two or three more members of staff".* In addition, other departmental employees, including IT technicians, were also beneficiaries of the training and development opportunities.

One key finding is that training and development opportunities provided to PCIaaS IT personnel have enabled them to develop skills/knowledge that have enhanced their competitiveness and employability in the labour market. The System Administrator, Cloud Services, expressed this opinion when he noted, "*in terms of personal development, I think having knowledge on these technologies allows you, and it is very valuable in the actual job market. Having in-depth knowledge on these technologies, I think will definitely give you a competitive advantage in the jobs market*". The creation of training and development opportunities emerged in the top ten performance measures in OU.

5.1.1.8 Rapid Responsiveness to Business Needs

PCIaaS has dramatically improved its responsiveness in swiftly meeting its members' needs in ways that were considered impossible in the past. Multiple participants expressed this opinion. For example, the System Administrator, Cloud Services, noted, "*PCIaaS has helped increase the velocity in which we can provide IT infrastructure*". PCIaaS has shortened the time for processing and analysing large amounts of data sets or big data analytics.

Despite the unexpected increase in student applications, PCIaaS reduced the several days' delay previously associated with student applications' processing. The Team Leader, Microsoft Access and Dynamics Team, Central IT Services noted, "*this year we got a lot more data, instead of having to say to the users look your data is delayed, you got to have to wait three days, we were able to just to make the service bigger, and we were able to start work on time*". Apart from shortening the amount of time for processing large data sets, this has also reduced payroll-related expenses and improved the employees' work-life balance by eliminating or reducing hours and weekends. Rapid responsiveness to business needs emerged in the eighth position of the top ten PCIaaS performance measures.

5.1.1.9 Greater Resilience

PCIaaS improved the resilience of the institution's IT infrastructure. Resilience is one of the main drivers of the institution's adoption of PCIaaS. The institution's PCIaaS provides greater resilience in systems and data failure, fostering speedy restoration of services and any data loss. It also provides excellent resiliency against points of failure by replicating the systems and data across multiple data centres. For example, the System Administrator, Cloud Services, noted, "*we have a very high-level of resiliency in the cloud so, we have basically a dual-site data centre, we have two data centres* *which means that if we lose a data centre, we get automatic failover, so that makes it much easier in terms of downtime*". In addition, greater resilience emerged in the tenth position of the top ten PCIaaS performance measures.

5.1.1.10 Ease and Simplicity of IT Management

There is a general perception in OU that PCIaaS offers ease and simplicity in managing its IT infrastructure. The institution's PCIaaS reduces manual processes, IT maintenance and offers ease and simplicity in managing hardware. It has also relieved IT staff of the responsibility of worrying about the maintenance of physical hardware. The elimination of the difficulties and complexities previously associated with increasing existing RAM has helped improve the services' availability running on those servers. For example, Technical Lead, Cloud Services, noted, "*a couple of our colleges have taken the virtual data centre service, and they replace their entire local IT service infrastructure with the virtual data centre. And they would not have done that unless it offered them some significant improvements in terms of costs and the ease of manageability*". IT staff efficiency emerged in the second position of the top ten PCIaaS performance measures in OU.

5.1.1.11 Higher and Better Performance IT Resources

PCIaaS has dramatically improved the performance of the institution's IT infrastructure. The Director of Infrastructure Services expressed this opinion when he noted, "*I would suggest that those customers that make use of the virtual data centre service that we offer will have an improvement in terms of their IT infrastructure*". PCIaaS offers high-performance computing resources with better processors, more memory, more storage, and higher speeds. Multiple study participants expressed this opinion, including the Web/Digital Officer, Said Business School/Bodleian Libraries, who noted that the institution's members now "*have a very diverse range of operating systems, of different versions*".

The high-performance computers offered by PCIaaS are also far more suitable for administrative purposes and academic and scientific research purposes. For example, there was a dramatic reduction in the processing time for data-intensive jobs such as student applications (Section 5.1.1.8 – Rapid Responsiveness to Business Needs). PCIaaS also offers the institution better bandwidth and faster connectivity than the institution's legacy IT infrastructure. The Web/Digital Officer, Said Business School/

Bodleian Libraries, expressed this opinion when he noted, "*the amount of bandwidth you can get is much better by private cloud*". Better bandwidth and connectivity enabled employees to work from anywhere, anytime, provided they had access to the internet. Higher and better performance IT resources also emerged in the tenth position of the top ten performance measures in OU.

5.1.1.12 Efficient and Better Utilisation of IT Resources

PCIaaS has enhanced efficiency and better utilisation of IT resources in OU by enabling the institution to host multiple VMs on one physical machine. PCIaaS also offers the institution rapid scalability and elasticity by allowing its IT infrastructure to handle dynamic workloads during peak and off-peak periods. For example, the System Administrator, Cloud Services, noted, "*so, you can put 20 of those services on one machine. So, the utilisation of the hardware definitely goes up. So, that is definitely a benefit*". The Technical Lead, Cloud Services, also noted, "*because we are virtualising 300 VMs on ten hypervisors something like this, that is going to be better than six departments having to deploy two or three hypervisors each for their 20 or 30 VMs. We have economies of scale, which is an easy way of putting that. Yes, I think we definitely saw better utilisation*".

5.1.1.13 Improve Standard and Modernity of IT Infrastructure

The general perception shared by most of the study participants in OU was that the institution's legacy IT infrastructure was archaic and not fit for purpose. However, PCIaaS has dramatically improved its standard and modernity. For example, the Director of Infrastructure Services noted, "*so, a department in effect would be moving from what is often a single cluster of hardware in inappropriate rooms often, and they are moving to more enterprise-class solution*". An opinion corroborated by the Web/Digital Officer, Said Business School/Bodleian Libraries when he noted, "*in terms of the university overall, because now they have the shared data centre, it is a rather pretty new development and customised, built for about six years now or something like that. Which is much better than having lots of servers floated around the university in unimproved and quite makeshift server rooms*". The Web/Digital Officer continued, "*like in my case, we have it covered in the building that was not even particularly suitable for having servers in them*".

The Director of Infrastructure Services also drew an analogy to further support the above opinion by comparing the institution's legacy IT infrastructure to a "*Ford Fiesta"* and the institution's PCIaaS to "*a Rolls Royce style of infrastructure"*. A sentiment also echoed by the Technical Lead, Cloud Services, when he noted, "w*e got state-of-the-art data centres, two of them"*.

5.1.1.14 High Availability and Reliability

PCIaaS has helped reduce the risk of system outages, thereby ensuring the high availability and reliability of IT services provided to the institution's members. PCIaaS also has unique features that enhanced the availability of services and non-interruption of services during maintenance. For example, the Director of Infrastructure Services noted that "*service availability has improved*". The Web/Digital Officer, Said Business School/ Bodleian Libraries, corroborated this opinion when he noted, "*when they do the maintenance of the infrastructure, I can still, the site still running, I can still access HTML, but I cannot get inside the VMware layer. I think it is implemented in such a way that they can work on the infrastructure layer without affecting the service*".

5.1.1.15 Improve Productivity

PCIaaS has improved the productivity of the institution's IT personnel through the acquisition of additional skills/knowledge. The additional training enhanced the productivity of PCIaaS IT personnel through their ability to perform more complex work in the institution's PCIaaS. The Director of Infrastructure Services expressed this opinion when he noted, "*I think implementing an enterprise private cloud does, it upskills staff in the sense that now, centrally at least, the staff are now managing a virtualised infrastructure, they have extra knowledge around how networking within a virtualised environment which is rather complicated, to say the least. I think there is an increase in productivity, more than that there is upskill in the staff, from kind of the traditional racking, installing, and cabling now to a far more (efficient)*".

PCIaaS has also helped improve the productivity of the PCIaaS IT personnel by enabling them to take on more responsibilities. Apart from being solely responsible for managing and supporting the institution's PCIaaS, they also have enough time to perform other responsibilities. Technical Lead Cloud Services expressed this opinion when he noted, "*I think so (agreeing that PCIaaS has improved his productivity).*

There are three of us involved in it, so we do not exclusively work on that all the time. We have other responsibilities as well".

5.1.1.16 Centralisation and Consolidation

PCIaaS facilitated the centralisation and consolidation of the institution's IT infrastructure in a central location, resulting in centralised IT resources management. The benefits of the centralisation of the institution's IT infrastructure were immense. Centralisation enhanced the institution's IT infrastructure's security in a well-secured central location and helped to eliminate the silos of the institution's IT infrastructure spread across several departments and colleges. In addition, centralisation simplified IT administrative tasks, including support, management, maintenance operations, installations, and applying patches and upgrades, and enabled IT personnel to provide better IT services to the institution's community members. For example, Technical Lead, Cloud Services noted, "*the main benefit here, I think, is that we can provide better central infrastructure in terms of, we have servers that are all well maintained, storage that is well maintained, backed up and resilient across two data centres. So, we can provide resilience and performance that a college would not be able to do on its own*".

Centralisation helped eliminate the need for individual departments and colleges to have their own IT infrastructure and the associated duplication of costs involved in supporting, managing, and maintaining silos of IT infrastructure. The centralisation of the institution's IT infrastructure reduced the number of individual servers supported, managed, and maintained by departmental IT personnel and enhanced the availability and reliability of the IT services provided. For example, System Administrator, Cloud Services, noted, "*there is much less physical infrastructure to look after because of the consolidation".* The System Administrator, Cloud Services, further noted, *"in terms of hardware, so we consolidate the hardware right down, there is less physical stuff to go wrong basically*". The centralisation will result in better utilisation of IT infrastructure and IT personnel and promote central services. For example, the Technical Lead, Cloud Services, noted that the institution's "*private cloud came out of the strategy to promote central services and transfer people*".

5.1.1.17 Lower IT Staff Costs

PCIaaS helped reduce IT staff costs by reducing the need to increase the number of IT staff, despite the increase in the size of IT infrastructure and the number of services provided. As the Director of Infrastructure Services noted, "*we are able to do more with the same number of staff*". The institution's PCIaaS platforms host approximately 700 VMs and 300 tenanted clouds (Cloud-as-a-Service), which are managed and supported by just three PCIaaS IT personnel. One tenanted Cloud-as-a-Service represents the entire IT infrastructure of an organisation.

The institution would have required more than three IT personnel to manage and support such a considerable size of IT infrastructure in a traditional environment and the associated cost of management overhead. Also, despite reducing the number of departmental IT personnel, there was no corresponding increase in IT personnel in the central 'infrastructure team'. This finding reveals that PCIaaS improved product productivity (increase in the quantity and quality of service) and labour productivity (increase in the volume of outcome compared to input). Improve productivity also emerged in the less supported category (see Table 5-1).

5.1.1.18 Research Repository and Collaboration

PCIaaS enabled OU to develop new kinds of innovative products, applications and services that have helped to enhance research, data repository and collaboration. Some of these repository systems include (1) World War One crowdsourcing project, (2) OU Apple's iTunesU Podcasts/OU Apple Podcasts, and (3) Nomads in Oman. The institution stores and published lectures on the institution's Apple's iTunesU. Technical Lead, Cloud Services expressed an opinion when he noted, "*Phoneman basically record lectures that may be of interest to the public and make them available on sites such as Apple's iTunesU*". The published materials institution's Apple's iTunesU are available online to members of OU and the public at large. The website is a repository that stores thousands of hours of audio and video materials online. The materials are free and publicly available to the institution's students, staff, alumni, and the public for teaching, learning, research, and collaboration.

PCIaaS also provided the platform for hosting several of the institution's systems, including the World War One crowdsourcing solution. The World War One crowdsourcing platform enables the general public to contribute relevant materials, including stories, pictures and objects related to Oxford during the First World War. In addition, the Nomads in Oman, a web-based digital archive, is used for storing more than 30 years of research work conducted by the institution's researchers. An opinion expressed by the Web/Digital Officer, Said Business School/ Bodleian Libraries, when he noted that, "*It (*Nomads in Oman*) is basically quite a complex web application for managing and saving photos. So is from, one of the academics I work with had about 30 years work of research grant for their research, which we needed to store and deliver online. Nomads in Oman is a digital archive of about 30 years of research work conducted by one of the researchers in Oxford University*". The online digital archives platform enables multiple users (citizens of Oman and OU researchers) to collect new research data, collaborate and contribute research materials.

5.1.1.19 Reduce the Amount of Space

OU has a federated IT delivery model whereby every department and college in the institution has its own IT infrastructure used in delivering IT services solely to members of their department or college. As a result, PCIaaS helped consolidate its IT infrastructure and reduce physical hardware footprints, thereby utilising less space.

Having a centrally provisioned PCIaaS that serves the whole institution's IT infrastructure needs eliminates every department and college's need to have their server (communication) rooms. For example, the Director of Infrastructure Services noted, "*the IaaS housed a far more efficient data centre than maybe when it was in small machine rooms scattered around the campus. Yes, I do think we gained efficiencies from that*". The System Administrator also expressed a similar opinion, Cloud Services, when he noted, "*we are using blade servers, with very small footprints. We can fit basically 64 blade servers into four physical racks. So, the physical space we need is much reduced in virtualisation*".

5.1.1.20 Accelerate/Lower IT Barriers to Innovation

The institution's PCIaaS helped lower IT barriers to innovation by providing affordable, cheap, fast, and easy access to IT platforms to put new ideas to test and to develop innovative systems. For example, Technical Lead noted that PCIaaS had reduced IT barriers to innovation "*by providing an environment for this (new business innovation)*". In a follow-up interview, he also noted, "*We kind of facilitate that (new business innovations) [.....] we got an environment on which they can provision their* *new applications, their program or their service or whatever they do. We got something for them. They do not have to find their solution to deploy their solution at some level. The IaaS has something for them. So, yes, I think we facilitated that*".

The provisioning of the innovation server and DIT environment also accelerated and lowered the IT barrier to innovation by providing a platform for developing and testing new applications. The Team Leader, Microsoft Access and Dynamics Team, Central IT Services, expressed the opinion when he noted that "*we use the cloud on three projects, essentially. So, I use it as a small Windows set of box as innovation server*". The continued by noting that "*the second area that is part of our use here, we have, a lot our projects will end up having quite large production environments, so we want to test a Sequel box, some web service, and we want to test that infrastructure earlier on, but for the many parts, we do need UAT [.......]. So, what we can do, we create a DIT environment that looks like production*".

5.1.1.21 Improve Satisfaction of Work

PCIaaS helped improve work satisfaction. The skills, knowledge, and personal development achieved, coupled with the institution's pride in having a PCIaaS that is fit for purpose, were significant sources of workplace satisfaction for the institution's members. The Web/Digital Officer, Said Business School/ Bodleian Libraries, expressed this opinion when he noted, "*Certainly, for my part, it has helped me learn much more about the best practice in terms of system administration and help in delivering projects. And I think that is tied to job satisfaction as well, you know, if your infrastructure is well professional and better managed, you know, that makes your job easier*". The Web/Digital Officer further continued by suggesting that the training and development opportunities and the additional skills acquired were sources of job satisfaction when he noted, "*You know you have job satisfaction, you are picking up skills, and you are working successfully. You know, the infrastructure wise, is running properly, and you have that kind of reassurance*".

5.1.1.22 Eliminate Bureaucratic Bottlenecks

Before PCIaaS, IT/business partnership and implementing projects that did not fit within the remit of a single department was problematic and challenging. PCIaaS has reduced, eliminated the bureaucratic bottlenecks that previously hampered the implementation of such projects. The elimination of these bureaucratic bottlenecks improved IT/business partnerships and made closer coordination and partnership between the various departments and colleges and the Central IT Services department easier.

The elimination of bureaucratic bottlenecks also resulted in the development of several new and innovative business solutions. Multiple study participants agreed with this observation. For example, the Technical Lead, Cloud Services, noted, "*Also of relevance here may be the fact that we offered the IaaS internally to IT Services projects as well, at no formal cost (as it would mean one IT Services team cross-charging to another, which makes little sense). So, IT Services projects have been able to take advantage of the private cloud and save themselves a lot of time/money/bureaucracy in deploying the resources they need*". This opinion was also corroborated by the Web/Digital Officer, Said Business School/ Bodleian Libraries when he noted, "*if the project involved does not really fit within a department, then the department is not going to let their IT staff work on it either. Private cloud team with the Central IT Services can take responsibility for that part of the system*". Thus, eliminating the bureaucratic bottlenecks helped bridge the institution's IT/business divide and the collaborative implementation of new systems, as discussed in Section 5.1.1.18.

5.1.1.23 Attracting Potential Students/Branding

PCIaaS enhanced the ability of OU to brand and attract potential students to the institution. The institution has a high rated reputation worldwide. Having a well-secured and modern IT infrastructure helps in branding and boosting the corporate image of the institution. PCIaaS has also enabled the institution to develop new types of external-facing products, applications, and services such as the institution's website and OU Apple Podcasts to project its corporate image to potential students, which has helped improve its corporate impact and ability in attracting potential students. For example, the Technical Lead Cloud Services that OU Apple Podcasts "*is a very popular service, apparently - both in terms of the publicity the University generates through publishing these videos (on, e.g., iTunesU or wherever) and in terms of students being able to catch up on lectures they missed/want to review again*". The Technical Lead Cloud Services, also noted that potential "*students come to the* *university website and to some degree to decide whether they go to Oxford or not, we host that*".

5.1.1.24 Allow Employees to Work Remotely

PCIaaS has reduced on-site support requirements and enabled IT personnel to work remotely from any country, which was previously impossible without VPN connectivity. For example, during one of the follow-up interviews with the Technical Lead, Cloud Services, the researcher found that he was in Iceland. The first interview with the Technical Lead, Cloud Services, was conducted while still in the UK. For example, Technical Lead, Cloud Services noted, "*Yeah, I think the VPN is really what makes the difference if I am honest. Although that said, I am working more on VMs in the cloud since moving to Iceland, as they can be accessed without recourse to VPN*". The Technical Lead, Cloud Services, also noted, "*So yes, I think it (PCIaaS) does provide some value there (by enabling him to work from Iceland)*" It is worthy to note that allowing employees to work remotely from home also helped to improve better work-life balance.

5.1.1.25 Free up Time to Focus on Core Business

PCIaaS has helped free up more time for IT personnel to devote to other important aspects of the institution's core business. Multiple participants expressed the opinion. For example, the Director of Infrastructure Services noted, "*I think there is a drive to say look if you got IT staff in a department or college, there are preferences that the IT staff are focusing on what is distinct about the department or college. And the more commodity-type IT should be pushed back to the central IT service".* The Director of Infrastructure Services further noted that the main benefit of PCIaaS to IT personnel is "*freeing up capacity to meet local requirements rather than to be doing what is general-purpose. We see this across the board. Obviously, IaaS helps here, but we also see it in other areas like networking, and desktop management and so on*". Despite the Director of Infrastructure Services claiming that the commodity-type IT being pushed back to the Central IT Services, the institution's PCIaaS IT personnel could still perform other responsibilities other than exclusively managing and supporting its PCIaaS. Consequently, the institution's PCIaaS IT personnel could now deliver more services than was previously possible.

5.1.2 Analysis of PCIaaS Business Value Dimensions

Table 5-2 presents the analysis of the PCIaaS organisational performance impact across nine PCIaaS business value dimensions, showing the most dominant and most relevant dimensions to participants in OU.

Table 5-2: OU – Analysis of the Most Dominant and Relevant Dimensions

Dimension of Business Value	No of PCIaaS Performance Measure	Most Dominant		Most Relevant	
		Freq (%)	Rank	Mean (%)	Rank
Business Risks Reduction	5	49 (21.88%)	1	9.80 (4.38%)	1
Improvement in Flexibility, Agility and Responsiveness	3	25 (11.16%)	3	8.33 (3.72%)	2
Research, Development & Innovation	3	23 (10.27%)	5	7.67 (3.42%)	3
Productivity Improvement and Labour Efficiency	6	40 (17.86%)	2	6.67 (2.98%)	4
Enhancement of Products and Services	3	18 (8.04%)	7	6.00 (2.68%)	5
Better Utilisation of Resources	3	17 (7.59%)	8	5.67 (2.53%)	6
Cost Reduction	6	25 (11.16%)	3	4.17 (1.86%)	7
Positive Working Environment	7	23 (10.27%)	5	3.29 (1.47%)	8
Increase Competitiveness & Growth	3	4 (1.79%)	9	1.33 (0.60%)	9

Legend: 1st – 3rd: Highly Significant, 4th – 6th: Moderately Significant, 7th – 9th: Less Significant

Table 5-2 outlines the most dominant and most relevant PCIaaS business value dimensions in OU across three categories. Both groups show differences in the hierarchy in seven of the dimensions of business value. Three dimensions of business value decreased in their hierarchy while four dimensions increased in their hierarchy. The top six most dominant dimensions of business value were: (1) business risks reduction, (2) productivity improvement and labour efficiency, (3) reduction of business risks, (4) improvement in flexibility, agility, and responsiveness, (5) research, development, and innovation, and (6) positive working environment. In contrast, the top six most relevant dimensions of business value were: (1) business risks reduction, (2) improvement in flexibility, agility, and responsiveness, (3) research, development, and innovation, (4) productivity improvement and labour efficiency, (5) enhancement of products and services, and (6) better utilisation of resources.

The dimensions of business risk reduction and improvement in flexibility, agility, and responsiveness are in the highly significant category of both groups. In contrast, the business value dimension of increase competitiveness and growth emerged in the less significant category appearing in the ninth position on both groups. This finding suggests that business risk reduction and improvement in flexibility, agility, and responsiveness are the most significant business value dimensions in OU. In contrast, the business value dimension of increase competitiveness and growth is the least significant business value dimension in OU.

5.1.3 Analysis of PCIaaS Performance Categories

Table 5-3 presents the analysis of the PCIaaS organisational performance impact across the two PCIaaS organisational performance categories, as revealed in Appendix 20.

Table 5-3: OU – Organisational Performance Categories

Organisational Performance Categories	Freq (%)
Operational Effectiveness	214 (95.54%)
Strategic Positioning	10 (4.46%)
Total	**224 (100%)**

Table 5-3 shows that operational effectiveness was the most dominant organisational performance impact of PCIaaS in OU. Operational effectiveness accounted for about 214 (95.54%), while strategic positioning was less dominant, accounting for only 10 (4.46%). PCIaaS performance measures in eight of the business value dimensions helped enhance its operational effectiveness. The result also reveals that some of the performance measures derived from PCIaaS in the dimensions of research, development and innovation, and increased competitiveness and growth enhanced its strategic positioning. However, the dimension of research, development and innovation was the only dimension that enhanced operational effectiveness and strategic positioning.

5.1.4 Summary and Findings: Organisational Performance Impact of PCIaaS

First, Table 5-1 presents the analysis of PCIaaS performance measures in OU. This study identified additional three PCIaaS performance measures in the data collected. The analysis shows that 25 PCIaaS performance measures were in the highly supported category, seven were in the less supported category, and seven were in the not supported category. Additional three PCIaaS performance measures also emerged from the data collected. Eleven PCIaaS performance measures emerged in the top ten PCIaaS performance measures in OU, while ten measures emerged in the bottom ten.

Secondly, Table 5-2 presents the analysis of PCIaaS business value dimensions. This study highlighted the hierarchical order of the most dominant and most relevant business value dimensions. Business risk reduction and improvement in flexibility, agility, and responsiveness emerged in the highly significant category of both groups. Increase competitiveness and growth emerged in the less significant category of both groups.

Thirdly, Table 5-3 presents the analysis of the PCIaaS organisational performance impact across the two categories. The result shows that operational effectiveness is the most dominant category, while strategic positioning is the less dominant category. The following sections present the organisational resources involved in exploiting PCIaaS in OU to improve its organisational performance, commencing with organisational factors.

5.2 OU: RQ2 – Analysis and Findings of Organisational Factors

This section presents the analysis of the organisational factors that influenced the realisation of the performance impact of PCIaaS in OU. Table 5-4 presents the nine organisational factors identified in OU across the five dimensions of organisational factors.

Table 5-4: OU – Categorisation and Frequency of Organisational Factors

Dimensions	Organisational Factors	Freq (%)
Organisational Structure	Governance and Decision Making*	16 (30.77%)
	Total	**16 (**30.77%)
Organisational Strategy	Business Vision	5 (9.62%)
	Education and Training	5 (9.62%)
	Motivational Incentives	4 (7.69%)
	Appropriate Strategy & Policy Changes	2 (3.85%)
	Total	**16 (**30.77%)
Organisational Power & Politics	Stakeholder Support/Resistance**	6 (11.54%)
	Top Management Support and Commitment	4 (7.69%)
	Total	**10 (**19.23%)
Organisational Culture	Institutional Culture and Environment	5 (9.62%)
	Total	**5 (**9.62%)
Organisational Processes	Business process and applications redesign	5 (9.62%)
	Total	**5 (**9.62%)

Dimensions	Organisational Factors	Freq (%)
Grand Total		**52 (100%)**

Legend: * Most visible, ** Second most visible, *** Third most visible

Table 5-4 highlights the organisational factors in each of the five dimensions and frequency distribution. Organisational strategy has the highest number of organisational factors and the highest number of supporting quotes in OU, accounting for four organisational factors and 16 (30.77%) supporting quotes. The dimension of organisational structure has one of the least organisational factors but the highest number of supporting quotes, with 16 (30.77%).

Organisational power and politics account for the second-highest number of organisational factors consisting of two organisational factors. This dimension accounts for the third highest number of supporting quotes. This finding suggests that power and politics are equally essential to exploiting PCIaaS in OU. In contrast, organisational culture and organisational processes also have one organisational factor each but account for the least supporting quotes. Furthermore, governance and decision-making were the most visible factors, with 16 (30.77%) supporting quotes. In contrast, appropriate strategy and policy changes are the least visible factors, with 2 (3.85%) supporting quotes. Finally, the second most visible factor was stakeholder support and resistance, with six supporting quotes.

However, this study suggests that the nine organisational factors have a differential influence on the performance impact of PCIaaS. Table 5-5 outlines the influence of the organisational factors identified in OU across the five dimensions and their impact on exploiting PCIaaS for performance impact.

Table 5-5: OU – Analysis of Organisational Factors Strengths and Weaknesses

Dimensions	Organisational Factors	Impact
Organisational Strategy	Education and Training	+
	Business Vision & Objectives	±
	Appropriate Strategy & Policies Changes	+
	Motivational Incentives	+
Organisational Power and Politics	Top Management & Commitment	±
	Stakeholder Support & Resistance	±
Organisational Structure	Governance & Decision-making	±
Organisational Culture	Institutional Culture & Culture	+
Organisational Process	Legacy Business Processes & Apps	-

Legend: + Positive impact (Enabler), - Negative impact (Inhibitor), ± Varied impact

Table 5-5 highlights the impact of the nine organisational factors identified in OU across three clusters: (1) positive impact, (2) varied impact, and (3) negative impact. Four organisational factors emerged in the positive impact cluster, four in the varied impact cluster, and only one organisational factor in the negative impact cluster. The organisational factor in the negative impact cluster did not contribute to exploiting PCIaaS for performance improvement.

All the organisational factors in the dimension of organisational strategy had a positive impact, except business vision and objectives, which had a varied impact. This finding indicates that organisational strategy had the most influence and is critical to the institution's ability in exploiting the potential of PCIaaS. Legacy business processes and applications had a negative impact. The researcher attributes the s negative impact of legacy business processes and applications to the institution's governance and decision-making structure. There was a lack of visibility into what every department and college are doing. More so, their right to decide not to subscribe to the PCIaaS means that their legacy business processes and applications are still in place. Therefore, negatively impacting the institution's ability to maximise the value of PCIaaS negatively.

Governance and decision-making structure, although the most visible organisational factors, had a varied impact on PCIaaS. Despite the efforts in encouraging the autonomous departments and colleges to subscribe to the centrally provisioned PCIaaS, the individual departments and colleges have the sole authority to decide on their choice of IT infrastructure. Consequently, some departments and colleges decided not to subscribe to PCIaaS and held on to their legacy IT infrastructure. As a result, there was an inconsistent take on of PCIaaS in the institution, which negatively impacted the institution's ability to maximise the value of PCIaaS. The following sections discuss the organisational factors that influenced the performance impact of PCIaaS in OU, beginning with education and training.

5.2.1 Education and Training

The integration of PCIaaS into OU was challenging and was mainly due to lack of awareness, knowledge gaps, fear, and resistance to change. Education and training were vital in overcoming these identified challenges. First, there was a lack of awareness of the potential of PCIaaS among critical members of the institution, including the top management. Second, the education and awareness of the strategic importance of PCIaaS to the institution provided by the PCIaaS IT personnel to these decision-makers were vital in gaining their support and trust. For example, in Section 5.3.1.5, it was found that PCIaaS IT personnel created the awareness of the benefits of PCIaaS by educating the institution's sceptical top management of its benefits to the institution.

Second, despite the years of professional experience and existing skills/knowledge, the institution's existing IT personnel lacked the skills/knowledge to fit into the PCIaaS IT personnel's role. As a result, the institution's existing IT personnel completed additional education and training to acquire the necessary cloud computing-related technical skills/knowledge to fit into the new role. For example, Technical Lead, Cloud Services, noted, "*We took some VMware related courses*".

Third, there was passive resistance by some of the departments and colleges to PCIaaS. As the subject experts and driver for PCIaaS in the institution, the institution's PCIaaS IT personnel's role was to educate members of the institution's community to engage, persuade and encourage them to subscribe to the centrally provisioned PCIaaS. For example, Technical Lead Cloud Services noted, "*We do not have a mandate, not as the university as a whole because we do not have the mandate to force that on people, we can only encourage it. There is a strategy to try and encourage it*". This opinion was also corroborated by the Director of Infrastructure Services when he noted, "*We can only make the case as to why it might be a good idea to virtualise more of the hardware estate*".

5.2.2 Business Vision and Objectives

The institution's business vision and objectives for PCIaaS were: (1) business risks reduction, (2) cost-effectiveness, (3) modernise legacy IT infrastructure, and (4) promotion of central services. The institution considers PCIaaS a cost-effective way to modernise its ageing and legacy IT infrastructure spread across the different colleges and departments in the institution. Multiple participants expressed this opinion. For example, the institution's Director of Infrastructure Services noted, "*the private cloud came about partly because departments and colleges in the university were running their own hardware in inappropriate spaces, so not in proper machine rooms or communication rooms but wherever they could put a rack or half rack of* *equipment. And it was felt that this was: (1) Inefficient, (2) High risk, particularly for critical systems and inefficient in the sense of that in terms of the electricity costs and the cooling and so on, they were higher than they should be*". This opinion was also expressed by the Director of Infrastructure when he noted that "*private cloud service was established to provide a cost-effective means of encouraging departments and colleges to move away from their own silos of hardware onto a virtualised infrastructure*".

Before PCIaaS, the implementation of cross-functional projects was problematic due to a lack of centrally provisioned IT infrastructure. Furthermore, as a very devolved institution, the colleges were unwilling to allocate their human and IT resources. Consequently, one of the institution's objectives for PCIaaS is to promote centralised services across the institution and integrate it into its strategic plan. Multiple participants agreed with this approach. For example, the Director of Infrastructure Services noted, "*One of the drivers of having IaaS centrally is to reduce risks of vulnerable unpatched or end of life servers' hardware within a department or college. And I think that is one of the drivers for having IaaS*". The Technical Lead, Cloud Services, also corroborated the above opinion when he noted, "*private cloud really came out of the strategy to promote central services and transfer people*". During the interview, the Technical Lead, Cloud Services also noted, "*there was a strategy back in 2011, which is when the cloud was formed, that services should be centralised where possible [....] and to try and follow the university strategic plan which was to offer or have the university take-up more central services of which the private cloud is one*". The data also indicated that the institution's IT committee consisting of "*representatives from the major divisions in the university*", played a significant role in the formulation of this strategy, promoting centralised services, including the development of new business applications and systems.

5.2.3 Appropriate Strategy and Policy Changes

Formulating appropriate strategy and policy changes enhanced the institution's ability to integrate PCIaaS into its business operations and processes. Some of OU's policy changes were: (1) a cloud-first policy and (2) a cloud acceptance usage policy. The data indicates that the cloud-first policy applied only to implementing cross-functional projects or projects implemented by the Central IT Services in conjunction with other departments and colleges. For example, the Team Leader, Microsoft Access, and Dynamics Team noted, "*if any department comes to us and says can you do this project, we in Central IT Services will always pick the cloud to do that at this time*". The institution also has a comprehensive cloud acceptable usage policy, as noted by the System Administrator, Cloud Services, who stated, "*we have acceptable use policy as an organisation which we expect all of our users to adhere to. It is quite a broad policy not to abuse the system or do anything illegal*".

5.2.4 Top Management Support and Commitment

Top management support and commitment influenced the institution's ability to exploiting PCIaaS. According to the data, sustained top management support and commitment throughout the lifecycle of the PCIaaS was critical in exploiting the potential of PCIaaS. Apart from the funding provided by the institution's top management at the initial stage of the implementation of the institution's PCIaaS, the top management failed to provide additional funding to purchase new tools necessary for post-implementation enhancement such as self-service provisioning. Such failure impeded the institution's ability to swiftly respond to users' requirements and needs, driving up the cost of services provided to users and preventing improvement in existing services and introducing new services. The top management's failure to identify the post-implementation enhancement funding to the institution's PCIaaS as a top priority negatively impacted its ability to maximise the performance impact of PCIaaS. For example, Technical Lead, Cloud Services noted,

> "*We do not have this support as we used to from senior management, not so much in terms of the ability to deliver what we intended to deliver in 2011, but we have not been really able to enhance it. For example, one thing is the ability of people beginning to self-service, self-provision their own VMs, at the moment they have to come to us, and we will provision the VMs for them, sure this takes a few hours, but what would be a nicer more efficient service that people are after is their ability to provision their own VMs without having to ask us to. We did not get any management buying all that and some various enhancement services as well, that would be nice to offer. We have not had buy-in for that for one reason or another*".

Technical Lead, Cloud Services also noted, "*to improve the business value, we still need more top management support than we currently got. We have not lost business value. You know what I mean. It is not worse than it was, but it has not [improved]. Over the years, we were hoping to improve service. And that would add value to the business based on business targets. But other things have taken priority, so that has not happened*".

5.2.5 Stakeholder Support

Organisational support and resistance also influenced the institution's ability to exploit PCIaaS. The institution's stakeholders supported the implementation of a centrally provisioned PCIaaS. For example, the Director of Infrastructure Services noted, *"our private cloud service was established in response to the growing demand for managed servers and storage and so on"*. However, like any organisational changes, despite committing to implementing any new technology, there was passive resistance to the use of centrally provisioned PCIaaS, especially among those departments and colleges that were reluctant to give up total control of their inefficient legacy IT infrastructure. For example, Technical Lead Cloud Services noted, "*To some degree, there is resistance amongst the colleges and departments for outsourcing if you like some of their infrastructures even though they still manage the VMs. A lot of them (colleges and departments) like to manage the entire stack all the way down to the hardware. So, the university's private cloud is like other clouds because it is not managed within the college or within the department. They kind of outsource it to Central IT Services*".

The resistance was due to the institution's governance and decision-making structure, which gives each department and college autonomous powers to decide on their IT infrastructure choice. However, the study participants sometimes preferred to use the term 'decision' rather than 'resistance' to describe some departments and colleges' unwillingness to subscribe to PCIaaS. For example, Technical Lead, Cloud Services noted, "*amongst some departments and colleges, then yes, there is resistance to that, it is not really, it is not even a resistance, it is their decision, they decide to use it, or they decide they do not like the idea and they do not want to use it*".

5.2.6 Governance and Decision-Making

The governance and decision-making structure had a varied impact on the performance impact of PCIaaS in OU. The institution had a combination of a bottom-up and a top-down decision-making structure aligned with its subsidiarity principle. The delegation of decision-making powers to the IT team was instrumental in the institution's adoption of PCIaaS. For example, the Director of Infrastructure Services noted, "*I am tempted to say in Oxford, the principle of subsidiarity helps because it allows for a combination of bottom-up and top-down service development*". The Director of Infrastructure Services also noted, "*I think the fact that that kind of responsibility and decision-making was devolved down to the team actually helped, so almost laissez-faire type approach helped to develop IaaS. That is not to say it would not have happened. It might have happened for different reasons and a later stage if we were reliant upon a more top-down approach to it*". The role played by the PCIaaS IT personnel will be discussed in Section 5.2.1.5 under Technological Leader.

As a federated and highly devolved institution consisting of several autonomous and self-governing colleges and departments, these colleges and departments are not only wholly independent administratively, legally, and financially but also make their own IT infrastructure decisions, manage their own IT budget, and own and manage their individual IT infrastructure. The institution's central authority lacks the mandate to compel departments and colleges to use the centrally provisioned PCIaaS. It was, therefore, the prerogative of the colleges to decide if they wanted to subscribe and use the PCIaaS services or not.

Consequently, the colleges were reluctant to cede their autonomy and powers to manage and control their own IT infrastructure and be dependent on Central IT Services. In addition, some colleges were subtly reluctant to subscribe to the centrally provisioned PCIaaS and did not want to decommission their traditional IT infrastructure by exercising or enforcing their rights. Interestingly, education and training were critical in overcoming these challenges. For example, Technical Lead, Cloud Services noted, "*As colleges and departments are to all intents and purposes separate entities making their own IT decisions, an IaaS private cloud perhaps fits in better at Oxford than it might at other HE institutions, where there is less devolution of IT decision-making*".

For PCIaaS to fit with the institution's governance and decision-making structure, the institution adopted public cloud-style provisioning of the institution's PCIaaS as a service, of which vCloud is the cloud computing technology. For example, the

Technical Lead, Cloud Services, noted, "*We are essentially business unit customers' last wall service provider. It is very similar to how a public cloud provider, Amazon or [.....]. We are operating at a much smaller scale. We are just rendering these services internally to our business units and to our other units, our colleges, and departments, that sort of thing*". A sentiment also echoed by the System Administrator, Cloud Services, when he noted, "*the way our organisation works, we are not necessarily a typical organisation in terms of how the university is devolved. In a typical IT organisation, you get much control over what your users do and do not. We act as like say an ISP we host stuff for our tenant*". The main reason for adopting the public cloud-style provisioning is to enable the departments and colleges to control the underlying IT infrastructure.

Interestingly, the inconsistent take-up of PCIaaS across the institution was also due to its governing and decision-making structure, which gave the colleges enormous powers to make their own IT decisions. Some colleges and departments were unwilling to surrender control of their IT infrastructure to the central authority. The institution's Director of Infrastructure Services expressed this opinion when he noted, "*I think there are some organisational factors that contribute to what I might call inconsistent take-up of the service. And again, this comes back to the idea that decisions are devolved to departments and colleges. So, this university does not have much. In terms of centralised IT, there is very little that has been mandated that it must be used. I think I have said this at the beginning. We offer a service; it is up to the departments and colleges to decide whether our service is good enough or attractive enough to take-up*". The Director of Infrastructure Services further added, "*I think that overall structure of the institution, as well as the federated nature of the institution, also works against a consistent approach to or strategic approach to things like cloud, whether it is a private cloud or public cloud*".

5.2.7 Institutional Culture and Environment

Institutional culture and environment positively impact the institution's ability to exploit PCIaaS, particularly its reputational culture and high-quality work culture. The institution is one of the most reputable tertiary educational institutions globally and has a high reputational culture for excellence built over the past century. The institution also has a high-quality and standard work culture for excellence that encourages its employees to deliver quality products and services, which also applies to the institution's PCIaaS. Therefore, having a modern and secured IT infrastructure enhanced the institution's reputational culture and public image. For example, the Web/Digital Officer noted, "*I think in terms of our image, and how we present ourselves to potential students is important. Being in Oxford, I mean, I do not know, I still work at the University, it does feel like we do not have to get anything particularly wrong before the media picks up on it. So, in terms of delivering modern professional IT solutions, it is important because, you know, if we get hacked, or systems go down, it is badly reported, that sort of thing potential students could take upon,[......] The University of Oxford is a huge reputational work that can cause reputational damage if projects are not delivered properly*".

5.2.8 Motivational Incentives

Due to the devolved nature of OU as a collegial institution with a federated governance structure, the institution's central authority has no mandate to compel the various autonomous departments and colleges to subscribe to the centrally provisioned PCIaaS. However, motivational incentives served as tools to attract and improve their engagement and participation in the diffusion of PCIaaS across the institution's length and breadth. For example, Technical Lead Cloud Services noted, "*we could not mandate this, so we have to make it attractive. So, there was funding that basically subsidised the price we offer to the wider university, so essentially we subsidised the costs for a couple of years to attract people in*". This opinion was also corroborated by the Director of Infrastructure Services when he noted, "*we offer a service, it is up to the departments and colleges to decide whether our service is good enough or attractive enough to take-up. We do not have a structure that says you must use, we must get rid of hardware, and 80% of our estate, IT estate must be virtualised. We do not just have that ability to say that to the university*".

5.2.9 Legacy Business Processes and Applications

There was very little organisation-wide visibility of the various departments and colleges' business processes due to the federated structure of the institution (hence the use of the thick walls to demarcate the departments and colleges in Figure 5-1). Consequently, the study participants could not say categorically if those departments and colleges redesigned their business processes. For example, Technical Lead, Cloud Services noted, "*I do not really know what many of the VMs are used for - at the IaaS* *level, we do not really need to know. We just want to know who is paying for the VM and who the technical contact should be. So what they run in it is not really of much concern to my team directly*". For example, the System Administrator, Cloud Services noted, "*our private cloud is more of IT systems-based, so we do not really have any visibility on what people are actually doing with their VMs because we just host, we look after the infrastructure*". The System Administrator, Cloud Services, also noted, "*I have only been here three years; the processes have remained pretty much the same since I have been here*".

Furthermore, Section 5.1.6.3 revealed that before PCIaaS, developing cross-functional applications or systems to improve the institution's business processes were problematic, which was one of the primary reasons for its adoption of PCIaaS. More so, Section 5.2.5 and 5.2.7 revealed an inconsistent organisational-wide take on of PCIaaS. As a result, some departments and colleges held on to their legacy business processes and applications. Therefore, the decision or refusal by some of these departments and colleges to subscribe to PCIaaS will negatively impact the institution's ability in exploiting PCIaaS to improve the legacy business processes and applications in such departments and colleges.

5.2.10 Summary and Finding: Organisational Factors

This section summarises the influence of organisational factors on exploiting PCIaaS on organisational performance in OU. The section highlights the nine organisational factors identified in OU that impacted its ability to exploit PCIaaS for performance improvement. Governance and decision-making emerged as the most visible organisational factors in OU, while appropriate strategy and policy changes are the least visible. This study also found that stakeholder support and resistance emerged as the second most visible organisational factors. In addition, the dimensions of organisational structure and strategy emerged as the most visible dimensions of organisational factors. However, organisational structure has only one organisational factor, while organisational strategy has the most organisational factors, account for four organisational factors. Finally, organisational power and politics is the third most visible dimension with two organisational factors.

However, the nine organisational factors identified in OU had a differential influence on the institution's ability in exploiting PCIaaS for performance improvement. Three categories of organisational factors were emerged: positive impact, varied impact, and negative impact. The three organisational factors that emerged in the category that had a positive impact are (1) education and training, (2) appropriate strategy and policies changes, (3) motivational incentives, and (4) institutional culture and culture. In contrast, legacy business processes and applications are the only organisational factors that emerged in the category that negatively impacted OU. As a result, legacy business processes and applications are not capabilities enabling organisational factors in OU. The study also shows that three organisational factors emerged in the category that had a varied impact on the institution's ability to exploit PCIaaS. However, PCIaaS IT personnel is the other organisational resources involved in exploiting PCIaaS for performance improvement in OU.

5.3 OU: RQ3 – Analysis and Findings of PCIaaS IT Personnel

PCIaaS IT personnel in OU played a significant role in the institution's ability in exploiting PCIaaS to improve its organisational performance. According to the Technical Lead, Cloud Service, the institution's PCIaaS IT personnel also contributed to the performance impact of PCIaaS by ensuring that its PCIaaS environments were highly available and reliable. When the researcher asked Technical Lead, Cloud Services if he thought that he played any role in shaping the performance impact of PCIaaS in his institution? He responded by saying, "*Yes, in terms of its availability and reliability*". The following section presents the analysis and findings of the activities performed by PCIaaS in OU, through which they contribute to the performance impact of PCIaaS.

5.3.1 Profiles of Activities Performed by PCIaaS IT Personnel

This section presents the analysis and discussion of the activities performed by PCIaaS IT personnel in OU. Table 5-6 presents the profiles of activities of PCIaaS IT personnel in OU.

Table 5-6: OU – Profiles of Activities of PCIaaS IT Personnel

Categories	Profile of Activities	Freq (%)
Operational Orientation	Architecture Builder*	30 (40.54%)
	Project Coordinator	14 (18.92%)
	System Provider	7 (9.46%)
	Total	**51 (68.92%)**
Strategic Orientation	Partner**	19 (25.68%)

Categories	Profile of Activities	Freq (%)
	Technological Leader^	4 (5.41%)
	Total	**23 (31.08%)**
Grand Total		**74 (100%)**

Legend: * Most Visible, ** Second Most Visible, ^Least Visible

Table 5-6 highlights the activities performed by PCIaaS IT personnel in OU, showing the architecture builder as the most dominant activities profile. Following is the partner profile. The activities profile of the project coordinator emerged as the third most dominant. The researcher attributes the dominance of partner and project coordinator activities profiles to the training, consultancy, and advisory services performed by PCIaaS IT personnel across the length and breadth of the institution in encouraging and convincing sceptical departments and colleges to subscribe to the centrally provisioned PCIaaS. The following sections discuss each of the five profiles of PCIaaS IT personnel's activities, beginning with architecture builder.

5.3.1.1 Architecture Builder

The activities performed by PCIaaS IT personnel in OU under this profile were: (1) building and managing the PCIaaS environments; (2) managing and planning systems development and implementation; (3) supporting hardware and software installation, configuration, and maintenance; (4) producing technical documentation; (5) technical leadership, and (6) crisis management. The institution’s PCIaaS IT personnel were actively involved in building and managing the institution’s PCIaaS environments. For example, The Technical Lead, Cloud Services, noted,

> “*I was involved in the design and implementation of the private cloud solution at a technical level, as well as defining the two services that we would offer from it (Hosted VMs and vDCs). Subsequent to that, I have been running the two services and been heavily involved in BAU operations (support, maintenance, and upgrade of the infrastructure, for example)*”.

The role played by the institution’s PCIaaS IT personnel under this profile was key to the successful implementation of the institution’s PCIaaS. For example, the Technical Lead, Cloud Service, who is the Sectional Head of the PCIaaS IT personnel, noted, “*I believe it was key to delivering the two services that we now offer out of the private* *cloud, from specifying, designing and deploying the infrastructure to architecting the two services that run on top of it*".

The activities performed by the institution's IT personnel also included the management of the PCIaaS environments and the planning of systems development and implementation. For example, Technical Lead, Cloud Services, noted that he was responsible for the "*management of the technical aspects of the services (including enhancements and development)*". Similarly, the System Administrator, Cloud Services, also noted, "*my role as a sysadmin is to manage the VI, which includes managing associated compute, network and storage*". PCIaaS IT personnel performed business-related activities under this profile and played a leading role in all aspects of its IT infrastructure/virtual environments. For example, the data reveals that IT personnel in OU are required to not only "*provide technical leadership for storage platforms within Infrastructure Services*" but also "*take a leading role in the development and deployment of automated systems for the management, maintenance, and enhancement of the virtual infrastructure*". Technical leadership is multi-disciplinary and requires a combination of technical, business management skills/knowledge. Some of the business management skills required for these activities might include leadership, teamwork, communication, and interpersonal skills/knowledge.

The activities performed by the institution's IT personnel also included supporting hardware and software installation, configuration, and maintenance, including keeping the hardware and software up to date. The Technical Lead, Cloud Services, also noted that IT personnel were required to "*plan and deploy operating system and application upgrades, security patches and other advanced system management tasks*". Technical Lead, Cloud Services also noted that he "*kept it (PCIaaS) running, ensured it has not run out of resources, fixed things that have broken for one reason or another. Tested disaster recovery, ensured it is still relevant in a modern age of containers and serverless*".

5.3.1.2 Systems Provider

The main activities performed by the IT personnel in OU under this profile were provisioning, deploying, and delivering quality and reliable PCIaaS services in response to users' requests, requirements, and needs. The institution provided two

PCIaaS services to the institution's members, including tenanted private cloud services and hosted VM services. The tenanted private cloud service provided an entire IT infrastructure to the colleges and departments, while the hosted VM service provided vServers to individual users. For example, Technical Lead Cloud Services noted that "*we simply responded to a number of customers in the University who were asking for IaaS to replace their existing vSphere local installations*".

PCIaaS IT personnel also played the role of service manager and ensured that services provided to the institution's members met the agreed SLA. The Director of Infrastructure Services noted, "*the Team Leader is also a service manager, so they are responsible for ensuring that the service is delivered and performed against an agreed SLA*". This study found that the institution's top management's lack of sustained support to provide funds to implement self-service provisioning negatively impacted this activity's performance (see Section 5.2.4 under top management support and commitment).

5.3.1.3 Project Coordinator

PCIaaS IT personnel in OU performed the project coordinator's activities by leading and participating in project implementation across the institution, previously problematic activities, mainly due to the bureaucratic bottleneck surrounding the implementation of cross-functional projects. For example, in Section 5.4.6.3, this study found that PCIaaS has helped eliminate the bottlenecks that previously hampered the implementation of cross-functional projects. PCIaaS IT personnel participated in the implementation of several projects across the institution. For example, when the researcher asked the Technical Lead the projects implemented using PCIaaS, he responded, "*I think there are lots of projects I could name, but just before I do, I kind of go and talk to them to make sure they are happy to be named in that. But I can do that. So, yes, there certainly would be projects*". As the SMEs, IT personnel also guided the implementation of projects on PCIaaS services. The Web/Digital Officer of the Business School also noted, "*When you are setting up a project, they will check through what you are trying to do with the system*".

Other activities performed by the institution's PCIaaS IT personnel under this profile were: (1) managing relationships with internal and external parties and (2) engaging, liaising, and collaborating with internal and external parties. For example, the

Technical Lead, Cloud Services, stated that "*engaging with stakeholders, architects, colleagues, and third-party suppliers to define strategic technical approaches to platforms, system integration, and IT operations management*" are some of the activities performed by the institution's PCIaaS IT personnel.

5.3.1.4 Partner

The activities performed by the institution's IT personnel under the profile of partners were providing consultancy, advisory services, advice, and expertise, not only to the institution's top management but also to the respective departments and colleges in the institution. For example, the System Administrator, Cloud Services, noted, "*I have been in a position where we offered consultancy to members of the university virtualisation and cloud services*". The data gathered from Technical Lead, Cloud Services, reveals that PCIaaS IT personnel are not only responsible for the "*provision of VMware consultancy where appropriate, acting as a subject matter expert*" but also to provide "*advice on VMware system security matters, maintaining high-level skills in this area*".

The institution's PCIaaS IT personnel also performed strategic partners' activities by setting out strategies, roadmaps, and policies to align its IT infrastructure with institutional business operations. For example, the data gathered from Technical Lead, Cloud Services reveals that IT personnel are not only responsible for the "*developing technical strategy and roadmaps within Infrastructure Services and the wider University*" but are also required to "*define and drive strategic technical approaches to platforms, system integration, and IT operations management*". PCIaaS IT personnel also provided leadership in the institution's IT infrastructure and strategic directions. For example, the data gathered from the Technical Lead, Cloud Services requires the institution's PCIaaS IT personnel to "*take a leading role in defining technical strategy, design, development and delivery, management and the continual improvement of systems providing IT Services to the University*". PCIaaS IT personnel in OU were also required to "*establish and chair when required, technical strategy working groups and similar bodies*". The data gathered from the Technical Lead, Cloud Services, also reveals that the institution's IT personnel were required to "*participate in the group's various activities within IT Services and across the University in promoting technical awareness and best practice*".

The institution's PCIaaS IT personnel also partnered with departments and colleges and persuade and encourage them to subscribe to the centrally provisioned PCIaaS and participate in group activities to promote technical awareness and best practices. This opinion was expressed by the Director of Infrastructure Services when he noted, "*so our job in Central IT Services is to make the case and to persuade a college or a department to invest their budget in a service that we provide, either by making the case that it is more cost-effective to do so or to make the case that it is more resilient or lower risks to do so*".

5.3.1.5 Technological Leader

PCIaaS IT personnel in OU also performed technological leaders' activity and were instrumental in the institution's adoption of PCIaaS. In addition, they played a significant role in getting buy-in from sceptical top management to provide funding for investment in the institution's PCIaaS. The Director of Infrastructure Services echoed the above opinion when he noted, "*the decision to put in place a private cloud as an IaaS was taken not by top-level management, but actually by the team which was delivering the service because they can see that it was not a more efficient way of doing things*". When the researcher asked the Technical Lead Cloud Services if the institution's PCIaaS IT personnel played any role in shaping the performance impact of PCIaaS, he responded by saying, "*Yes, in terms of ... and pushing it (PCIaaS) through back in 2011 to a sceptical upper management (needed some investment)"*.

Due to IT's ever-changing and evolving nature, PCIaaS IT personnel in OU also researched to assess new and emerging technologies and the most cost-effective way of providing IT services. The institution's PCIaaS IT personnel were required, according to the data gathered from the Technical Lead, Cloud Services, to "*assess new technologies and their use in the context of a centralised virtual infrastructure and central storage environment, used in a multi-tenant environment*". The data gathered also reveals that IT personnel conducted "*research into the most cost-effective solutions that fit the needs of the service*". Such research and assessment of new technologies provided direction and guidance in convincing the departments and colleges to subscribe to the centrally provisioned PCIaaS and how best they can embed the use of new and emerging technologies into the fibre of the institution's business operations.

5.3.2 Skills/knowledge of PCIaaS IT Personnel

This section presents the analysis and discussion of the skills/knowledge of PCIaaS IT personnel in OU. Table 5-7 presents the skills/knowledge of PCIaaS IT personnel identified in OU.

Table 5-7: OU – Skills/Knowledge of PCIaaS IT Personnel

Dimension of Competencies	Skill & Knowledge	Freq (%)
Technical Competencies	Vendor(s) Cloud Infrastructure	10 (10.75%)
	Storage Area Network (SAN)	10 (10.75%)
	Networking	8 (8.60%)
	Programming Language	6 (6.45%)
	Troubleshooting/Problem Solving	4 (4.30%)
	Automation and Orchestration	3 (3.23%)
	Systems Integration	2 (2.15%)
	Virtualisation	2 (2.15%)
	Active Directory	1 (1.08%)
	IT/Cloud Security	1 (1.08%)
	Software-defined everything	1 (1.08%)
	Total	**48 (51.61%)**
Business Management Competencies	Interpersonal and Communication	8 (8.60%)
	Information Technology Management	7 (7.53%)
	Business Domain	5 (5.38%)
	Customer Service & Relationship Management	5 (5.38%)
	Project Management	4 (4.30%)
	Teamwork	3 (3.23%)
	Data Regulation and Compliance	3 (3.23%)
	Leadership	3 (3.23%)
	Analysis and Judgment	2 (2.15%)
	Systems Analysis and Design	2 (2.15%)
	Self-Motivated	1 (1.08%)
	Time Management	1 (1.08%)
	Sense of Humour	1 (1.08%)
	Total	**45 (48.39%)**
Grand Total		**93 (100%)**

The researcher categorised the 24 skills/knowledge into the two dimensions of competencies adopted in this study, consisting of 11 technical competencies and 13 business management competencies. The most dominant skills/knowledge in hierarchical order are (1) vendor(s) cloud infrastructure, (2) storage area network, (3) networking, and (4) interpersonal and communication skills/knowledge. However, the technical competencies have a higher frequency than business management competencies.

PCIaaS IT personnel require both technical competencies and business management competencies. While the technical competencies required are different from other IT professionals' roles, the business management skills/knowledge are generally the same as those in other IT personnel roles. The Director of Infrastructure Services expressed this opinion when he noted, "*Yes, they do have soft skills, but to be honest, the soft skills are also required in other types of roles*". The following section presents the discussion of each of the dimensions of the competencies (skills/knowledge) of the institution's PCIaaS IT personnel.

5.3.2.1 Technical Competencies

PCIaaS IT personnel should be highly technically skilled and have diverse skills/knowledge to implement a successful PCIaaS. The System Administrator, Cloud Services, expressed this opinion when he stated that "*you need good people to implement a successful private cloud, highly technical people conscientious, Perfectionist*". This participant also noted that PCIaaS IT personnel should also have "*deep technical knowledge*". The System Administrator, Cloud Services, further noted that "*if you got incompetent people running your environment, probably you have issues, I guess. The competence of the IT personnel running the cloud is very important*". However, the Director of Infrastructure Services presented a similar but opposing argument to the opinion expressed above by the System Administrator, Cloud Services, when he noted, "*No actually. In our case, I can see why that might be true in some organisations. In our case probably not, a different set of skills but not necessarily more qualified*".

PCIaaS IT personnel require a new set of technical skills/knowledge not previously applied to other IT personnel roles. One key finding in OU is that training influences IT personnel technical competencies and is fundamental to the performance of their activities. Despite the years of IT professional experience, the institution's existing IT personnel underwent additional training to acquire cloud-related technical skills/knowledge to fit into the role of PCIaaS IT personnel. Technical Lead, Cloud Services noted, "*We took some VMware related courses. And we actually had some consultancy with VMware themselves to come and help us with the design*".

PCIaaS IT personnel must have transferable skills/knowledge between cloud platforms, particularly those applicable to the public cloud. The Technical Lead, Cloud Services, agreed when he noted, "*we are beginning to use that (referring to AWS) too*". In a follow-up question, the researcher asked if PCIaaS IT personnel require a different skill set for public cloud IaaS. The Technical Lead, Cloud Services, said, "*yes, some things there are different. But the fundamental concepts are much the same, and managing your cloud with automation is similar too (PowerShell/Python skills are useful)".*

PCIaaS is a complex network of computers, systems, and software running in the same physical infrastructure. Therefore, PCIaaS IT personnel need troubleshooting and problem-solving skills/knowledge to support and manage the institution's PCIaaS environments effectively. According to Technical Lead, Cloud Services, PCIaaS IT personnel should have "*expert knowledge to troubleshoot and resolve complex issues in the VMware virtual environment, including networking, software, hardware, and SAN related issues*". Other technical skills/knowledge required by PCIaaS IT personnel included automation and orchestration, system integration, and virtualisation.

5.3.2.2 Business Management Competencies

The study identified 17 business management skills/knowledge of PCIaaS IT personnel in the data gathered in OU. PCIaaS IT personnel need interpersonal and communication skills/knowledge due to its importance in performing almost all the activities across all profiles. Interpersonal and communication skills are vital in dealing with customers and explaining technical concepts in a non-technical language. For example, Technical Lead Cloud Services noted, "*You need the ability to articulate how it works to a customer. So, you need to be able to talk to both technical and non-technical people in order to not necessarily sell a service but to explain how it works, what it is for, where it is useful, where it might not be so useful. So that is a combination of technical and communication skills*". The Technical Lead Cloud Services further noted that "*most of our customers are system administrators in technical folks themselves. So, you have a technical conversation with them, but it is one that you are able to articulate. So, you need communication skills to do that, the technical skills to know what the issue you are talking about*". PCIaaS IT personnel's interpersonal and communication skills were crucial in getting top management buy-in. Also, as technological leaders for PCIaaS in OU, they were the primary champions for adopting the PCIaaS (See Section 5.3.1.5).

PCIaaS IT personnel need IT management skills/knowledge to predict and forecast growth in customers' demands, and IT services requirements. For example, Technical Lead, Cloud Services, noted, "*you need the ability to predict how the demand for the services is going to grow or not*". This finding indicates that customer satisfaction was of fundamental importance to the institution's IT personnel. IT management skills/knowledge were some of the critical skills/knowledge required by PCIaaS IT personnel in OU to predict future trends in the cloud computing industry to enable IT personnel to make sound business decisions. For example, Technical Lead, Cloud Services, noted: "*you need some technologist skills to predict how IaaS, how private cloud ... next two years*". The System Administrator, Cloud Services, noted that it was vital for PCIaaS IT personnel to have "*the ability to look at technology and understand what is coming down the road in the next four/five years is important, keeping abreast with current development*".

Skills/knowledge in the institution's business area were also necessary for PCIaaS IT personnel. The System Administrator, Cloud Services, noted that "*it is necessary for [PCIaaS] IT personnel to have knowledge of the business area*" and "*… as an IT person, you need to understand what your organisation is trying to achieve and help achieve them. It is important to have a broad knowledge of what the business is doing*". With the increasing involvement of PCIaaS IT personnel in project implementation across the colleges and departments, having a broad understanding of the institution's business area and those of each of the colleges and departments was vital in meeting the business needs requirements. PCIaaS IT personnel were SMEs in the provisioning and use of PCIaaS and were involved in project implementation across several colleges and departments, so they needed project implementation skills/knowledge. For example, Technical Lead, Cloud Services noted that PCIaaS IT personnel required "*project management skills to implement and design solution adequately*". PCIaaS IT personnel's necessary skills/knowledge were leadership, data regulation and compliance, teamwork, analysis and judgement, systems analysis, and design.

5.3.3 Summary and Findings: PCIaaS IT Personnel

The within-case analysis illustrates that the institution's PCIaaS IT personnel performed the five profiles of activities through which IT personnel contribute to ITBV, were (1) architecture builder, (2) systems provider, (3) project coordinator, (4) partner, and (5) technological leader. The architecture builder's profile is the most visible, followed by the partner's profile. The project coordinator activities profile is the third most visible profile of activities performed by PCIaaS IT personnel in OU. Finally, the profiles of the system provider and technological leader are the least performed activities. The first activities profile performed by PCIaaS IT personnel in OU was that of the technological leader. In performing this responsibility, they were instrumental in the institution's adoption of PCIaaS by assessing and investigating the viability of the new and emerging technologies in providing the most cost-effective IT services to the institution's members. In addition, their role was vital in getting the institution's top management buy-in.

Architecture builder is the second role performed by PCIaaS IT personnel in OU. The primary responsibility of the architecture builder is building and managing the institution's PCIaaS environments. In addition, the architecture builder is also responsible for managing and planning systems development and implementation of upgrades or enhancement to PCIaaS. Other responsibilities performed include supporting hardware and software installation, configuration, and maintenance, producing technical documentation, providing technical leadership, and crisis management. The responsibilities are vital to providing a highly available and reliable PCIaaS that is fit for purpose, without which the realisation of the organisational performance impact of PCIaaS will be problematic.

As the systems provider, PCIaaS IT personnel provide high quality and reliable PCIaaS services to meet users and business needs and requirements. They respond to users and business needs and requirements and ensure that the services provided meet the agreed SLAs. In performing the responsibilities of project coordinator, PCIaaS IT personnel in OU actively participated in implementing system development projects across the institution. In addition, PCIaaS also manage relationships with internal and external parties by engaging, liaising, and collaborating with internal and external parties. Finally, PCIaaS IT personnel perform partner responsibilities by training members of the institution and providing consultancy and advisory services and expertise to the institution's members, including the top management.

This study also identified 24 skills/knowledge that enabled the institution's PCIaaS IT personnel to perform their responsibilities. However, the analysis also shows that training in the chosen vendor(s) cloud infrastructure to be critical in obtaining some of the skills/knowledge in technical competencies. The skills/knowledge consist of 11 technical competencies and 13 business management competencies. This finding highlights the dominance and importance of business management competencies to PCIaaS IT personnel in OU. This finding is not surprising because the PCIaaS IT personnel led the organisational change to PCIaaS as its technological leader. This role needs strong business management competencies such as business domain skills/knowledge and interpersonal and communication skills/knowledge.

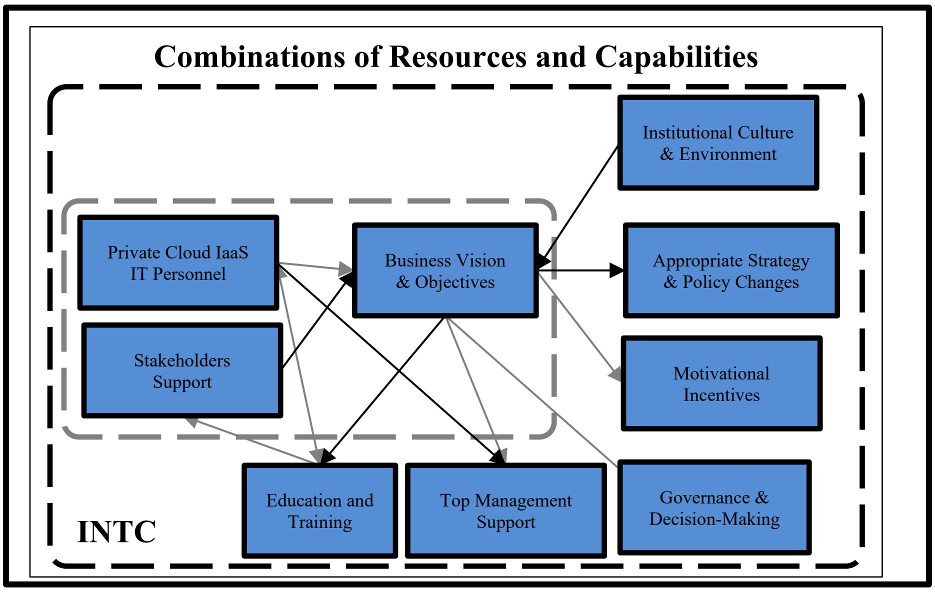
5.4 OU: RQ4 – Analysis of Organisational Capabilities

This section presents the analysis of RQ4, which investigates the capabilities visible in the two organisational resources investigated in RQ2 and RQ3 as presented in Section 5.2 and Section 5.3, respectively. Table 5-8 highlights the two capabilities identified in OU and the attributes of the resources that make up the capabilities.

Table 5-8: OU – Composition of PCIaaS Capabilities

Resources	Organisational Factors/Activities	RIC	INTC
Organisational Factors	Education and Training		X
	Business Vision and Objectives	X	X
	Appropriate Strategy and Policy Changes		X
	Stakeholder Support	X	X
	Top Management Support and Commitment		X
	Governance and Decision-Making		X
	Institutional Culture and Environment		X
	Motivational Incentives		X
PCIaaS IT Personnel	Architecture builder		X
	Systems Provider		X
	Partner		X
	Project coordinator		X
	Technological leader	X	

Table 5-8 presents the two PCIaaS capabilities identified in OU and the combinations of the resources that contributed to developing the capabilities. The activities profile of technological leader contributed to research and innovation capabilities while the other four profiles of activities contributed to integration capabilities. Two organisational factors contributed to research and innovation capabilities and integration capabilities: business vision and objectives and stakeholder support. Figure 5-2 presents the combination of resources and capabilities that enabled OU to leverage PCIaaS to improve organisational performance.



<u>NOTE</u>: Research and Innovation Capabilities (RIC), Integration Capabilities (INTC)

Figure 5-2: OU – Combination of Organisational Resources and Capabilities

Figure 5-2 highlights the combinations of resources and capabilities that worked together in OU to create the capabilities that enabled the institution to exploit the potential of PCIaaS to improve organisational performance. The two capabilities identified in the institution were: (1) research and innovation and (2) integration.

5.4.1 Research and Innovation Capabilities

PCIaaS IT personnel, stakeholder support, and business vision and objectives (see Figure 5-2) combined to develop OU research and innovation capabilities. The institution's PCIaaS was borne out of the objective to exploit emerging and new technology to promote central services to overcome some of the bureaucratic bottlenecks that hindered implementing cross-functional projects in OU. First, Section 5.1.5 indicates a growing demand among the institution members for managed servers, storage, and several other services. Consistent with the institution's learning culture, coupled with its desire to satisfy and meet the institution's members demands, it was revealed in Section 5.3.1.5 that its PCIaaS IT personnel, as the technological leaders for PCIaaS in OU, explored the variability of PCIaaS in providing the most secured, nimble, and cost-effective IT services to members of the institution. This particular activity sets the foundation and the pathway for integrating PCIaaS into the institution.

The promotion of central services helped enhance and accelerate the implementation and development of cross-functional IT services by eliminating the bureaucratic bottlenecks that previously hampered the institution's ability to implement and develop cross-functional systems and solutions. In addition, the promotion of central services and eliminating bureaucratic bottlenecks made it possible for the institution to respond swiftly to business needs rapidly. Subsequently, integrating PCIaaS into the institution and connecting it to its strategic plan was sanctioned by the institution's central IT committee, consisting of several key stakeholders.

5.4.2 Integration Capabilities

Many challenges characterised the institution's transition from its legacy IT infrastructure and integration of PCIaaS into its operations and processes. These challenges included passive resistance to change embodied in the institution's governance and decision-making structure, fear, and skills/knowledge gap. These challenges could undermine the integration of PCIaaS into the institution's operations and processes. Section 5.2.6 revealed a centrally provisioned PCIaaS by the institution's central authority worked against the spirit of the institution's devolved governance structure. The central authority lacks the mandate to compel the various autonomous colleges and departments to use the centrally provisioned PCIaaS. Consequently, by exercising their rights and authority as autonomous departments and colleges, some departments and colleges were subtly resistant to change. In addition, the institution's existing IT personnel lack of cloud computing-related skills/knowledge could hamper their ability to support and manage PCIaaS and fit into PCIaaS IT personnel's role.

Section 5.2.1 revealed a lack of awareness, knowledge gaps, fear, and resistance to change. The institution recognised education and learning as crucial in overcoming these challenges. In pushing PCIaaS across the institution, its PCIaaS IT personnel educated other institution members, including the top management, on the potential of PCIaaS in solving the institution's IT infrastructure problems. The education provided created the awareness of the potential of PCIaaS, which was vital in getting the institution's top management support to integrate PCIaaS into the institution's operations and processes.

Three of the institution’s existing PCIaaS IT personnel completed additional training to acquire the vital cloud computing-related technical skills/knowledge specific to the vendors’ cloud infrastructure (see Table 5-7). Having completed the requisite training, the institution’s existing IT personnel fitted into the new role created by PCIaaS and became the institution’s PCIaaS IT personnel and SMEs. They played a leadership role in driving and championing technological change management. The PCIaaS IT personnel also educated members of the institution that showed subtly resistance to change of the potential of PCIaaS with the view to encouraging them. For example, Section 5.3.1.4 outlines the vital role of PCIaaS IT personnel in educating, training, and providing advisory and consultancy services to the institution's members, especially the key stakeholders and sceptics in the PCIaaS colleges and departments. The education, training, and advisory and consultancy provided were critical in getting their support and buy-in and helped to integrate PCIaaS across the institution’s length and breadth.

Section 5.3.1.3 shows that PCIaaS IT personnel worked collaboratively with the various departments and colleges to implement projects aimed at new product development. As a result, some newly developed products and services resulted in better and higher quality services and research collaboration. Interestingly, the institution leveraged PCIaaS to develop several new cross-functional systems. Among these systems was ‘Nomads in Oman’, which has enhanced its ability to gather research data and collaborate between internal and external parties. The education and training also created developmental opportunities for members of the institution. Section 5.1 shows that PCIaaS improved the performance of those colleges and departments that integrated PCIaaS into their operations. Section 5.2.7 also shows that as a leading world-class university, members of the institution have a learning culture for quality and service delivery excellence. In adherence to this culture, members of the institution shared understanding that any major IT incident might result in loss of confidence and reputational damage. Hence, their desire to incorporate PCIaaS into their operations and processes.

Section 5.2.6 outlines the role of governance and decision-making in the institution’s ability to integrate PCIaaS into its operations and processes. Being a federated institution, the institution adopted a public cloud-style approach in deploying PCIaaS to reaffirm the colleges and departments' control over their IT infrastructure. This approach balanced two objectives: to respect the autonomy and authority of the individual colleges and departments and to deliver a centrally provisioned PCIaaS. The public cloud-style approach enabled the individual colleges and departments to control their PCIaaS and integrate PCIaaS into their operations and processes.

Furthermore, Section 5.2.3 reveals that formulating appropriate strategy and policy changes helped enhance the integration of PCIaaS in developing new products and services. One such policy change instituted by the institution was the cloud-first policy, which placed PCIaaS as the preferred IT deployment platform. This policy aimed to ensure the usage of PCIaaS for all new cross-functional IT systems and solutions and the migration of legacy IT systems to PCIaaS. To further enhance the institution's ability to integrate PCIaaS into its operations and processes, this study also found in Section 5.2.8 that the institution leveraged motivational incentives such as subsidies to encourage members of the institution to subscribe and integrate PCIaaS into the institution's operations and processes. The subsidies were put in place to ensure that PCIaaS was economically attractive compared to the legacy IT infrastructure.

5.4.3 Summary and Findings: Organisational Capabilities

This section highlights the capabilities for exploiting PCIaaS in OU to improve its organisational performance: (1) research and innovation capabilities, (2) integration capabilities. Unique and distinct combinations of the activities performed by PCIaaS IT personnel and organisational factors combined in developing these capabilities. However, organisational factors are the major contributor to organisational capabilities. The institution's research and innovation capabilities aimed at incorporating PCIaaS to solve its internal business problems and challenges was the entry point of PCIaaS into the institution. In achieving this business vision and objective, PCIaaS IT personnel and organisational factors contributed in diverse ways to ensure the successful integration of PCIaaS into the institution. For example, the institution's PCIaaS IT personnel needed additional training to acquire the skills/knowledge to support and manage the institution's PCIaaS to fit for business. They also disseminated their knowledge to other institution members through training, advisory, and consultancy services. In addition, the institution leveraged motivational incentives to encourage the various departments and colleges to subscribe and integrate PCIaaS into their operations and business processes.

5.5 Chapter Summary

This chapter aimed to present the within-case analysis of the organisational performance impact of PCIaaS in OU and the organisational resources and capabilities involved. First, this study identified 32 PCIaaS performance measures supported in OU, of which 25 were in the highly supported category and seven in the less supported category. The remaining seven emerged in the not supported category. This study also identified the top ten performance measures in OU. In addition, this study identified the two PCIaaS business value dimensions that emerged in the highly significant category of the most dominant and most relevant categories: business risk reduction and improvement in flexibility, agility, and responsiveness. The dimension of increase competitiveness and growth is the least significant PCIaaS business value dimension in OU. This study also identified operational effectiveness as the most dominant category of the organisational performance impact of PCIaaS in OU, while strategic positioning was less dominant.

Second, this study identified nine organisational factors in OU across the five dimensions of organisational factors. The organisational strategy had the highest number of factors and occurrences of supporting quotes. All the factors of organisational strategy except business vision and objectives positively impacted exploiting PCIaaS, which had a varied impact. Business vision and objectives are the vehicle that drives the performance impact of any organisation, and thus PCIaaS. Compared to other cases, this might put OU in a disadvantageous position in its ability to fully exploit and maximise the potential available in PCIaaS in enhancing the institution's operations and processes.

Organisational structure had only one organisational factor, governance and decision-making, but has the highest number of supporting quotes as the dimension of organisational strategy with four organisational factors. PCIaaS is a centrally provisioned virtualised IT infrastructure. In contrast, the institution operates federated governance and decision-making structure that devolves absolute authority to the various autonomous departments and colleges. It is therefore not surprising that fusion might arise from the coexistence of two contrary systems. This finding might explain why governance and decision-making were the single most mentioned organisational factors.

The organisational power and politics had the second highest number of factors and supporting quotes. Both factors have a significant role to play in the performance impact of PCIaaS. Top management support and commitment are fundamental in getting funding for the pre-implementation and post-implementation enhancement of PCIaaS. The lack of sustained funding from the institution's top management negatively impacts the ability in exploiting the full potential of PCIaaS for performance improvement. Based on the institution's governance and decision-making structure, the individual departments and college are administratively, legally, and financially independent and have the rights to make their own IT infrastructure decisions, manage their own IT budget, and own and manage their individual IT infrastructure. As a result, some departments and colleges were subtly and passively resistant to change by exercising these rights and decision-making authority. It is therefore not surprising that stakeholder support and resistance is the second most mentioned organisational factors. Other organisational factors across other dimensions also had an impact on the performance impact of PCIaaS. Appropriate strategy and policy changes were the least mentioned organisational factors. However, four organisational factors had a positive impact, four had a varied impact, while one organisational factor had a negative impact.

The institution's PCIaaS IT personnel performed all five profiles of activities. However, the architecture builder's profile was the most visible, followed by the project coordinator's profile and the profile partner. The profiles of system providers and technological leaders were the least visible profile of activities in OU. The skills/knowledge required by PCIaaS IT personnel were identified and categorised across the dimensions of technical competencies and business management competencies. However, the skills/knowledge in the dimension of technical competencies were the most dominant in OU, while the skills are knowledge in the dimension of business management competencies was the least dominant.

Finally, the institution's PCIaaS IT personnel combined with organisational factors developed two capabilities: (1) research and innovation capabilities and (2) integration capabilities. However, organisational factors were the most dominant contributor to organisational capabilities. The institution's PCIaaS IT personnel, through their activities as technological leaders, and two organisational factors (stakeholder support and business vision and objectives), combined to develop its research and innovation capabilities. All organisational factors (see Table 5-8) and the activities performed by PCIaaS IT personnel across all five profiles except the technological leader combined in developing integration capabilities.

Chapter Six – University College Cork

6.0 Introduction

This chapter presents the within-case analysis and findings of the organisational performance impact of PCIaaS in UCC. UCC situates in Cork City was founded in 1845 as one of three Queen's Colleges located in Cork, Galway, and Belfast. The three colleges derived their names from the reign of Queen Victoria. The university was then known as Queen's College Cork (QCC). In 1908, it was renamed UCC under the Irish Universities Act of 1908. However, UCC was renamed National University of Ireland, Cork, in 1997 under the Universities Act 1997, but a Ministerial Order of 1998 renamed the university as UCC and made it a constituent university of the National University of Ireland.

The university is one of the most prominent universities in Ireland. UCC is a renowned institution that has produced scholars in all fields of human endeavours. The institution has produced notable personalities, including Professor George Boole F.R.S and Professor Mary Ryan, BA DLitt, to mention a few. Professor George Boole, the first Professor of Mathematics at QCC, invented 'Boolean algebra' in 1854. Boolean algebra is the foundation of the Digital Age, which forms modern high-speed computing. Mary Ryan was the first woman in Ireland and Great Britain to become a Professor. Mary Ryan was awarded a Professoriate of Romance Languages at UCC in 1909.

The institution is the third largest university in Ireland, with about 20,000 students comprising about 14,000 undergraduates' students and 3,000 international students. It offers 120 degree and professional programmes in the Humanities, Business, Law, Science, Medicine, Dentistry, and Nursing and has about 5,000 staff.

The institution has one PCIaaS environment, described as the Production environment, which runs on two cloud infrastructures: (1) VMware ESXI and (2) Microsoft HyperV. For example, the Director of the IT Services department noted, *"we use VMware and Microsoft. We use both hypervisors, HyperV and ESX"*. The environment offers vServers to members of the institution, used as application servers or database servers. The institution's PCIaaS consists of "*50% vSphere, 50% HyperV*". The present capacity of the PCIaaS environment is "*approximately 450 VMs, 150 vSphere, 300*

HyperV". According to the Senior Data centre Engineer, the institution's PCIaaS actual capacity is 600, but its current capacity "*without further investment at current rates"* is 450. In addition, the institution's PCIaaS environment also provides "*remote access using Citrix*". Figure 6-1 presents the UCC PCIaaS environment profile showing the institution's cloud technologies, the services provided, and the primary users of the services.

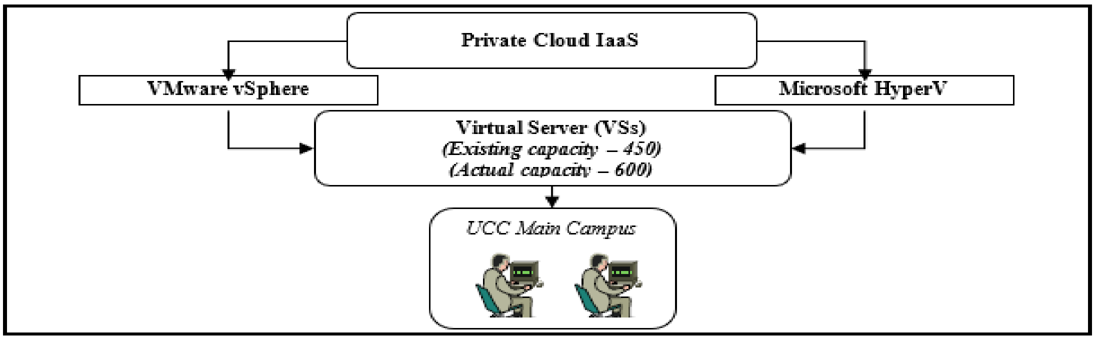


Figure 6-1: Profile of UCC PCIaaS Environment

The primary users of PCIaaS in UCC were the Applications Group in the IT Services department, Departmental IT staff, and the research community. The Director of IT Services noted, "*The end-users of our PCIaaS service are the applications team within my department, so we have an application team; they build all the applications, so they are one of the customers [….] Another customer is the IT people in the colleges, [….] The third customer probably which is growing is the research groups*". The Director of IT Services also noted that the Central IT Services department looked after half of the academic staff, while the other was looked after by the departmental IT. He also noted that "*but it is not consistent, for some academic staff, we look after them directly, and for some areas, they have the IT people. So, we look after maybe half of the academic staff, and maybe the other half have their own IT people, in the middle of that. Particularly areas where there are technology subjects being taught, such as Computer Science and BIS they have their own IT people*". However, the Director of IT Services stressed that "*the three big customer groups – my applications people, the IT people in the departments and the research groups. They are the three main customers for IaaS*". The following section presents the analysis and discussion of the organisational performance impact of PCIaaS in UCC.

6.1 UCC: RQ1 – Analysis and Findings of Organisational Performance

This section presents the analysis of the organisational performance impact of PCIaaS in UCC. The study investigated using 35 PCIaaS performance measures across nine dimensions of business value and two organisational performance typologies. The study identified one PCIaaS performance measure in the data collected – business process efficiency.

6.1.1 Analysis of PCIaaS Performance Measures

Table 6-1 presents the analysis of PCIaaS performance measures in UCC, showing their frequency distribution, ranking, and classification.

Table 6-1: UCC – Analysis of PCIaaS Performance Measures

Rank	PCIaaS Performance Measures	Freq	Percent	Category
1	Rapid responsiveness to business needs^	18	9.42	H
2	Cost-effective and affordable enterprise-class IT services^	16	8.38	H
3	Better business continuity and disaster recovery^	15	7.85	H
4	Greater resilience^	13	6.81	H
5	Improved infrastructure/data security^	13	6.81	H
6	Rapid turnaround time for new products development^	12	6.28	H
7	Development of new classes of products, apps & services^	11	5.76	H
8	IT staff efficiency^	10	5.24	H
9	Ease and simplicity of IT management^	8	4.19	H
10	High availability and reliability^	7	3.66	H
11	Centralisation and consolidation	6	3.14	H
12	Efficient and better utilisation of IT resources	6	3.14	H
13	Create training and development opportunities	6	3.14	H
14	Research repository and collaboration	5	2.62	H
15	Improve satisfaction of work	5	2.62	H
16	Free up time to focus on core business	4	2.09	H
17	Lower IT staff costs	4	2.09	H
18	Improve standard and modernity of IT infrastructure	4	2.09	H
19	Lower cost of failure	3	1.57	H
20	Lower IT management/ maintenance expenses/costs	3	1.57	H
21	Better and higher quality of services	3	1.57	H
22	Higher performance of IT resources	3	1.57	H
23	Accelerate/lower IT barriers to innovation	3	1.57	H
24	Improve productivity	2	1.05	L
25	Less worry/flexibility applying system-wide upgrades/update	2	1.05	L
26	Reduce costs of cooling and power – energy savings	2	1.05	L
27	Improve/enhance user experience*	1	0.52	L
28	Allow employees to work remotely*	1	0.52	L
29	Business process efficiency*	1	0.52	L
30	Increase/Improve competitiveness*	1	0.52	L
31	Provide opportunities for flexibility and autonomy*	1	0.52	L
32	Lower/eliminate software costs*	1	0.52	L
33	Reduce the amount of space*	1	0.52	L
34	Attracting potential students/reputational image*	0	0.00	N

Rank	PCIaaS Performance Measures	Freq	Percent	Category
35	Create opportunity for potential growth*	0	0.00	N
36	Collective problem-solving*	0	0.00	N
37	Better work-life balance*	0	0.00	N
38	Go green/reduced carbon footprint*	0	0.00	N
39	Eliminate bureaucratic bottlenecks*	0	0.00	N
	Grand Total	**191**	**100**	
	Mean	**4.90**	**2.56**	
	Median	**3.00**	**1.57**	
	Highly Supported Category (H)			**23**
	Less Supported Category (L)			**10**
	Not Supported Category (N)			**6**

Legend: ^ Top Ten Performance Measures, * Bottom Ten Performance Measures

There were a total of 191 occurrences of supporting quotes in UCC. The mean and median of supporting quotes were 4.87 (2.56%) and 3 (1.58%), respectively. The result shows that 33 of the PCIaaS performance measures investigated were supported in UCC, including 23 PCIaaS performance measures in the highly supported category, ten in the less supported category, and six in the not supported category. In addition, ten PCIaaS performance measures emerged in the top ten list of PCIaaS performance measures in UCC.

The result shows that the 23 PCIaaS performance measures in the highly supported category accounted for 178 (93.19%) of the supporting quotes, while the remaining ten in the less supported category account for the remaining 13 (6.81%). The analysis also reveals that the top ten PCIaaS performance measures account for 123 (64.40%) supporting quotes. All the business value dimensions had PCIaaS performance measures in the highly supported category, except for increased competitiveness and growth. The following section discusses the 23 PCIaaS performance measures in the highly supported category as the researcher deems them as the most important to study participants in UCC.

6.1.1.1 Rapid Responsiveness to Business Needs

PCIaaS has improved its agility and responsiveness in providing and delivering better and faster IT services to meet the university community's demands. Multiple participants expressed this opinion. For example, the Director of IT Services expressed this opinion when he noted, "*my unit is more agile and more responsive to the demands of the university community*". The Director of IT Services also noted, "*Infrastructure does not give me as many problems anymore. I can largely meet their demands from an infrastructure point of view*". This opinion was also corroborated by the Head of the Platform Group when he noted, "*the infrastructure that we have is private cloud, our IaaS that we have here has enabled us to be more responsive to the demands of our users out there*". The Head of the Platform Group also noted, *"we are more agile in terms of being able to deliver services out to people*".

PCIaaS has improved the responsiveness of the institution in meeting its IT infrastructure needs. Before PCIaaS, the institution cannot handle unexpected requests during the academic semester. For example, change requests to academic modules were handled before the commencement of the academic semester. However, PCIaaS has significantly enhanced the institution's ability to rapidly respond to unexpected changes to academic programmes in ways previously impossible with traditional IT infrastructure. It also provides the institution with the underlying IT infrastructure to swiftly respond and meet the digital transformation needs of the institution's rapidly changing environment.

The storage of research data and materials collected as part of any research programme is vital to any educational institution. This type of research data requirement is unpredictable as it depends on many external factors such as funding. PCIaaS provided UCC with the capacity to meet the data storage needs of the research groups. The institution can now adequately provide research groups with a secured storage platform to store their sensitive research data behind the institution's firewalls, and data regularly backed up to a second data centre to protect against any failures.

Having such a secure central storage platform for research data provides excellent benefits to both the researchers and the institution, particularly GDPR and research funding. As the owner of all the research data, the institution can now conveniently meet its obligations regarding the research data's security, such as access and storage, retention of research data, and archiving of the research data. Section 6.1.1.14 discusses data repository and collaboration.

6.1.1.2 Cost-effective and Affordable Enterprise-class IT Services

The general perception in UCC is that PCIaaS offered a cost-effective and affordable way of provisioning enterprise-class IT services. The institution conducted a cost analysis and compared the most cost-effective way of providing IT services between PCIaaS, public cloud, and traditional IT infrastructure. The analysis revealed that PCIaaS was more cost-effective than physical servers. For example, the Director of IT Services noted that "*we also put a pricing model in place internally as well so that we can charge people internally to buy the server because previously they might go to PFH just to buy the server, but now they come to us"*.

Furthermore, purchasing vServers in the PCIaaS was more cost-effective than in the public cloud. For example, the Director of IT Services noted, "*we do not tend to buy IaaS that much from the big guys (cloud providers) because we are big enough, we have enough stuff. We have about 200 – 300 terabytes worth of data that we need. So, the only reason we do it ourselves is that it is cheaper because we priced it with Microsoft and AWS, and that probably would be more expensive*".

The study also reveals that PCIaaS provided the institution with a cost-effective platform to host the institution's CoreHR solutions on-premise rather than subscribing to the vendor's cloud version, which would have cost the institution twice the amount they are currently paying the vendor for using the CoreHR solution. The Director of IT Services expressed this opinion when he noted, "*CoreHR said to me we got a cloud service, so we put it in our data centre, so not really cloud. It is just a BT data centre, and we got to charge you twice as much as you are currently paying. I kind of say no. I want to leave that where it is because there is no benefit for me in moving it there. Because I already got the hardware because I got enough under our system going on. 'Cos I already have that hardware, so a little bit extra for the CoreHr solution does not cost me enough extra, but you want to charge me double the price*". These analyses show that PCIaaS offered the institution the most cost-effective way of provisioning IT infrastructure than using either public cloud IaaS or the traditional IT infrastructure.

6.1.1.3 Better Business Continuity and Disaster Recovery

PCIaaS has improved business continuity and disaster recovery in UCC by ensuring minimal service disruption and downtime in the event of any system outrage. PCIaaS also provided the institution better disaster recovery in restoring data and mission-critical business applications and systems in a system outage. The Director of IT Services expressed this opinion when he noted, "*from a data point of view as well, now we have been able to build a disaster recovery because now we put all the systems* *into one data centre, we have a second data centre in the Western gateway, so we have some better disaster recovery. So now we have less single points of failure. So, we have better risk management for data and better risk management for our system outrage*".

PCIaaS also had unique features such as checkpoint, rollback, automatic failover, and mirroring. For example, the Head of the Platform Group noted, "*the fact that you have SANs that are replicating, you have computed on both sides, so that if a VM is running here, that if that node fails, it can failover across to another node in the cluster, and worst case, it could fail back out to the data centre, so that is the massive value that we have there*". These unique features and capabilities offered by PCIaaS helped to improve the institution's business continuity and disaster recovery capacity.

6.1.1.4 Greater Resilience

PCIaaS offered the institution greater resilience – this was one of the most dominant PCIaaS performance measures that emerged in the data gathered in UCC. PCIaaS provided greater resilience in failure by allowing its IT systems to failover from the primary data centre to the secondary data centre. The Head of Enterprise Application Group expressed this opinion when he noted, "*it probably thus offers greater resilience in terms of failover options and things like that*". Greater resilience provided the institution's IT infrastructure with many benefits in the face of risks. The most important is the significant reduction in failure or any catastrophic event capable of disrupting the institution's mission-critical applications and systems.

6.1.1.5 Improve Infrastructure and Data Security

PCIaaS enhanced the institution's IT infrastructure and data security by eliminating the practice of 'shadow IT'. Before PCIaaS, practices such as 'shadow IT' or 'ghost IT' and storing research data on 'Dropbox' were rampant in the institution, especially among the research community members. IT systems were not supported by qualified IT personnel in ghost IT practices. From the perspective of data security and privacy, having research data stored outside the institution's firewall was a bad practice. It exposed and made the institution's sensitive and non-sensitive personal data vulnerable to theft and cyber-attacks. Multiple study participants expressed this opinion. For example, the Director of IT Services noted, "*it has reduced some data risks […]. By centralising all of our data, we at least know where it is because in the past, for example, if a Professor in a department wants a server, he would build it themselves. Maybe a student will build it, then put their own data on it. Nobody knows what data was on that or if it is patched. So, anybody can potentially hack that server, and maybe it would have students' data on it, or maybe they are doing something with it. That risk is now less because all major systems are now on the central infrastructure, patched and secured. So that is an improvement, I think from a risk profile perspective [and] from a data point of view also*".

PCIaaS enabled the central IT services department to take back full responsibility, ownership, control, and management of the institution's IT infrastructure. Doing so has improved its IT infrastructure and data security and enhanced its compliance with its obligations under the applicable data protection laws, e.g., GDPR. The Director of IT Services noted, "*they more or less bought into that central model. Right now, they do not want the risk sitting with them anymore. Maybe before they did, but now with the data protection laws and legal obligations for holding data, they kind of prefer that I have that responsibility. They do not have to worry about that anymore*". The institution's ability to provide a secure central repository for research data also improves researchers' chances of getting their research funded by research funding bodies.

6.1.1.6 Rapid Turnaround Time for New Products Development

PCIaaS provided rapid turnaround time for IT services' deployment by reducing IT resources' deployment time from months to a few days or even hours by eliminating the procurement cycle for new physical servers. The PCIaaS IT personnel can swiftly create and copy VMs and deploy them multiple times as needs arise. Consequently, this has considerably reduced the amount of time previously taken to fulfil new physical servers' requests. It has also led to a significant reduction in delivery time for implementing projects and developing new business applications and systems. By accelerating the development time for new products, the institution can swiftly respond to business needs.

The swift deployment of VMs has also helped to eliminate the complexity of starting projects. Multiple participants agreed. For example, the Director of IT Services noted that "*I think I am faster. So, when the business needs a project to do, then I can supply the infrastructure quicker for the project*". An opinion also corroborated by the Head of the Enterprise Applications Group when he noted, "*the main thing here is that while hardware and building the platform was always a big component and a time contributor to projects in the past that now is significantly reduced*". More so, the Head of the Enterprise Applications Group also noted, "*the principal benefit, certainly the most obvious, will be the speed of delivery. We want to shorten the turnaround time for, say, requesting a server platform, which might take anything up to two months to turn around. We can now get that within a matter of hours but certainly within days. So that allows us to actually speed up the actual project delivering time quite a bit*".

6.1.1.7 Development of New Classes of Products, Applications and Services

PCIaaS facilitated the development of new classes of products, applications, and services in UCC, which have led to a significant increase in the services provided to members of the institution community. The primary aim of developing these new products, applications, and services was to support administrative duties and enhance educational services delivery, e.g., the provision of SQL servers to students of the BIS department. The System Administrator BIS department expressed this opinion when he noted, "*it has (PCIaaS has enhanced the delivery of educational services to your students). It just means we can offer more services as well because we have the time. So, let us say, now instead of just having Oracle, we now have Microsoft SQL for our students because we had time to maintain two servers whereas before we would have just offered one*".

PCIaaS enabled the institution to implement several new classes of products, applications and services or are in the process of being implemented. Notable among them were: (1) virtual desktops (vDesktop lab), (2) financial applications, (3) research applications, and (4) new digital services. Implementing vDesktop lab will help advance the institution's capability to deliver distance learning to students, particularly students in technology-intensive courses such as BIS and Computer Science. The research application will help to provide a platform for research data repository and collaboration. The new digital services will help redesign and streamline its legacy and inefficient business processes to make them more efficient and the institution more competitive.

6.1.1.8 IT Staff Efficiency

PCIaaS has improved the efficiency of IT personnel and departmental IT personnel in UCC. Study participants described several instances through which IT staff efficiency manifested, such as labour reduction, reduction in time and effort spent building servers and systems, and managing, supporting, and maintaining servers and systems. The institution's main benefits from IT staff efficiency were: (1) a significant increase in the services provided with fewer IT personnel and (2) timely response and fulfilment of business requests and needs. For example, the System Administrator, BIS department noted, "*Again, it comes back to our ability to offer more with less. Like previously, we could not offer those benefits because especially, during the term, because we are too busy*".

6.1.1.9 Ease and Simplicity of IT Management

PCIaaS has delivered ease and simplicity of IT infrastructure management by reducing the hardware that needs to be supported and maintained. The Head of the Enterprise Applications Group expressed this opinion when he noted, "*the ongoing operational management of that infrastructure is a lot less than if you were buying individual servers, and configuring those servers, extending those servers, replacing those servers in the kind of traditional mode of the traditional kind of server-based data centre*". As a result, the institution has the benefits of the simplicity of managing hardware from a single console and firmware upgrade, thereby reducing the complexity of managing and supporting the institution's IT infrastructure. Consequently, it is now easier to deploy services and system upgrades and to manage and monitor the institution's IT infrastructure's performance from a central location.

6.1.1.10 High Availability and Reliability

According to the opinion expressed by multiple study participants, the institution's legacy IT infrastructure and systems were "*going out of warranty*" and "*were unsupported*". Experience has shown that systems running on unsupported hardware expose the organisation to many vulnerabilities, including security risks, risk of availability, risk of reliability, risk of data loss, and many other different types of risks.

However, PCIaaS has improved the availability and reliability of the institution's IT infrastructure and services. According to the Director of IT Service, "*we have benefits of less risk on data availability*", "*I think there is less risk [...] Less risk for the data, less risk for the availability*", and that "*the infrastructure is [....] easier to make it highly available, which means that that is an improvement in our service offering*".

PCIaaS enhanced operational stability and provided better visibility of the institution's IT infrastructure and systems' monitoring and availability. For example, the Head of the Enterprise Applications Group noted, "*the other (benefit) would be operational stability*". Multiple study participants described the institution's IT infrastructure as a "*robust infrastructure*" with "*better load-balancing*". The Head of the Platform Group and the Head of the Enterprise Application Group expressed opinions. Robustness and load-balancing increase the availability and reliability of IT infrastructure and systems. Load-balancing also improves the performance of systems and improves better utilisation of resources. Members of this institution have also acknowledged the high availability and reliability of the institution's PCIaaS. The Director of IT Service expressed an opinion when he noted, "*I have not experienced any issue from the university community. People are saying it is great that they do not have to manage that physical server anymore, and the people have bought into it as well*".

6.1.1.11 Centralisation and Consolidation

Before adopting PCIaaS, UCC had a hybrid IT delivery model consisting of central IT and faculty/departmental IT services. PCIaaS enabled the institution to consolidate its IT infrastructure in a central location. The institution derived several benefits from consolidating its IT infrastructure and services in a central location. For example, the Head of the Platform Group noted that "*there is massive benefit from PCIaaS".* He continued by adding that "*it certainly consolidates your services, your infrastructure into one place*". In addition, centralisation enabled the institution's IT systems and data once scattered across the institution's length and breadth to be brought under the control and ownership of the central IT department, thereby improving the security of the systems and data and the security of the systems and data organisational data visibility.

Centralisation also enhanced the institution's compliance with GDPR and other applicable data protection laws and legal obligations. Second, centralisation helped in reducing infrastructure, data, and cybersecurity risks. Third, centralisation helped simplify IT administrative tasks such as managing storage, upgrading the firmware and management, and hardware maintenance. Finally, centralisation also helped eliminate IT assets' duplication across different faculties and departments. Duplication of IT assets results in the duplication of costs and IT personnel and inefficient use of IT assets.

6.1.1.12 Efficient and Better Utilisation of IT Resources

PCIaaS offers UCC scalability, shareability, reusability, and expandability of existing IT resources without adding more hardware resources. For example, the Director of IT Services noted, "*one of the big advantages of cloud is that you can scale big*". He also noted, "*I do not need as much infrastructure because I can share it between the different applications*". The Head of the Enterprise Applications Group also noted, "*very easily expandable, from the IaaS point of view*". He also noted, "*it gives us expandability*". Statistics have shown that the typical server utilises far less than its overall resources and capacity, and about 80% of the typical server capacity is unused. Therefore, efficient and better utilisation of IT hardware is derived from scalability, shareability, reusability, and expandability of existing IT resources without adding more hardware resources. Also, the running of several VMs enhances the efficient use of resources. However, the institution can only maximise scalability benefits if the business solutions are cloud-native applications. Cloud-native applications are software specifically designed and built to operate in cloud computing environments.

The reusability of PCIaaS resources has reduced waste, thereby enabling the institution to take more IT-related risks. Similarly, PCIaaS enabled the institution to charge users for usage or purchase servers for a short duration (i.e., a 'pay-as-you-go' plan). Reusability of resources helps improve efficiency and better utilisation of resources by avoiding purchasing a physical server that may be left idle if the user has no further use of the server after the project. In addition, the 'pay-as-you-go' plan helps to reduce the cost of failure.

6.1.1.13 Created Training and Development Opportunities

PCIaaS created training and development opportunities for the institution's IT personnel, including the PCIaaS IT personnel. While some institution's members attended the Irish Management Institute (IMI), others attended the Cork Institute of Technology (CIT) and Microsoft Online. Multiple participants expressed this opinion. For example, the Director of IT Services noted, "*Yes, there were a couple of things. We put some people on the Irish Management Institute (IMI) cloud business course, it a cloud for business masters*". The Director of IT Services also noted that "*two of my managers did that course, and several others of the technical staff did converged infrastructure, private cloud infrastructure training. So, they began to educate themselves about cloud infrastructure"*. He continued by adding that "*this was done during the process of our adoption of cloud*". The opinion expressed above was also echoed by the System Administrator BIS when he noted, "*I am currently completing a master's on Cloud Computing, obviously in CIT*". The System Administrator BIS also noted that "*I went and I complete a virtualisation online with Microsoft*" The purpose of providing these training and development opportunities to the institution's PCIaaS IT personnel and departmental IT personnel is to equip them with the skills/knowledge to exploit the potential of PCIaaS for performance improvement effectively.

6.1.1.14 Research Repository and Collaboration

Before PCIaaS, the institution lacks a centralised research data repository and collaboration systems. For example, Section 6.1.1.5 revealed that before PCIaaS, the use of 'shadow IT' or 'ghost IT' and Dropbox for storing research data were common practice, especially among the academic and the research community members. PCIaaS helped eliminate infrastructure and data security issues by providing a research data repository and collaboration platform. As a result, members of the institution academic and research community no longer have to rely on unsecured desktop computers, Dropbox, USB removable storage facility, or the traditional collaborative method of sharing printed papers, all of which are inefficient and prone to risks.

The System Administrator BIS department was more passionate about the importance of the institution's PCIaaS in creating research data repository and collaboration platforms for academic and research communities than other study participants in UCC. The insight provided by the System Administrator is not surprising because he is more involved with academia, students, and researchers than other study participants in OU. Therefore, he believed that PCIaaS enabled the institution to offer research repository and collaboration platform for the academic and research communities. As a result, the System Administrator BIS department believes that members of the academic and research communities can "*now share information*", "*maintain and manage the information better*", "*stored and shared (information) on a file, in a folder that they only have access to*", "*easier for them to collaborate*", and having a "repository of information they can use going forward". Therefore, he believed that PCIaaS "has helped us *enhance the research groups*" and make them "*now more efficient*". Table 6-2 outlines the System Administrator BIS department opinions on research data repository and collaboration.

Table 6-2: UCC BIS's System Administrator Opinions on Research Repository and Collaboration

Research Repository and Collaboration
"*from the old days of having a staff member who could even print out if they are sharing information to a colleague,* ***whereas now, it is stored and shared on a file, in a folder that they only have access to***".
"***It is easier for them to collaborate*** *as well because* ***they can share that information*** *as well. Like, we would have a lot of shared folders, and before, people could have had their own drives and their own information****, whereas now everything is shared****. Now, members of staff, we encourage them not to share anything locally.* ***Everything is shared in a shared folder,*** *there are shared folders for exams, there are shared folders for students, and* ***everything is more collaborative, their work is more collaborative as well***".
"*So again, I said previously,* ***the collaborative effect****, like if a staff member is writing a paper. We have a lot of research projects we* ***have dedicated to shared folders*** *[....] basically* ***they can collaborate a lot easier, and the sharing of data is a lot easier, and it has totally improved.***"
"*It has helped us* ***enhance the research groups****.* ***Research groups are now more efficient****. So, staff who currently are doing research and have research groups having been* ***able to maintain and manage the information better****. Let us say you have health research group at the moment. All that information is stored centrally for them in a private cloud. So,* ***if they are going on to a new project, that information is still there****. So, you are* ***maintaining almost like a repository of information they can use going forward.***"

Furthermore, having a secure and centralised research data repository also enhances the institution researchers' ability to get research funding from funding agencies. For example, the Head of Platform Group noted,

> "*a lot of the funding bodies now will actually insist that researchers […], if you work in a research group, and you go out for funding, they are going to start more and more now, looking to you for well, […], how are you actually going to make sure that the data is managed appropriately. What is the data plan in terms of, you know what during active research, how are you going to store that data? When the research ends, how are you going to actually archive that data and manage that data? And how are you going to make it openly accessible for other researchers to build on that, the outcomes that you have delivered as part of the research? So, a lot more of the research funding bodies are what they want now, so there is an obligation on us to be able to deliver that. There are multiple ways we can do that, and we do have the infrastructure to be able to do that, but the infrastructure, as I said, is not enough. There is a whole process around it*".

Having a secured centralised data repository helped reduced business risks by improving data security.

6.1.1.15 Improve Satisfaction of Work

The quality of work-life balance, making jobs better, and providing highly available and reliable IT Services derived from PCIaaS positively impacted job satisfaction in UCC. PCIaaS also provided excellent features that allow the proactive pre-emption of systems failures, which has helped deliver highly available and reliable IT services to business users. As a result, the institution's PCIaaS IT personnel are now experiencing a significant reduction in the time, effort, and stress levels previously associated with monitoring, managing, and supporting the institution's traditional IT infrastructure. For example, the Head of the Platform Group noted, "*the key here is actually to make their job better*". The System Administrator, BIS department, corroborated this opinion when he noted, "*it (PCIaaS) definitely contributed positively (job satisfaction) because otherwise, you could be spending days building a machine*".

6.1.1.16 Free up Time to Focus on Core Business

PCIaaS freed up more time for the institution's IT personnel and department IT technicians to focus on core business, particularly deploying and offering more services. Freeing up time for the institution's PCIaaS IT personnel to focus on other core business strategies enhances greater partnerships between IT and business. This opinion was expressed by the Director of IT Services when he noted, "*because it then allows my resources to focus on extracting value from the system rather than building the system […] there is plenty of work for IT and the less engineering we need to do, the more time we have to extract value from IT and engage in other organisation's business. We want to take IT out of the engine room, building all the bits, and make IT a partner with the business*". The System Administrator, BIS department expressed a similar opinion when he noted that "*it (PCIaaS) allows us to offer more (services). Again, I supposed people out there would always consider that virtualisation and private cloud will actually reduce the workload for IT personnel, but in fact, it just means you can offer more services*".

6.1.2.17 Lower IT Staff Costs

PCIaaS has enabled the institution to save money in providing IT staff requirements, thereby lowering IT staff costs. Despite the current size of the institution's IT infrastructure coupled with a significant increase in the services provided to members of the institution's community, the institution provided more services with a smaller number of PCIaaS IT personnel. The institution had two PCIaaS IT personnel supporting and managing its PCIaaS which is impossible in a traditional IT environment. The Senior Data Centre Engineer noted, "*Data centre team is two people, while services have significantly increased. New services are available, e.g., self-provisioning and storage*". The System Administrator, BIS department express a similar opinion when he noted, "*one person can do what previously could be three people doing it, to be honest*". This finding suggests that PCIaaS improved product productivity and labour productivity by enabling the institution to offer more services with fewer PCIaaS IT personnel. Improve productivity also emerged in the less supported category.

6.1.1.18 Improve Standard and Modernity of IT Infrastructure

One of the institution's objectives is to improve the standard and modernity of its IT infrastructure. Before adopting PCIaaS, the institution's IT infrastructure was ageing and out of warranty and unsupported. The institution's ageing IT prevented it from being agile and responsive in meeting its IT infrastructure needs. The data reveals that PCIaaS has helped improve modernity, robustness, and capacity and streamline its IT infrastructure. Multiple participants were of this opinion. For example, the Platform Group Head noted that "*we have a modern set of infrastructures*". The System Administrator, BIS department also stated that PCIaaS enabled the institution's IT infrastructure to be "*more modernised and more streamlined*". PCIaaS has also improved the standard of the institution's IT infrastructure. For example, the Head of Platform Group stated that the "*standardisation of the platform from an overall IT perspective is another big plus*" for PCIaaS.

6.1.1.19 Lower Cost of Failure

PCIaaS has lowered the cost of failure for researchers and the implementation of new projects in UCC by enabling the institution to offer a pay-as-you-go plan for IT services. Business users can now pay for IT services for a short duration instead of investing in a physical server's full cost. Such a 'pay-as-you-go' plan can help reduce the project's cost in the event of failure. The Head of the Platform Group expressed this opinion when he noted, "*PCIaaS will reduce the cost on them [...], so if they have a project, they go out as you said, and they buy a server and could cost them €5,000*". The Head of the Platform Group continued by adding that "*what we can do is, now is that if a researcher is only investing for five years, we can say, you want a server, it is going to cost you maybe €1,000 per year for a server of that spec, they might commit two years, and it is not working, and just kill it off so suddenly. They have not invested a huge amount of money in the research, so in that sense, yes it does*". Similarly, PCIaaS enables the institution to use its existing capacity, thereby eliminating the need to invest in new IT hardware and reducing the cost of failure. By eliminating the complexity previously associated with the start-up of new project implementation, PCIaaS has helped reduce project implementation costs and the cost of failure.

6.1.1.20 Lower IT Management and Maintenance Costs

This study identified several ways through which PCIaaS has lowered IT management and maintenance costs. The provisioning of reliable IT services free from any performance issue is the primary goal of any organisation. PCIaaS saved UCC maintenance costs by enabling the institution to provide high-performance computers, which has helped eliminate performance issues previously associated with its traditional IT environment. The Head of Enterprise Applications Group reported, "*I suppose, in terms of, is it saving a lot of money being able to provide the capacity to* *avoid any of those performance issues? Yes, certainly the cloud and the private cloud give us that"*. Congruently, the institution has also observed a reduction in IT management and maintenance costs. The System Administrator, BIS department expressed this opinion when he noted, "*for management, and for maintenance, management, cost-wise, it (PCIaaS) is excellent*".

6.1.1.21 Better and Higher Quality of Services

PCIaaS has enabled UCC to provide higher quality IT services which have helped ensure a speedy response to business users' IT service requirements and the high availability and reliability of the institution's IT services. The Director of IT Services expressed this opinion when he noted, "*the infrastructure is quicker to deploy, easier to deploy and easier to make it highly available, which means that that is an improvement in our service offering*". Due to the institution's IT infrastructure's improved capacity, the mission-critical financial systems have been upgraded and migrated to the institution's PCIaaS. Similarly, PCIaaS has also helped improve the quality of the educational IT services provided to students. For example, the BIS department can now provide higher quality, personalised educational IT services. Students of the department now have the IT resources to build their websites, and they are now provided with SQL servers, whereas previously, they only had network drivers with limited storage capacity.

6.1.1.22 Higher and Better Performance IT Resources

PCIaaS has helped to improve the performance of the institution's IT infrastructure and services. The Director of IT Services expressed this opinion when he noted, "*yes, I do think that our PCIaaS has increased the IT capability of this institution*". The institution's IT infrastructure's improved capacity to provide supercomputers has helped avoid performance issues in its IT systems, solutions, and applications. The absence of performance issues with the institution's PCIaaS enabled the institution to save costs that it would have usually spent on IT maintenance. The Head of the Enterprise Applications Group noted, "*is it saving a lot of money being able to provide the capacity to avoid any of those performance issues? Yes, certainly the cloud and the private cloud give us that*". High-performance computers are also indispensable for conducting complex computations or big data analytics.

6.1.1.23 Accelerate or Lower Barriers to Innovation

PCIaaS has lowered the IT barrier to innovation in UCC by providing opportunities for the institution's researchers to have free, cheap, easy, immediate, and on-demand access to the underlying IT infrastructure and resources to support research and innovation. For example, the Director of IT Services noted, "*it (PCIaaS) makes trying something new a little bit easier, let us say now they want to try out a new application, I can say okay, bring the application, we give you a VM, if it does not work, we get the VM back*". The Head of the Platform Group expressed a similar opinion when he noted, "*it (PCIaaS) does create opportunities for researchers to be able to, I supposed, quickly run up infrastructure to support their research projects*". The institution's system developers have also taken advantage of PCIaaS for rapid prototyping and pilot phases of new business applications in ways hitherto impossible with traditional IT. This opinion was echoed by the Senior Data Centre Engineer when he noted that PCIaaS has "*rapid prototyping and pilot phases*".

6.1.2 Analysis of PCIaaS Business Value Dimensions

Table 6-3 presents the analysis of the most dominant and the most relevant business value dimensions to study participants in UCC.

Table 6-3: UCC – Analysis of the Most Dominant and Relevant Dimensions

Dimension of Business Value	No of PCIaaS Performance Measure	Most Dominant		Most Relevant	
		Freq (%)	Freq Rank	Mean (%)	Mean Rank
Business Risk Reduction	5	50 (26.32%)	1	10.00 (5.26%)	1
Improvement in Flexibility, Agility, and Responsiveness	3	30 (15.79%)	2	10.00 (5.26%)	1
Cost Reduction	6	29 (15.26%)	3	4.83 (2.54%)	4
Productivity Improvement and Labour Efficiency	6	26 (13.68%)	4	4.33 (2.28%)	5
Research, Development & Innovation	3	19 (10.00%)	5	6.33 (3.33%)	3
Better Utilisation of Resources	3	13 (6.84%)	6	4.33 (2.28%)	5
Positive Working Environment	7	12 (6.32%)	7	1.71 (0.90%)	8
Enhancement of Products and Services	3	10 (5.26%)	8	3.33 (1.75%)	7
Increase Competitiveness/Growth	3	1 (0.53%)	9	0.33 (0.18%)	9

Legend: 1st – 3rd Position: Highly Significant, 4th – 6th Position: Moderately Significant, 7th – 9th Position: Less Significant

Table 6-3 shows the most dominant and relevant PCIaaS business value dimensions in UCC across three categories. There were similarities and differences in ranking some of the most dominant dimensions and the most relevant business value dimensions. Two dimensions of business value that maintained the same ranking as the most dominant and most relevant categories were: (1) business risks reduction (first position) and (2) increase competitiveness and growth (ninth position). The following four dimensions of business value increased in their position: (1) improvement in flexibility, agility, and responsiveness (second to the first position), (2) research, development, and innovation (fifth to the third position), (3) better utilisation of resources (sixth to the fifth position), and (4) enhancement of products and services (eight to the seventh position). The analysis also showed that three dimensions of business value decreased in their ranking: (1) cost reduction (third to the fourth position), (2) improved productivity and labour efficiency (fourth to the fifth position), and (3) positive working environment (seventh to the eighth position).

Three categories of dimensions of business value that emerged were: (1) highly significant, (2) moderately significant, and (3) less significant. The dimensions of business risk reduction and improvement in flexibility, agility, and responsiveness emerged in the highly significant categories in both groups. In contrast, the least significant dimension of PCIaaS business value in UCC are (1) positive working environment, (2) enhancement of products and services, and (3) increase competitiveness and growth. However, cost reduction and research, development, and innovation are also significant, emerging in the highly significant category in the one group and the moderately significant category in the other group.

6.1.3 Analysis of PCIaaS Organisational Performance Categories

Table 6-4 presents the PCIaaS organisational performance impact in UCC across the two PCIaaS organisational performance categories, as outlined in Appendix 21.

Table 6-4: UCC – PCIaaS Organisational Performance Impact

Organisational Performance Categories	Freq (%)
Operational Effectiveness	190 (99.47%)
Strategic Positioning	1 (0.53%)
Total	**191 (100%)**

Operational effectiveness was the most dominant category of the organisational performance impact of PCIaaS in UCC, accounting for about 189 (99.47%), while strategic positioning was a less dominant category, accounting for only one (0.53%). However, this study found evidence suggesting that the institution recognised that PCIaaS could enhance its competitiveness. Nevertheless, there was no noticeable evidence that PCIaaS had improved its competitiveness.

6.1.4 Summary and Findings: Organisational Performance Impact of PCIaaS

First, Table 6-1 presents PCIaaS performance measures showing their frequency distribution, ranking, and classification. The result shows that 33 of the PCIaaS performance measures investigated were supported, including 23 in the highly supported category and ten in the less supported category. The 23 PCIaaS performance measures in the highly supported category are the most relevant to study participants in UCC. Also identified is the top PCIaaS performance measures. However, the top six PCIaaS performance measures in hierarchical order are (1) rapid responsiveness to business needs, (2) cost-effective and affordable enterprise-class IT services, (3) better business continuity and disaster recovery, (4) greater resilience, (5) improved infrastructure and data security, and (6) rapid turnaround time for new products development.

Second, Table 6-3 presents the analysis of PCIaaS business value dimensions highlighting the most dominant and the most relevant PCIaaS business value dimensions across three categories. The dimensions of business risk reduction and improvement in flexibility, agility, and responsiveness are the most visible emerging in the highly significant categories in both groups.

Third, Table 6-4 presents the analysis of PCIaaS organisational performance impact across two categories. Operational effectiveness emerged as the most dominant category of PCIaaS organisational performance impact. In contrast, strategic positioning emerged in the less dominant category. However, the two organisational resources involved in exploiting PCIaaS for performance improvement are PCIaaS IT personnel and organisational factors. The following section discusses the influence of organisational factors on PCIaaS performance impact.

6.2 UCC: RQ2 – Analysis and Findings of Organisational Factors

This section presents the analysis of the organisational factors that influenced the performance impact of PCIaaS in UCC. Table 6-5 presents the organisational factors identified in UCC across the five dimensions.

Table 6-5: UCC – Categorisation and Frequency of Organisational Factors

Dimensions	Organisational Factors	Freq (%)
Organisational Strategy	Appropriate Strategy & Policy Changes**	10 (15.15%)
	Business Vision	7 (10.61%)
	Education and Training	4 (6.06%)
	Motivational Incentives	2 (3.03%)
	Educational Technology Champions	1 (1.52%)
	Total	**24 (36.36%)**
Organisational Power & Politics	Stakeholder Support & Resistance*	11 (16.67%)
	Top Management Support & Commitment***	9 (13.64%)
	IT Leadership	2 (3.03%)
	Total	**22 (33.33%)**
Organisational Processes	Business Process & Applications Redesign	7 (10.61%)
	IT Business Partnerships	5 (7.58%)
	Total	**12 (18.18%)**
Organisational Culture	Institutional Culture and Environment	6 (9.09%)
	Total	**6 (9.09%)**
Organisational Structure	Governance and Decision Making	2 (3.03%)
	Total	**2 (3.03%)**
Grand Total		**66 (100%)**

Legend: * Most Visible, ** Second Most Visible, *** Third Most Visible, ^Least Visible

Table 6-5 outlines the 12 organisational factors in each of the five dimensions and frequency distribution. The dimension of organisational strategy has the highest number of organisational factors and the highest frequency of supporting quotes in UCC. Closely following is the dimension of power and politics with the second highest organisational factors and the second highest frequency of supporting quotes. Organisation structure has the least number of organisational factors and the least frequency of supporting quotes. This finding suggests that organisational strategy, and power and politics are essential to exploiting PCIaaS in UCC.

Furthermore, stakeholder support and resistance were the most visible factors, accounting for 11 (16.67%) supporting quotes. Closely following is appropriate strategy and policy changes, with 10 (15.15%) supporting quotes. The third most visible is top management support and commitment, accounting for 9 (13.64%) supporting quotes. Governance and decision-making are the least visible organisational factors, with 2 (3.03%) supporting quotes. However, this study indicates that the 12 organisational factors differentially influenced the performance impact of PCIaaS. Table 6-6 highlights the strengths and weaknesses of the 12 organisational factors identified in UCC.

Table 6-6: UCC – Analysis of Organisational Factors Strengths and Weaknesses

Dimensions	Organisational Factors	Impact
Organisational Strategy	Education and Training	+
	Business Vision & Objectives	±
	Appropriate Strategy & Policies Changes	+
	Motivational Incentives	+
	Educational Technology Champions	-
Organisational Power and Politics	Top Management and Commitment	±
	Stakeholder Support and Resistance	±
	IT Leadership	+
Organisational Structure	Governance and Decision-Making	+
Organisational Culture	Institutional Culture & Environment	-
Organisational Process	Legacy Business Processes & Apps	-
	IT/Business Partnership	+

Legend: + Positive Impact, - Negative Impact, ± Varied Impact,

Table 6-6 highlights the 12 organisational factors that impacted the institution's ability to exploit PCIaaS for performance improvement. Organisational strategy accounted for the highest number of organisational factors, followed by organisational power and politics. The dimension of organisational processes had the third most visible organisational factor. Organisational culture and organisational structure had the least number of organisational factors. Organisational factors constituted strength and weakness to the ability to exploit PCIaaS in UCC. Seven of the organisational factors had a positive impact, two had a varied impact, while three had a negative impact. The researcher excluded three organisational factors that had a negative impact when considering its capabilities. Sections 6.2.1 to 6.2.12 presents the organisational factors across five dimensions. Section 6.2.13 presents the summary of the section. The following section presents the discussion of each of the organisational factors.

6.2.1 Education and Training

Some of the challenges experienced by UCC in integrating PCIaaS into the institution's operations and processes include (1) lack of awareness, (2) knowledge gap, (3) fear, and (4) resistance to change. Education and training were vital in overcoming these challenges. First, there was a lack of awareness of the potential of PCIaaS among the top management of the institution. Second, the education and awareness provided by the institution's IT leadership to the decision-makers on the strategic value of PCIaaS were vital in gaining their support and trust. For example, in Section 6.1.2, it was found that the IT leadership made a business case for pushing the new technology to the institution's top management.

Second, the complexity of PCIaaS requires IT personnel to require a broader set of new cloud-related technical and business skills/knowledge to manage and support PCIaaS effectively. For example, the Head of the Platform Group noted, "*everything is now converged centrally, and people need to have a broader set of IT skills and be able to cope with anything really*". However, the institution's existing IT personnel lacks the requisite technical and business skills vital to manage, support effectively, and exploit the potential of PCIaaS. Therefore, additional education and training are needed to upskill the institution's existing IT personnel to acquire the necessary cloud computing-related technical skills/knowledge and business skills to fit into the PCIaaS IT personnel's role. For example, in Section 6.1.6.1, it was found that some of the institution's existing IT personnel attended courses in IMI, CIT, and Microsoft Online to acquire the necessary skills/knowledge to manage and support PCIaaS. In addition, the institution's Director of IT personnel stressed the importance of additional education and training when he noted that "*people have to learn how to use it, make sure they are comfortable*". A similar opinion was also echoed by the System Administrator BIS when he noted that "*so, initially when we went down the road of virtualisation, I had to learn how to use HyperV, I had to learn even how to set the network for virtual resources*".

Third, some members of the institution were fearful of migrating from its legacy IT infrastructure to PCIaaS. As a result, these members were passively resistant to change. However, education provided to the institution's members helped mitigate such fear and resistance to change, enhance stakeholder support, and improve their ability to extract value from PCIaaS. The Director of IT Services expressed this opinion when he noted, "*Oftentimes, change and resistance to change probably have to do with fear of the unknown. But the more they learn it, the more they use it, the more they get used to it, and the more value they can extract from it. That is exactly* *what we did*". The Director of IT Services further added that to eliminate fear, resistance to change, and the ability to exact value from PCIaaS that "*We taught people how to use it, we took our time, it took longer than is expected, but everybody here now, I think, has bought into the cloud is the way of doing our business. For most people in IT, that is not a debate within IT anymore, whether not cloud or cloud. Most people are kind of saying the cloud is the way to go*".

Fourth, PCIaaS was intimidating to a particular IT personnel group that preferred the traditional IT infrastructure. Consequently, this group of IT personnel became resistant to change. The education, training and awareness provided to them on the usefulness of PCIaaS to their job and the institution by the institution's IT Leadership were vital in convincing them and getting their support. As the Director of the IT Services department noted, "*one of the things is that we have to convince some people that it was safe to use private cloud IaaS rather than the traditional physical servers. What I mean by that are the database people here in the IT department. Some of them say no, they do not want to use the virtual servers. I want the physical servers. The database people are the database administrators (DBA), the people running the Oracle systems. So, we have to convince them, so they are now on board as well*". The Director of IT Services also stressed the importance of educating institution's members that PCIaaS will not threaten their employment and the importance of additional education and training to exploit PCIaaS to enhance their performance. For example, the Director of IT Services noted, "*you need to explain to them how it is not a threat, how they can learn it and be part of the solution, how their jobs would change for the better*".

6.2.2 Business Vision and Objectives

The institution's business vision and objectives for PCIaaS centred around: (1) cost-effectiveness, (2) risks reduction, (3) modernity of IT infrastructure, and (4) agility. A clear, well-defined, and measurable business case articulated by the institution's IT Leadership and put forward to its top management was vital in gaining top management support and funding. The business case enabled the institution's top management to gain a complete understanding of the potential of PCIaaS for the institution. For example, the Head of the Platform Group noted, "*At the very start we upgraded our infrastructure here, we actually have to make a case, [the Director of IT Services] has to make a case to the University Management Team to say I need a certain amount of funding to invest in the data centre for the following reasons. Those reasons were an ageing infrastructure, so we have to move off because a lot of hardware was going out of warranty and unsupported, so we need to move that. And so, he wants to be able to build and offer IaaS to UCC and makes us more reactive. So, we have certainly delivered on actually*".

The institution also aligned its vision and objectives for PCIaaS with its strategic plan. The Director of IT Services stated, "*I think you need to connect your project for PCIaaS to strategic business value. You have to because that is how you get funding, and you get buy-in from the top management. So, you need to make the case, not because or we need VMware because it is cool, and you know my guys would like it, and it would make us get great 32 bits systems or 64 bits systems. No. You need to explain the value proposition of PCIaaS in business value terms such as agility, speed, and cost-effectiveness. So, you need to make that case*". To effectively leverage the potential of PCIaaS required aligning the PCIaaS with the institution's immediate business needs and requirements and its strategic plan.

6.2.3 Appropriate Strategy and Policy Changes

The formulation of appropriate strategy and policy changes enhanced the institution's ability to exploit PCIaaS. Some of the strategic changes identified in UCC were: (1) cloud-first policy, (2) cloud migration policy, and (3) cloud data storage policy. Multiple participants expressed this opinion. For example, the Director of IT Services noted, "*the policy of the institution toward the cloud is that if cloud exists, cloud-first. And if the cloud service is available, we would consume it first as a cloud service*". The Head of the Platform Group also echoed this opinion when he noted, "*we will not be replacing any of the hardware. We will not be replacing hardware on a like for like basis*". The Head of the Platform Group also noted, "*if any hardware comes up for replacement, we say look well, that should be migrated into our Converged infrastructure. That is the policy here*". The Head of the Enterprise Applications Group also corroborated this opinion when he noted, "*obviously the reality of the situation is, if I go and ask for a server unless there is a particular reason why it* *cannot be delivered through the IaaS model, then it is going to be delivered through the private cloud rather than [physical server]*".

As previously discussed in Sections 6.1.7.1 and 6.1.8.2, the storing of research data has always been problematic for the institution. The practice of storing the institution's research data in hard copy, Dropbox or unsecured computers ('shadow IT practices') was common. To stop these trends and enable the institution to comply with its obligations under GDPR and research funding agencies, the institution must have a cloud storage policy to compel all researchers to store their research data in a secured, central storage location. For example, the Head of the Platform Group noted, "*so unless a policy comes out, to say what, you must store your data here, if you are doing research on behalf of UCC, then you know what, this is where you store it*". This policy change will enable the institution to enhance the quality of services provided to the research community in meeting the needs of a rapidly changing educational and technological environment. Section 6.1.8.2 discusses the performance impact of having a secured storage location for research data repository and collaboration.

6.2.4 Top Management Support and Commitment

The funding provided by the institution's top management support was of vital importance during the pre-implementation stage of the institution's PCIaaS. For example, the Director of IT Services also noted, "*There was a buy-in from the top management that provided the fund to buy the infrastructure, which was very important*". However, sustained top management funding over the entire lifecycle of PCIaaS is equally vital in exploiting the potential of PCIaaS. However, the institution's top management failed to identify post-implementation enhancement of the institution's PCIaaS as a top priority. Consequently, getting the needed fund to purchase new tools essential for post-implementation enhancement and maximising the performance impact of PCIaaS was challenging. For example, the Senior Data Centre Engineer noted, "*lack of funding required us to gain maximum ROI from the investment in the IaaS system. We needed to develop monitoring systems, better disaster recovery and better ways to automate responses to issues*".

6.2.5 Stakeholder Support

Stakeholders' support is central to exploiting the potential of PCIaaS in UCC. The Director of IT Services expressed this opinion stated, "*To fully leverage the future of* *cloud in all these, you actually need the business to engage with this*". This study identified four categories of stakeholders in UCC, including IT staff, students, research groups, and academics. The importance of IT staff supports as critical organisational resources in driving the implementation and organisational change was emphasised by the Director of IT Services when he noted, "*we have to get the IT staff on board – very important. That takes time because they have to buy into it. You cannot force it on them because they bring the value out of it. The Director cannot say cloud, and everybody has to do it because if the staff do not believe it, you do not really get value out of it. So that slows it down, but it is the right thing to do*".

All stakeholders were generally supportive of the institution's PCIaaS except the research group. The Head of the Platform Group expressed this opinion when he noted, "*Getting researchers to buy-in to it and getting researchers to actually invest in that is difficult because a lot of them would prefer not to invest any of their money. Because sometimes, the researchers, the money that they have is quite tight*". The delay in getting the institution's research community to engage with PCIaaS wholly affected its performance impact. The Head of the Platform Group noted, "*in terms of where I have been disappointed, in terms of where we have not proven the value is that the research community have not really engaged with us*".

6.2.6 Governance and Decision-Making

Strong governance is essential for ensuring the efficient and effective use of PCIaaS. The strong governance and decision-making provided by the institution's top management around the structure of the institution played a significant role in the centralisation and centralised provisioning of the institution's PCIaaS. For example, the Director of IT Services noted, "*We are going to do this infrastructure centrally, we are not going to do it everywhere anymore, we are not going to have 15 places where we have servers, we are going to have one (1). So, there was a buy-in from the top management, and they all said, okay, you run all the service, we are going to give you money, build it as a service, and everybody else now has to use your service*".

The relative ease of creating VMs, if not adequately managed and controlled, might lead to a 'VM-sprawl'. Strong governance is critical in formulating the best guidelines to enforce the proper control, management, and VM-sprawl prevention. For example, the Director of IT Services noted,

> "*One of the big challenges was governance. It was so easy to create servers in cloud IaaS that we need to make sure that we understood who owns the servers, how long was it for, (and) what it is needed for. Because what we found out is because it was so easy to create servers, we found out that we had several hundred servers and nobody knew who was using them, because they were created and the person that was using them, in a big place like this with 5000 staffs, they left, or whatever and the server was still there. So, we have to put stronger governance so that there is clear ownership of each of the servers*".

6.2.7 Institutional Culture and Environment

The institution's environment theoretical orientation hindered its capabilities to harness the power of cloud technology (PCIaaS) to develop vLabs that are important in harnessing TEL and teaching. For example, the Director of IT Services noted, "*a lot of the courses in CIT are more technical, so there is a lot more kind of building servers and storage and all the rest of it, (while) the courses in UCC do not tend to be as technical; they are a little bit more theoretical,*". The Director of IT Services further added, "*but nothing has happened in that because nobody has asked for it, I supposed on our end because I assume because that because they do not do as much practical oriented program here in UCC*".

The institution's inability to leverage PCIaaS to innovate, redesign and integrate the institution's legacy business processes spread across the length and breadth of the institution is rooted in the institution's rigid public sector culture that is difficult to change. The fast pace of technological evolution compared with the slow pace of business processes and culture changes posed a significant challenge for the institution. The Director of IT Services noted that the institution required "*cultural changes, changes in policies, work practices, and restructuring. And that is not easy in the public sector. […] And it changes slowly. There lies the biggest problem. The biggest problem in the university is processes, and cultural change is slow. And technology is much faster than the culture*".

Furthermore, to redesign the institution's legacy business processes and integrate its business operations, organisational change and cultural transformation are vital. A fundamental paradigm shift from the old mindset prevalent in the institution is also a prerequisite. Multiple study participants expressed this opinion, including the Director of IT Services, the Platform Group Head, and the Senior Data Centre Engineer. For example, the Senior Data Centre Engineer noted that "*moving to an 'always on' is a paradigm shift and requires new tools, new mindsets, and new skills*". Multiple participants expressed the same opinion. For example, the Head of the Platform Group noted, "*we need to move away from the traditional mindset of we want to manage hardware to actually we want to manage services. And that is, I supposed, the biggest challenge that we face. Is that mindset changed*?". An opinion echoed by the Director of IT Services when he noted, "*I have all the key stakeholders in one project team who can carry out the business end to end, and then we build you a technology solution to fully leverage that and integrate all the various part of it, and that is a big cultural change for the organisation. We are only just starting on that, and I think that is the biggest challenge for our organisation*".

6.2.8 Motivational Incentives

It was challenging getting the support of the research community. Consequently, the institution adopted motivational incentives strategies such as the 'carrot and sticks approach' and 'free usage quota' to compel or entice members of the institution's community to use the PCIaaS services. The carrot approach involved giving free VMs to the research community members depending on their research work size. Conversely, the stick approach involved formulating appropriate policies to mandate the research community to use the institution's PCIaaS. For example, the Head of Platform Group noted, "*I suppose it is the carrot and stick approach. So much, we need the policy to force the researchers to use the centralised infrastructure, and at the same time, they have to see value in it. And for them, value means different things to them. Value for them might be free. I do not know*". The Head of Platform Group also noted, "*The way we are approaching that now is that we kind of offering what, to a certain level, we give it for free now because we appreciate there is certain usage there, there is small demand. It makes no sense that they are paying us probably for that, so we can say there is a certain amount for free. That is what we are doing at the moment*".

6.2.9 Educational Technology Champions

The lack of educational technology champions negatively influenced the institution's capabilities to leverage PCIaaS to develop virtual laboratories to enhance teaching and learning. The institution's IT Leadership has vast experience, expertise, and knowledge of the potential of the PCIaaS in shaping new ways of teaching and learning. Ironically, the lack of educational technology champions within the academic community hindered the institution's capabilities to harness the potential of PCIaaS to shape new ways of teaching and learning. The institution's academic community has to date, not shown any interest in leveraging the potential of PCIaaS to develop virtual computing environments for some of the technologically intensive programmes. For example, when the researcher asked the Director of IT Services why the institution had not implemented virtual laboratories, he responded by saying:

> "*We could do that, but nobody has asked us for it, actually, I supposed so. One of the things is that I was, my last job, I was the IT manager in [**redacted**], in my last job. So, I built that. That system I built that when I was the IT manager there ..... So, nobody has (asked for it). The academic, in [**redacted**], [**redacted**] is the Head of the Computing Department, and he was the one who said that IT, I want you to build me a vLab. And we went out, and we talked to VMware, and we built something. But in UCC, nobody has asked for that. But I think it would be probably a good thing, but it is expensive, and the academic community would really need to be the champions because IT could not really do all of that. In [**redacted**], for example, the academic staff manage all the virtual software, so if the (UCC) academic community were interested in that, we could do that for them. But nothing has happened in that because nobody has asked for it*".

The above opinion highlights the importance of educational technology champions in integrating PCIaaS into teaching and learning in UCC.

6.2.10 Legacy Business Processes and Applications

Redesigning the institution's legacy business process and applications is a critical factor in the institution's ability to exploit the potential of PCIaaS. The institution's legacy business processes are inefficient and scattered across different departments. In addition, the institution's legacy business applications and systems are not native cloud applications and cannot therefore scale. Hence, the necessity to redesign its legacy business processes and applications. For example, the Director of IT Services noted, "*now I have infrastructure that can scale, but now my worry is that I have to redesign the applications so they can scale as well*". Sections 6.2.12 highlights the initiative (DevOps culture and team) adopted by the institution in redesigning its legacy business processes and applications.

The institution's legacy business applications and systems lack the capacity and capability to automatically scale in response to changes in workload or, in the words of the Director of IT Services, when they are "*bombarded with traffic"*. The Director of IT Services also noted, "*The problem now is probably that the applications software in some cases cannot really work to the full effect with the infrastructure*". The Directors of IT Services continued by adding that "*to fully leverage the future of cloud in all these, you actually need the business to engage with this and to say because one of the big problems in UCC and the same in other organisations is the number of the various business processes are not in one department. They are in lots of departments, so there is a little bit in Finance that has to work with human resources that have to work with some other service*". The opinion expressed above highlights the importance of IT/business partnership in the institution's ability to redesign its business processes and applications to enhance exploiting the potential of PCIaaS to improve its performance.

6.2.11 IT Leadership

IT Leadership plays a critical role in educating and creating awareness of the potential of PCIaaS among members of the institution. In addition, IT leadership was instrumental in influencing and bringing on board other institution members both within and outside the IT Services department, including the top management and a particular group of IT personnel. The Director of IT Services expressed this opinion when he noted, "*I came here, and I did say I want to cloud where I can and where there is value*".

Despite the importance of digital transformation to the institution's competitiveness, driving its digital transformation was problematic. The institution's top management exhibits a lack of commitment in driving digital transformation and change management. For example, the Director of IT Services noted, "*it does, and that is slow.*

It is new, and it is slow. Top management wants the digital world. Sometimes they do not probably know how and what it means to get there. Oftentimes it means changing how you do your business radically". To fill the void created by the institution's top management, the institution IT leadership is leading the institution's change management and digital transformation initiative. For example, the Director of IT Services noted, "*So many organisations want to do things digitally; can they change their processes and ways of working to work digitally? We are only starting on that journey, but I am here trying to lead where we can. I am trying to say this is how we should do it*".

6.2.12 IT/Business Partnerships

IT/business partnership was crucial to UCC's ability to realise the performance impact of PCIaaS. The Director of IT Services expressed this opinion when he noted, "*we want to bring IT out of the kitchen and then to the living room, you know what I mean, so we want to take it out from the engine room building all the bits and make IT a partner with the business*". The institution's IT leadership recognised the importance of IT/business partnership in driving its digital transformation and competitiveness. For example, the Director of IT Services noted, "*All is about enabling the business to be more strategically get an edge to deliver better digital services, to be faster and quicker and more efficient than our competitors. That is all we are all about. We are an enabling department; we exist to enable [the organisation] to get the edge to do things better, do things faster*". However, one of the institution's challenges in building IT/business partnerships was having the different functions in the institution to work collaboratively. For example, the Director of IT Services noted, "*all the different offices have to kind of work together. That is, the biggest problem probably is getting all these people working".*

To overcome the institution's challenges in building a robust IT/business partnership, its IT leadership employed a DevOps culture. For example, the Director of IT Services noted, "*All we are going to do in IT is to create more. All of my Project Managers now are not called Project Managers anymore. I call them Product Managers. So, I am trying to embed more of what is called a DevOps culture within IT whereby we say, here is a product team, we build you a product which would be an application system, and we talked to the business and said you need to build that, a business product team* *who can run the process end to end*". DevOps is a term used to describe an IT culture, which encourages teamwork, collaboration, and strong partnership between IT and business. DevOps Style collaboration involves different stakeholders across the different functions within an institution sharing their knowledge, expertise, and experience and working together to improve the institution's inefficient and fragmented legacy business processes, IT systems, and services. Adopting the DevOps style collaboration to system development will help enhance the institution's legacy business processes and applications redesign.

6.2.13 Summary: Organisational Factors

This section summarises the influence of organisational factors on exploiting PCIaaS on organisational performance in UCC. First, Table 6-5 highlights the frequency distribution of the 12 organisational factors identified in UCC across the five dimensions. Stakeholder support and resistance emerged as the most visible organisational factors in UCC. In contrast, Educational technology champions are the least visible organisational factors. Appropriate strategy and policy changes emerged as the second most visible, while Top management support and commitment emerged as the third most visible organisational factors. In addition, this study also found that Organisational strategy is the most visible dimension of organisational factors in terms of the number of organisational factors and the frequency value. Similarly, organisational power and politics is the second most visible dimension of organisational factors. Organisational structure emerged as the least visible dimension.

Second, Table 6-6 highlights the influence of the 12 organisational factors identified in UCC across three categories. Six organisational factors emerged in the positive impact category (education and training, appropriate strategy and policies changes, motivational incentives, IT leadership, governance and decision-making, and IT/Business partnership). Three organisational factors emerged in the varied impact category (business vision and objectives, top management and commitment, and stakeholder support and resistance. Similarly, three organisational factors emerged in the negative impact category (educational technology champions, institutional culture and environment, and legacy business processes & applications). As a result, these three organisational factors are not capabilities generating or enabling organisational factors in UCC.

6.3 UCC: RQ3 – Analysis and Findings of PCIaaS IT Personnel

PCIaaS IT personnel played a significant role in the institution's ability to exploit PCIaaS for performance impact. The Director of IT Services acknowledged the vital role of PCIaaS IT personnel in the institution's ability to exploit PCIaaS to improve its performance when he noted, "*IT personnel played a very important role*". He also added that "*the IT staff contributed to using the IaaS better*". The Senior Data Centre Engineer also acknowledged the importance of the role played by PCIaaS IT personnel. For example, when the researcher asked him if he thought PCIaaS had contributed to the performance impact of PCIaaS, he vehemently responded: "*Yes*" and went on to enumerate the activities he had performed and his skills and competencies. The following sections discuss the profile of PCIaaS IT personnel activities in UCC.

6.3.1 Profile of Activities Performed by PCIaaS IT Personnel

This section presents the analysis and discussion of the activities performed by PCIaaS IT personnel in UCC through which they contribute to the performance impact of PCIaaS. Table 6-7 presents the profiles of activities of PCIaaS IT personnel in UCC, highlighting the frequency of occurrence.

Table 6-7: UCC – Profiles of Activities of PCIaaS IT Personnel

Categories	**Profile of Activities**	**Freq (%)**
Operational Orientation	Architecture Builder*	18 (50.00%)
	System Provider**	11 (30.56%)
	Project Coordinator	2 (5.56%)
	Total	**31 (86.11%)**
Strategic Orientation	Partner	4 (11.11%)
	Technological Leader^	1 (2.78%)
	Total	**5 (13.89%)**
Grand Total		**36 (100%)**

Legend: * Most Visible, ** Second Most Visible, ^Least Visible

Table 6-7 highlights the five profiles of activities performed by PCIaaS IT personnel in UCC. Architecture builder emerged as the most visible activities profile performed by the institution's PCIaaS IT personnel, while System provider is the second most visible activities profile. These two profiles of activities are the daily activities performed by PCIaaS IT personnel. In addition, the technological leader activities profile is the least visible. Section 6.3.1.1 to Section 6.3.1.5 shows the five profiles of PCIaaS IT personnel's activities in UCC.

6.3.1.1 Architecture Builder

The activities performed by IT personnel in UCC under this profile were: (1) building and managing the PCIaaS environments, (2) managing and planning systems development and implementation, (3) supporting hardware and software installation, configuration, and maintenance, (4) producing technical documentation, and (5) crisis management. The activities performed by the institution's IT personnel in this profile helped to ensure the resilience, availability, and reliability of the institution's PCIaaS environment that was fit for purpose. According to the Senior Data centre Engineer, "*VMware management and deployment*" was one of the activities performed by PCIaaS IT personnel in UCC.

The institution's PCIaaS IT personnel also supported hardware and software installation, configuration, and maintenance, including keeping the hardware and software updated. For example, the Senior Data Centre Engineer "*installed the entire vSphere IaaS system*" but was also "*responsible for the day to day running of the virtualised data centre*". Other activities performed were: "*vSphere systems administration, SAN administration, Linux systems admin, Windows systems admin, networking, scripting, backup administration, public cloud (AWS and Azure), data centre engineering*". He was also responsible for deploying monitoring solutions for the data centre, providing technical support to the Windows HyperV and VMware virtualised platforms, and monitoring the virtualised data centre's operations. PCIaaS IT personnel also troubleshoot network performance issues. Congruently, to ensure the security of the institution's PCIaaS environment, PCIaaS IT personnel were also responsible for applying critical patches, security updates, and upgrades to the hypervisors and guest operating systems. The activities performed by the institution's PCIaaS IT personnel under this profile were managing and planning systems development and implementation. For example, the Senior Data Centre Engineer noted that one of the activities he performed was to: "*plan and support the migration of services to VMware as necessary*".

This profile, although technical, also required business management activities and skills/knowledge. For example, the Senior Data Centre Engineer noted that he "*provides expertise and leadership on VMware management and deployment*". They were also required to work collaboratively with other team members, including IT staff, to develop SOPs, manuals, documentation, and IS operation standards based on industry best practices. For example, the Senior Data Centre Engineer noted his role also requires him to "*maintain appropriate user and technical support documentation*" and "*ensure all documentation and procedures to manage and monitor the data centre are optimal and based on industry best practice*". They were also involved in planning and supporting the migration of services to VMware. In performing this activity, they worked with business users to ensure the smooth migration of legacy services.

6.3.1.2 Systems Provider

The primary activities performed by IT personnel in UCC under this profile were: implementing and providing highly available and reliable PCIaaS IT services to meet its business needs. For example, the Senior Data Centre Engineer participated in implementing all aspects of the PCIaaS, including automation and the disaster recovery (DR) system. These two systems provided benefits to the institution. For example, automation enabled the institution members to easily and quickly request and provided computing and storage facilities while the DR system helped in disaster recovery and business continuity. One of the roles of the Senior Data Centre Engineer is not only to play "*a key part in the innovation and automation of the data centre"* but also to participate in "*ongoing development and enhancement of the VMware solution to deliver improved services, monitoring, reporting, and orchestration*". The institution's PCIaaS IT personnel also provide and deliver IT services to different institution members, including the research community, academic staff, students, and departmental IT services groups. According to the Senior Data Centre Engineer, it is essential that "*the system must be deployed correctly but tailored to the business needs of the organisation*".

6.3.1.3 Project Coordinator

The primary activities performed by PCIaaS IT personnel in UCC under the project coordinator's profile include coordinating IT-related activities and relationship management. PCIaaS IT personnel collaborated with internal and external parties, including the IT teams, business units, and vendors, and helped evaluate, analyse, and formalise user requirements. PCIaaS IT personnel in UCC also served as the escalation point for resolving technical problems with the vendors or other third parties, particularly those beyond their remit. For example, the Senior Data Centre Engineer noted that he serves as the "*escalation point for technical and user support as required*".

6.3.1.4 Partner

The primary activities performed by IT personnel in UCC under the profile of partners were: (1) user training, (2) reporting, and (3) providing advice and expertise on business strategies. The institution's PCIaaS IT personnel played a significant role by providing training to users of the PCIaaS services that enabled the institution to earn users' trust and reduce resistance and extract value from PCIaaS. The Director of IT Services expressed this opinion when he noted, "*the more they learn it, the more they use it, the more they get used to it, and the more value they can extract from it. That is exactly what we did, we taught people how to use it, we took our time, it took longer than is expected, but everybody now I think is bought into the cloud is the way of doing our business*". The analysis of the data gathered from the Senior Data Centre Engineer also reveals that his role involves "*providing strategic and operational vision and the ability to implement change within a data centre environment*". Further analysis of the data gathered also reveals that he also "*develop a set of monthly reports and metrics in relation to the data centre*".

6.3.1.5 Technological Leader

PCIaaS IT personnel's primary activities in UCC under the profile of technological leader were testing and using the hypervisors software to identify its potential that will enable better use of the PCIaaS services. The hypervisors' testing was one of the most difficult challenges faced by IT personnel due to the gap in knowledge both on IT personnel and the external implementation partner. The Director of IT Services noted when asked by the researcher about the contribution of PCIaaS IT personnel to the institution's ability to exploit PCIaaS for performance. He responded, "*IT staff contributed to using the IaaS better. So, they helped test all of the Hypervisor software and use it and turn it into service*".

6.3.2 Skills/Knowledge of PCIaaS IT Personnel

This section presents the analysis and discussion of the skills/knowledge (competencies) of PCIaaS IT personnel. Table 6-8 presents the requisite skills/knowledge of IT personnel identified in the data gathered in UCC.

Table 6-8: UCC – Skills/Knowledge of PCIaaS IT Personnel

Dimension of Competencies	Skill & Knowledge	Freq (%)
Technical Competencies	Vendor(s) Cloud Infrastructure	11 (17.19%)
	Storage Area Network (SAN)	5 (7.81%)
	Automation and Orchestration	5 (7.81%)
	Networking	4 (6.25%)
	Virtualisation	4 (6.25%)
	Systems Integration	3 (4.69%)
	Programming Language	3 (4.69%)
	IT/Cloud Security	2 (3.13%)
	Total	**37 (57.81%)**
Business Management Competencies	Systems Analysis and Design	6 (9.38%)
	Project Management	3 (4.69%)
	Flexible	2 (3.13%)
	Change Management	2 (3.13%)
	Interpersonal and Communication	2 (3.13%)
	IT Contract Management	2 (3.13%)
	Agile	2 (3.13%)
	Customer Service & Relationship Management	2 (3.13%)
	Data Regulation and Compliance	2 (3.13%)
	Dynamic	2 (3.13%)
	Teamwork	1 (1.56%)
	Adaptable	1 (1.56%)
	Total	**27 (42.19%)**
Grand Total		**64 (100%)**

Table 6-8 presents the 20 skills/knowledge of PCIaaS IT personnel across two dimensions of competencies, highlighting the frequency of supporting quotes. Business management competencies have the highest number of skills/knowledge but fewer supporting quotes, with 12 skills/knowledge and 27 (42.19%). In contrast, business management competencies have the highest frequency of supporting quotes but fewer skills/knowledge, accounting for eight skills/knowledge in UCC. However, the top-most visible skills/knowledge in hierarchical order are (1) Vendor(s) Cloud Infrastructure, (2) Systems Analysis and Design, (3) Storage Area Network (SAN), (4) Automation and Orchestration, (5) Networking, and (6) Virtualisation.

PCIaaS IT personnel required a slightly different but broad set of skills/knowledge than other IT personnel. Multiple study participants expressed this opinion, including the Director of IT Services, the Platform Group Head, and the Senior Data Centre Engineer. For example, the Director of IT Services noted, "*some of the skills now we would look for are slightly different*". The Director of IT Services also noted that PCIaaS IT personnel require "*different skills because IT is exploding in terms of demand*". Some of these skills were different from those required by IT personnel working in the traditional IT environment, but PCIaaS had rendered some skills obsolete. For example, the Director of IT Services noted when asked by the researcher in a follow-up question if traditional IT skills were going out of use, "*yes, some of them are, PC supports, desktop supports*".

PCIaaS is a complex infrastructure that requires PCIaaS IT personnel to have a broader set of skills/knowledge to contribute to the performance impact of PCIaaS. The Head of the Platform Group expressed this opinion when he noted, "*I think people have to have a much broader set of experience now actually. There is no, no. The days of someone just forcing it, I work on storage, I work on the network, I work on operating systems, they are probably gone because everything is now converged centrally*". A similar opinion was also expressed by the Senior Data Centre Engineer when he noted, "*yes. It is now a cross-disciplinary environment, removing silos of skills"*. The Senior Data Centre Engineer also noted, "*all competencies must work correctly together, with a holistic view taken to the architecture*".

The study also indicates that UCC preferred highly skilled and multi-talented IT personnel to manage their PCIaaS. For example, the Head of the Platform Group noted when the researcher pressed him if the cloud needed highly skilled IT personnel, "*depends on what you mean by cloud. If you are really on PCIaaS, yes you need people who can actually do all these things and get stuck into it*". The Director of IT Services took the most forceful position when he noted, "*I need someone I could pay 70k a year to rather five people I could pay 30k. I need fewer people better paid and higher up the knowledge chain a little bit*". Ironically, the Director of IT Services also noted, "*I would not find that in one person, I am just saying these are the mix of the type of people that I need*". In Section 6.1.6.1, this study found that members of the institution underwent additional education and training to acquire both technical and business management competencies to effectively exploit the potential of PCIaaS for the institution's benefit. The following section presents the discussion of each of the dimensions of the competencies (skills/knowledge), beginning with technical competencies.

6.3.2.1 Technical Competencies

This study identified ten technical skills/knowledge required by PCIaaS IT personnel in the data gathered in UCC. One key finding in UCC was that training influenced PCIaaS IT personnel technical competencies and was fundamental to performing their activities under the architecture builder and systems provider profiles. Due to the importance of technical skills/knowledge to PCIaaS IT personnel, three of the institution's existing IT personnel were sent on cloud business courses and vendor-specific courses to acquire vendor-specific knowledge on the institution's chosen cloud infrastructure. The Director of IT Services expressed this opinion in Section 6.1.6.1, where he noted that "*two of my managers did that, and several of the technical staff did converge infrastructure – private cloud infrastructure training*". The Head of Platform Group, the Senior Data Centre Engineer, and the System Administrator BIS department echoed a similar opinion. For example, when the researcher asked the Head of Platform Group about the necessary skills/knowledge required by PCIaaS IT personnel, he responded by saying: "*IT people would know how to use HyperV, ESX, that is one*". The System Administrator, BIS, also offered a similar response when he noted, "*You cannot. Personally now, I went, and I completed a virtualisation online with Microsoft*". Congruently, the Senior Data Centre Engineer also noted, "*skills/knowledge in the vendor's cloud infrastructure are important*".

Additional training acquired by IT personnel indicated that skills/knowledge on the chosen vendor(s) cloud infrastructure were essential to manage and support the institution's PCIaaS environment. However, the Senior Data Centre Engineer believed that he did not need to do any such training on the specific vendor's cloud infrastructure. He had qualifications, background, and years of experience in cloud-related technology before being employed as the Senior Data Centre Engineer. According to the job specification, before being appointed to this role, the Senior Data Centre Engineer had about "*seven years of experience working in IT and data centre environments*". He also noted that he has about "*five years of experience deploying* *and managing services on a VMware platform with excellent knowledge of ESXi, and the VMware products*". Congruently, IT personnel also required skills and competencies in cloud interoperability. For example, the data also indicates that the Senior Data Centre Engineer also had "*experience deploying and extending infrastructure to public cloud platforms such as Azure and AWS*". The Head of the Platform Group also expressed a similar opinion when he noted, "*you need people now that can actually understand how services can be built within the cloud. And that is a skill set of its own, I think, so you need cloud architects and people who work in the public cloud and who could understand whether they are AWS or Agile, and how you can build up these services in a public cloud environment, that is important*".

PCIaaS IT personnel also required skills/knowledge in IT and cloud security. For example, the Director of IT Services noted, "*Security is probably another capability. So, people that understand IT security, there are a lot of risks, people that understand that*". One of the advantages of private cloud to large organisations is the enhanced security and privacy over the public cloud. Considering the risks associated with the cloud, PCIaaS IT personnel need skills/knowledge in cloud security, including the applications and data in the cloud infrastructure.

Other technical skills and competencies required by PCIaaS IT personnel were: virtualisation, SAN (storage), networking, monitoring, orchestration and automation, system administration, and backups. For example, when the researcher asked the Senior Data Centre Engineer about the necessary skill PCIaaS IT personnel should possess, he said, "*networking, vSphere, SAN, Linux & Windows Sysadmin*". The Director of IT Services also noted that IT personnel require skills and competencies in virtualisation and SAN and networking. According to him, "*You now must have virtualisation and SAN and networking (skills)*". The Platform Group Head also noted that PCIaaS IT personnel should have "*skills in virtualisation, so virtualisation skills*". The Head of Platform Group also noted that he wanted his IT personnel to have an "*understanding how to manage storage, and how to manage virtualisation and how to do the orchestration. They are the three key competencies"*. The Senior Data Centre Engineer echoed this when he noted that PCIaaS IT personnel also required "*excellent knowledge and experience of server deployment, storage deployment, data centre networking, and backup solutions*".

PCIaaS IT personnel needed to have skills/knowledge in monitoring, automation, scripting, and orchestration. For example, the Platform Group Head noted, "*I want anyone to look at the monitoring and the actual automation and orchestration*". The Head of the Platform Group also noted, "*automating things is the key part of all these. That is the only way I am going to get value out of this in the future. The days of thinking around inside and doing things manually are gone. That is where the real value is. So, if I am looking for someone, I want someone that is able to automate things for me. I want standardisation, and I want automation*". He also added, "*people (IT personnel) have put the time and effort into automating some of the scripts and standardising them. So no longer now are they going in and actually to manually configure it, it is a click of the button, and it runs through that script there for them. That is where the benefit was*".

6.3.2.2 Business Management Competencies

This study identified 12 business management skills/knowledge required by PCIaaS IT personnel in the data gathered in UCC. PCIaaS IT personnel require vendor management skills. For example, the data collected from the Senior Data Centre Engineer states that PCIaaS IT personnel need "*experience managing partners and third-party vendors"*. A similar opinion was also echoed by the Director of IT Services when he noted that he required "*somebody (IT personnel) who can do supplier management for our IT suppliers, that is one capability I look for now*". PCIaaS IT personnel also required legal and regulatory skills. The Director of IT Services expressed this opinion when he noted, "*I probably look for contract management, service management, a little bit more because most of the cloud services would be underpinned with a contract*". He then went further and added that he requires "*somebody who knows how to manage an IT contract, making sure the vendors are committed to us in the right way, managing the performance of an external vendor. This is becoming very important because so many of our software development is done by external parties*".

One initiative to fully leverage the enormous potential of the institution's PCIaaS was the formulation of a multi-functional product team consisting of private cloud IT personnel and other members of the institution's community in other departments. The analysis of the data gathered from the Senior Data Centre Engineer revealed that IT personnel were required to "*work with IT staff within the team*". Therefore, teamwork and project management skills enabled PCIaaS IT personnel to perform better the responsibilities attached to their role.

PCIaaS IT personnel also required project management skills, particularly during the transition from the traditional IT environment to the PCIaaS environment, which involved many projects. For example, the Head of the Platform Group noted, "*if we have IT staff working on projects, it is essential they all have project management experience*". The Head of the Platform Group also added, "*the only time you look for that (project management skills/knowledge) is during your transition period*". He then went further to argue, "*I suppose if you are setting up a new service, you need a project manager. If you have services that are running and operationalised, you do not need a project manager. You need someone to manage it, manage the operations of it and make sure that things are running smoothly*". The Director of IT Services also noted, "*I need some system analyst skills, some project management skills*".

PCIaaS IT personnel are client-facing, partnering with business users to analyse their needs and requirements and proffer IT solutions. So, they must have analyst skills, communication skills, and change management skills. For example, the Director of IT Services noted, "*I need more analysts. I need more people who can talk to the business. I probably need more externally facing people than historically would have been internally facing. I need people I can send into the teaching office, send into research centres, have a conversation, understand their needs, help them build the solution and help manage the change through that solution*". The Director of IT Services also noted that "*most organisations are hiring people with analyst skills because they want people who can translate what they do in reality into IT*". The Senior Data Centre Engineer also stressed the necessity of PCIaaS IT personnel having the "*ability to implement change within a data centre environment*". The Senior Data Centre Engineer also noted that it was vital for PCIaaS IT personnel to have "*excellent communication, written, and verbal skills*".

With the GDPR, PCIaaS IT personnel must have legal and regulatory skills/knowledge. According to the Head of the Platform Group, "*It is always a skill, and there has to be awareness. Everybody dealing with data needs to be aware of, particularly if they have a data control role. They have an obligation to understand* *what data they are collecting, how they are storing it and who has access to it. And they need to be aware of it very quickly now because that is coming in in May 2018, and they need to be aware of it. And that particularly applies to researchers*". The consequences of the GDPR breach are enormous.

Furthermore, it is also advantageous for PCIaaS IT personnel to be agile. For example, the Senior Data Centre Engineer noted that IT personnel should have the "*willingness to rapidly deploy new services on a test/pilot basis, to be agile and adaptable and willing to change. Also, not to take personal ownership to systems, to be able to change to new ones when needed*". Similarly, the Head of the Platform Group also noted, when asked by the researcher about any additional skills he would require IT personnel to have, "*IT is moving so fast, the technology is so wide now at this stage, that you need somebody that is capable of doing multiple things. [……] so, I think you need somebody now who is capable of turning their hands on anything really and being dynamic*". The Head of Platform Group also noted that he required a "*person (IT personnel) that is dynamic, and they are flexible, and I suppose who could turn around to anything really because change is so fast*".

6.3.3 Summary: PCIaaS IT Personnel

This section relates to the within-case analysis of PCIaaS IT personnel in UCC. The activities performed by the institution's PCIaaS IT personnel were categorised into the five profiles of activities through which IT personnel contributed to the performance impact of PCIaaS: (1) architecture builder, (2) systems provider, (3) project coordinator, (4) partner, and (5) technological leader. However, the activities profile of the architecture builder was the most visible, followed by the system provider. The third most visible profile of activities performed by PCIaaS IT personnel was that of the partner. Finally, the activities profile of the technological leader was the least visible.

This study identified 20 skills/knowledge across two dimensions of competencies that enhanced the institution's PCIaaS IT personnel's ability to perform their activities. Eight skills/knowledge were in the dimension of technical competencies, while 12 skills/knowledge were in the dimension of business management competencies. However, in terms of frequency value, technical competencies are the most visible. As a result, the researcher concludes that technical and business management competencies are essential to PCIaaS IT personnel in UCC in exploiting PCIaaS to realise optimal performance impact.

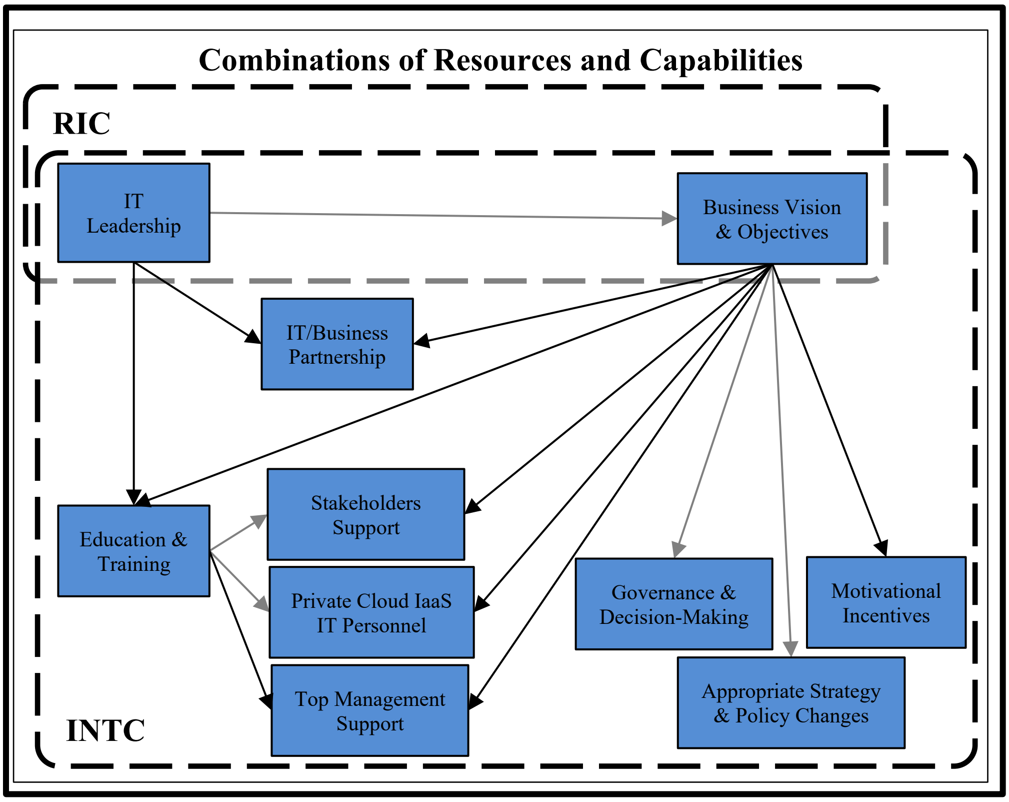
6.4 UCC: RQ4 – Analysis of Organisational Capabilities

This section presents the analysis and findings of RQ4, which investigated the organisational capabilities visible in the two organisational resources investigated in RQ2 and RQ3, as presented in Section 6.2 and Section 6.3. Table 6-9 outlines the two capabilities identified in OU and the attributes of the resources that make up the capabilities.

Table 6-9: UCC – Composition of PCIaaS Capabilities

Resources	Organisational Factors/Activities Profiles	RIC	INTC
Organisational Factors	Education and Training		X
	Business Vision & Objectives	X	X
	Appropriate Strategy & Policies Changes		X
	Motivational Incentives		X
	Top Management and Commitment		X
	Stakeholder Support and Resistance		X
	IT Leadership	X	X
	Governance and Decision-Making		X
	IT/Business Partnership		X
PCIaaS IT Personnel	Architecture builder		X
	Systems Provider		X
	Partner		X
	Project coordinator		X
	Technological leader		X

The two PCIaaS capabilities identified in UCC are highlighted in Table 6-9, showing the resources combined to develop the capabilities. All the activities profiles performed by PCIaaS IT personnel contributed to integration capabilities, while the two organisational factors that contributed to research and innovation capabilities were business vision and objectives and IT leadership. Figure 6-2 presents the combination of resources and capabilities that enabled UCC to leverage PCIaaS to improve organisational performance.



NOTE: Research and Innovation Capabilities (RIC), Integration Capabilities (INTC)

Figure 6-2: UCC – Combination of Organisational Resources and Capabilities

Figure 6-2 highlights the combination of resources that resulted in developing the two capabilities visible in UCC: (1) research and innovation and (2) integration. Both capabilities are discussed in the following sections.

6.4.1 Research and Innovation Capabilities

IT leadership and business vision and objectives were the two organisational factors critical to UCC's innovating ability. Transformational IT leadership influenced IT innovation. Section 6.1.11 highlights the role of IT leadership in the institution's ability to innovate through PCIaaS. The institution's IT leadership played a significant role in championing its technological innovation. Section 6.1.2 also highlights the institution's vision and objectives for PCIaaS and the significant role play by IT leadership in articulating these vision and objectives, including cost-effectiveness, risks reduction, the modernity of IT infrastructure, and agility. The institution's IT leadership aligned the investment in PCIaaS with its strategic business priorities, which helped bolster the integration of PCIaaS into the institution's business operations and processes.

6.4.2 Integration Capabilities

Section 6.1.1 highlights the vital role played by the institution's IT leadership in integrating PCIaaS into the institution's operations and processes. The institution's IT leadership educated members of the institution, including some top management, and got their buy-in and funding by presenting a good business case of the potential of PCIaaS. However, Section 6.1.1 reveals that, like any other new technology, the integration of PCIaaS in UCC was not without some challenges. Notable among these challenges were: (1) gap in skills/knowledge, (2) fear of the unknown, and (3) passive resistance to change. Section 6.1.1 highlights some of these challenges. First, the institution's existing IT personnel lacked the requisite cloud-related skills/knowledge to manage and support PCIaaS. Second, PCIaaS was intimidating to some groups of IT personnel who preferred the traditional physical servers. Education and learning were crucial determinants in overcoming these challenges. They also helped integrate PCIaaS into the institution by undergoing additional training and educating other institution members. Finally, the institution's PCIaaS IT personnel helped improve the delivery of improved IT services to the institution's members by testing the hypervisors and turning them into services.

Section 6.2.6 reveals that governance and decision-making influenced the institution's ability to integrate PCIaaS. For example, strong governance and decision-making played a significant role in integrating and centralised provisioning of the institution's PCIaaS, which enabled the institution to reap the benefits of centralisation and consolidation. Strong governance was also critical in ensuring proper control, management, and prevention of VM-sprawl, which was vital to enhancing the availability and reliability of the institution's PCIaaS. This study also found in Section 6.2.3 that the institution also formulated appropriate strategy and policy changes to enhance its ability to integrate PCIaaS into its operations and processes. For example, the institution's cloud-first policy prioritised PCIaaS as the first choice over traditional IT infrastructure, except in the case of incompatibility.

Furthermore, cloud storage policy compels researchers to store their research data in a secure and central storage location to reduce data risks and enhance research collaboration and researchers' ability to secure research funding from funding agencies. However, there was subtle reluctance by the research group members to subscribe to the institution's PCIaaS services. To further encourage the research group, motivational incentives were put in place to enhance the institution's ability to integrate PCIaaS. The institution used subsidies and the free quota to encourage this group of stakeholders to subscribe and use the institution's PCIaaS to enable them to integrate the potential of PCIaaS in conducting their research.

Section 6.2.11 highlights IT leadership's significant role in integrating PCIaaS into the institution's operations and processes. It found that the institution's IT leadership filled the vacuum created by the institution's top management's failure to drive the institution's organisational or technological change. For example, in Section 6.2.5 and 6.2.12, it was revealed that the institution's IT leadership recognised that a more strategic and robust partnership between IT and business would enhance the institution's ability to integrate PCIaaS into its operations and processes. First, there was strong support for more digital services by the institution's members. The digitalisation of the institution's services was predicated on enhancing better and more efficient services delivery than its competitors. This quest was the driving force behind the DevOps culture established by the institution's IT leadership to enhance its ability to develop new products and services. Second, the institution's IT leadership recognised that a stronger partnership between IT and business would enhance its ability to develop new digital services and serve as a catalyst for change.

Furthermore, Section 6.2.11 highlights the critical role played by the institution's IT leadership in establishing the DevOps culture approach to system development as a vehicle to drive the institution's digital transformation. DevOps practices helped encourage, promote, and build a culture of collaboration, teamwork, and partnership between IT and key stakeholders across the institution to enhance its ability to develop new digital services. In addition, DevOps practices enabled the institution to adopt a product-oriented approach rather than a project-oriented approach to new product development. Some of the benefits of DevOps were: (1) greater partnership between IT/business, (2) accelerate new product development and new digital services tailored to business needs, (3) improve business process efficiency, (4) enable employees to work digitally, and (5) the digitalisation of services is expected to give the institution a strategic edge over its competitors.

6.4.3 Summary: Organisational Capabilities

This section highlights the two capabilities identified in UCC that enabled the institution to exploit PCIaaS to improve its organisational performance: (1) research and innovation capabilities and (2) integration capabilities. Combining the activities performed by the institution's PCIaaS IT personnel and different organisational factors resulted in developing these capabilities. Organisational factors were the major contributor to the institution's capabilities. However, the innovativeness of the institution's IT leadership was vital in incorporating PCIaaS into the institution.

6.5 Chapter Summary

This chapter presented the within-case analysis of the organisational performance impact of PCIaaS in UCC and the organisational resources involved, including (1) organisational factors and (2) PCIaaS IT personnel. Firstly, this study identified the 33 PCIaaS performance measures supported in UCC, consisting of 23 PCIaaS performance measures in the highly supported category and ten in the less supported category. Six PCIaaS performance measures emerged in the not supported category. Also identified were the performance measures that emerged in the top ten PCIaaS performance measures in UCC. In addition, this study also identified the PCIaaS business value dimensions that emerged in the most dominant and most relevant groups across three categories: (1) highly significant, (2) moderately significant, and (3) less significant. Two PCIaaS business value dimensions emerged in the highly significant categories in both groups: (1) business risk reduction and (2) improvement in flexibility, agility, and responsiveness. In comparison, the three PCIaaS business value dimensions that emerged in the less significant category in both groups were (1) positive working environment, (2) enhancement of products and services, and (3) increase competitiveness and growth. Operational effectiveness emerged as the most dominant PCIaaS organisational performance category, while strategic positioning is the less dominant in UCC.

Secondly, this study identified 12 organisational factors across the five dimensions of organisational factors that impacted the institution's ability to exploit PCIaaS for performance impact. Stakeholder support and resistance emerged as the most visible organisational factors in UCC, while educational technology champions are the least visible. In addition, organisational strategy emerged as the most visible dimension of organisational factors, while organisational structure emerged as the least visible dimension. However, the study found three categories of organisational factors emerged in UCC, consisting of six factors in the positive impact category, three in the varied impact category, and three factors in the negative impact category. As a result, the three organisational factors that only had a negative impact on the institution's ability to exploit PCIaaS are not capabilities enabling factors.

Furthermore, this study also identified the 20 skills/knowledge across the technical and business management competencies that enabled the institution's PCIaaS IT personnel to perform the activities under the five profiles of activities. This study found that the activities profile of architecture builder emerged as the most visible, system provider is the second most visible activities profile, and technological leader is the least visible. However, the top skills/knowledge of PCIaaS IT personnel in UCC in hierarchical order are (1) vendor(s) cloud Infrastructure, (2) systems analysis and design, (3) storage area network, (4) automation and orchestration, (5) networking, and (6) virtualisation.

Finally, the institution's PCIaaS IT personnel combined with organisational factors developed two capabilities: (1) research and innovation capabilities and (2) integration capabilities. Two organisational factors contributed to the institution's research and innovation capabilities: IT leadership and business vision and objectives. In addition, PCIaaS IT personnel, through their activities across the five profiles activities and all organisational factors (see Table 6-9), combined to develop integration capabilities.

Chapter Seven - Cross Case Analysis

7.0 Introduction

This chapter presents a cross-case analysis of the three cases. The within-case analysis has been presented in chapters four, five, and six. First, Section 7.1 compares the organisational performance impact of PCIaaS. The within-case analysis in Sections 4.1, 5.1, and 6.1 in CIT, OU, and UCC identified the PCIaaS performance measures, highlighting the three categories of PCIaaS performance measures, including the top ten performance measures. Also identified are the PCIaaS business value dimensions, highlighting the three categories across two groups, and the organisational performance impact of PCIaaS across two categories. Second, section 7.2 provides a comparison of the organisational factors that influenced the performance impact of PCIaaS. Finally, sections 4.2, 5.2, and 6.2 identified the organisational factors that influenced the organisational performance impact of PCIaaS across the five dimensions of organisational factors, highlighting the three categories of impacts.

Third, section 7.3 compares the contributions of PCIaaS IT personnel. In the within-case analysis in Sections 4.3, 5.3, 6.3 for CIT, OU, and UCC, the skills/knowledge and the activities performed by PCIaaS IT personnel were identified and categorised into two dimensions of competencies and three competency categories. Also identified are the activities performed by PCIaaS IT personnel across the five profiles of activities. Finally, Section 7.4 compares the organisational capabilities to exploit PCIaaS based on the within-case analysis in Section 4.4, 5.4, and 6.4, which identified the three PCIaaS capabilities developed from the combination of PCIaaS IT personnel and organisational factors. Section 7.5 finally summarises the chapter highlighting the main findings.

7.1 RQ1 – Comparative Analysis of Organisational Performance Impact of PCIaaS

This section presents a comparative analysis of RQ1, which investigated the organisational performance impact of PCIaaS across the three cases, including CIT, OU, and UCC. The within-case analysis has been presented in Sections 4.1, 5.1, and 6.1, respectively. There are three levels of comparative analysis. First, Table 7-1 presents a comparative analysis of PCIaaS performance measures, highlighting the classification of PCIaaS performance measures into three categories, including (1) highly supported category, (2) less supported category, and (3) not supported category. Second, Table 7-2 presents a comparative analysis of PCIaaS dimensions of business value, highlighting the most visible business value dimension in the most dominant and most relevant group in each category across the three cases. Finally, Appendix 22 presents a comparative analysis of the two PCIaaS organisational performance categories, highlighting the most dominant PCIaaS organisational performance impact. Finally, sections 7.1.1, Section 7.1.2, and Section 7.1.3, respectively, presents the findings of the cross-case comparative analysis of PCIaaS performance measures, the dimensions of business value, and the organisational performance impact of PCIaaS.

7.1.1 Comparative Analysis of PCIaaS Performance Measures

This section analysed 39 PCIaaS performance measures consisting of 35 identified in the literature and four that emerged from that data. Table 7-1 presents a comparative analysis of PCIaaS performance measures across the three cases, highlighting the top ten and bottom ten PCIaaS performance measures and the PCIaaS performance measures across the three categories: highly supported, less supported, and not supported.

Table 7-1: Cross Case Comparative Analysis of PCIaaS Performance Measures

Rank	PCIaaS Performance Measures	CIT		OU		UCC		Three Cases		Category			
		Freq	%	Freq	%	Freq	%	Freq	%	CIT	OU	UCC	Cases
1	Cost-effective and affordable enterprise-class IT services	6*	4.03%	18*	8.04%	16*	8.38%	40*	7.09%	H	H	H	H
2	Better business continuity and disaster recovery	5*	3.36%	17*	7.59%	15*	7.85%	37*	6.56%	H	H	H	H
3	Rapid responsiveness to business needs	7*	4.70%	10*	4.46%	18*	9.42%	35*	6.21%	H	H	H	H
4	IT staff efficiency	4	2.68%	17*	7.59%	10*	5.24%	31*	5.50%	H	H	H	H
5	Development of new classes of products, apps & services	6*	4.03%	14*	6.25%	11*	5.76%	31*	5.50%	H	H	H	H
6	Improved infrastructure/data security	4	2.68%	13*	5.80%	13*	6.81%	30*	5.32%	H	H	H	H
7	Rapid turnaround time for new product development	5*	3.36%	12*	5.36%	12*	6.28%	29*	5.14%	H	H	H	H
8	Create training and development opportunities	8*	5.37%	11*	4.91%	6	3.14%	25*	4.43%	H	H	H	H
9	High availability and reliability	10*	6.71%	7	3.13%	7*	3.66%	24*	4.26%	H	H	H	H
10	Greater resilience	1^	0.67%	9*	4.02%	13*	6.81%	23*	4.08%	L	H	H	H
11	Ease and simplicity of IT management	5*	3.36%	9*	4.02%	8*	4.19%	22	3.90%	H	H	H	H
12	Efficient and better utilisation of IT resources	5*	3.36%	8	3.57%	6	3.14%	19	3.37%	H	H	H	H
13	Improve satisfaction of work	9*	6.04%	4	1.79%	5	2.62%	18	3.19%	H	H	H	H
14	Centralisation and consolidation	5*	3.36%	5	2.23%	6	3.14%	16	2.84%	H	H	H	H
15	Improve standard and modernity of IT infrastructure	4	2.68%	7	3.13%	4	2.09%	15	2.66%	H	H	H	H
16	Higher and better performance IT resources	3	2.01%	9*	4.02%	3	1.57%	15	2.66%	L	H	H	H
17	Research repository and collaboration	5*	3.36%	5	2.23%	5	2.62%	15	2.66%	H	H	H	H
18	Lower IT staff costs	4	2.68%	5	2.23%	4	2.09%	13	2.30%	H	H	H	L
19	Reduce the amount of space	8*	5.37%	4	1.79%	1^	0.52%	13	2.30%	H	H	L	L
20	Free up time to focus on core business	3	2.01%	4	1.79%	4	2.09%	11	1.95%	L	H	H	L
21	Better and higher quality of services	5*	3.36%	2	0.89%	3	1.57%	10	1.77%	H	L	H	L
22	Improve productivity	2^	1.34%	6	2.68%	2	1.05%	10	1.77%	L	H	L	L
23	Provides opportunities for flexibility and autonomy	5*	3.36%	3	1.34%	1^	0.52%	9	1.60%	H	L	L	L
24	Accelerate/lower IT barriers to innovation	1^	0.67%	4	1.79%	3	1.57%	8	1.42%	L	H	H	L
25	Less worry/flexibility applying system-wide upgrades/update	2^	1.34%	3	1.34%	2	1.05%	7	1.24%	L	L	L	L
26	Improve/enhance user experience	6*	4.03%	0^	0.00%	1^	0.52%	7	1.24%	H	N	L	L
27	Attracting potential students/reputational image	3	2.01%	4	1.79%	0^	0.00%	7	1.24%	L	H	N	L
28	Allow employees to work remotely	2^	1.34%	4	1.79%	1^	0.52%	7	1.24%	L	H	L	L
29	Increase/improve competitiveness	5*	3.36%	0^	0.00%	1^	0.52%	6	1.06%	H	N	L	L
30	Lower IT management/ maintenance expenses/costs	1^	0.67%	1^	0.45%	3	1.57%	5^	0.89%	L	L	H	L
31	Lower cost of failure	1^	0.67%	0^	0.00%	3	1.57%	4^	0.71%	L	N	H	L
32	Create opportunity for potential growth	4	2.68%	0^	0.00%	0^	0.00%	4^	0.71%	H	N	N	L
33	Eliminate bureaucratic bottlenecks	0^	0.00%	4	1.79%	0^	0.00%	4^	0.71%	N	H	N	L
34	Business process efficiency	2^	1.34%	0^	0.00%	1^	0.52%	3^	0.53%	L	N	L	L
35	Better work-life balance	0^	0.00%	3	1.34%	0^	0.00%	3^	0.53%	N	L	N	L
36	Lower/eliminate software costs	2^	1.34%	0^	0.00%	1^	0.52%	3^	0.53%	L	N	L	L
37	Reduce costs of cooling and power – energy savings	0^	0.00%	1^	0.45%	2	1.05%	3^	0.53%	N	L	L	L
38	Collective problem-solving	1^	0.67%	0^	0.00%	0^	0.00%	1^	0.18%	L	N	N	L
39	Go green/reduced carbon footprint	0^	0.00%	1^	0.45%	0^	0.00%	1^	0.18%	N	L	N	L
	Total	**149**	**100%**	**224**	**100%**	**191**	**100%**	564	100%				
	Mean	**3.82**	**2.56%**	**5.74**	**2.56%**	**4.90**	**2.56%**	14.46	2.56%				
	Median	**4.00**	**2.68%**	**4.00**	**1.79%**	**3.00**	**1.57%**	11	1.95%				
	Highly Supported Category									**22**	**25**	**23**	**17**
	Less Supported Category									**13**	**7**	**10**	**22**
	Not Supported Category									**4**	**7**	**6**	**0**

Legend: *Top Ten Group, ^Bottom Ten, H: Highly Supported, L: Less Supported, N: Not Supported

Table 7-1 presents a comparative analysis of the PCIaaS performance measures across the three cases, highlighting the ranking, the top ten and bottom ten PCIaaS performance measures, and the three categories of PCIaaS performance measures. Interestingly, increase competitiveness and growth emerged in the top ten PCIaaS performance measures in CIT, while in OU and UCC, it emerged in the bottom ten PCIaaS performance measures. In addition, two performance measures (provides opportunities for flexibility and autonomy and reduce the amount of space) emerged in the top ten PCIaaS performance measures in CIT, while in OU, it emerged in the bottom ten PCIaaS performance measures. However, five PCIaaS performance measures emerged as the top five PCIaaS performance measures across the three cases and the three cases combined. The researcher concludes that these five PCIaaS performance measures are the most important PCIaaS performance measures: (1) cost-effective and affordable enterprise-class IT services, (2) better business continuity and disaster recovery, (3) rapid responsiveness to business needs, (4) development of new classes of products, applications, and services, and (5) rapid turnaround time for new product development. According to the analysis, these top five PCIaaS performance measures were visible in the top ten groups and the highly supported category across the three cases and the three cases combined (see Table 7-1).

Cost-effective and affordable enterprise-class IT services emerged in the first, second, and fourth positions of the top ten list of PCIaaS performance measures in OU, UCC and CIT. The measure also emerged in the first position of the top ten list in the combined cases and the highly supported categories across the three cases. Furthermore, UCC highlighted the cost-effectiveness of PCIaaS over physical IT, public cloud, and the vendor's SaaS. In addition, CIT stressed the cost-effectiveness of PCIaaS in making the teaching of large IT infrastructure economically possible.

Better business continuity and disaster recovery emerged in the second, third, and fifth positions of the top ten list of PCIaaS performance measures in OU, UCC and CIT. The measure also emerged in the second position of the top ten list in the combined cases and the highly supported categories across the three cases. All three cases highlighted the importance of PCIaaS to better business continuity and disaster recovery. For instance, in OU, it was found that PCIaaS has dramatically improved its RTO and RPO. The institution was also enabled to swiftly recover from an unexpected power failure in its data centres. Similarly, CIT was also able to swiftly recover from an unexpected failure in its primary data centre. This type of failure in a traditional IT delivery model can halt the entire business operation of both institutions.

Rapid responsiveness to business needs emerged in the first, third and eighth positions of the top ten list of PCIaaS performance measures in UCC, CIT and OU, respectively, and in the third position of the top ten list in the combined cases, and the highly supported categories across the three cases. All three cases highlighted the importance of PCIaaS in improving the agility and responsiveness in delivering swift IT services to meet the demands of business and users. For instance, in UCC, change requests to academic modules are now being handled during the academic semester, in ways previously not possible. Similarly, CIT also highlighted the importance of PCIaaS in improving the agility and responsiveness in meeting the technological needs of the institution's students.

Development of new products, applications, and services emerged in the fourth position of the top ten list of PCIaaS performance measures in CIT and OU, the sixth position in UCC and the fifth position in the combined cases. The measure also emerged in the highly supported categories across the three cases. All three cases highlighted the importance of PCIaaS in facilitating several new classes of products, applications, and services. For example, the cloud-based educational programs and the vDesktop and vCloud Labs in CIT and the institution's B.I. Platform. Similarly, in OU, numerous systems were also developed, and new platforms that lowered IT barriers to innovation provided for members of the institution to develop and test new applications. PCIaaS also helped eliminate the bureaucratic bottlenecks previously hampering the collaborative development of cross-function systems in OU by the central IT Services and the various departments and colleges (see Section 5.1.1.22). Consequently, the institution developed several systems, which were of benefit to members of the institution and the general public.

Finally, **the rapid turnaround time for new product development** emerged in the fifth position of the top ten list of PCIaaS performance measures in CIT, sixth position in OU and UCC, and seventh position in the combined cases. The measure also emerged in the highly supported categories across the three cases. All three cases highlighted the importance of PCIaaS in improving IT Systems development projects' implementation. For example, in CIT, it was found that there is a dramatic reduction in the turnaround time for project delivery by eliminating 95% of several redundant stages that previously hampered the delivery of projects and new product development.

Furthermore, the researcher concludes that the bottom four PCIaaS performance measures across the three cases and the three cases combined as the least important PCIaaS performance measures: (1) business process efficiency, (2) lower/eliminate software costs, (3) collective problem-solving, and (4) go green/reduced carbon footprint. These four PCIaaS performance measures were visible in the bottom ten groups, the less and not supported categories across the three cases and the three cases combined (see Table 7-1).

Business process efficiency was mentioned twice and once in CIT and UCC as a value derived from PCIaaS but not mentioned in OU. As a result, the measure emerged in the not supported category in OU and the less supported category in CIT, UCC, and the three cases combined. Similarly, lower/eliminate software costs was not mentioned as a value derived from PCIaaS in OU and mentioned twice and once in CIT and UCC. Consequently, the measure emerged in the not supported category in OU and the less supported category in CIT, UCC, and the three cases combined. Collective problem-solving was not mentioned as a value derived from PCIaaS in OU and UCC and mentioned once in CIT. The measure only emerged in the not supported category in OU and UCC and the less supported category in CIT and the three cases combined. Similarly, go green/reduced carbon footprint was not mentioned as a value derived from PCIaaS in CIT and UCC and mentioned once in OU. The measure only emerged in the not supported category in CIT and UCC and the less supported category in OU and the three cases combined.

This study also categorised and analysed the 39 PCIaaS performance measures across the nine dimensions of PCIaaS business value presented in the following section.

7.1.2 Comparative Analysis of PCIaaS Business Value Dimensions

This section presents the analysis of the PCIaaS business value. Table 7-2 presents a comparative analysis of PCIaaS business value dimensions across the three cases.

Table 7-2: Cross Case Comparison of Most Dominant and Relevant Dimensions of Business Value

S/N	Dimension of Business Value	No of PCIaaS Performance Measure	Most Dominant						Most Relevant					
			CIT		OU		UCC		CIT		OU		UCC	
			Freq (%)	Rank	Freq (%)	Rank	Freq (%)	Rank	Mean (%)	Rank	Mean (%)	Rank	Mean (%)	Rank
1	Better utilisation of resources	3	18 (12.08)	3	17 (7.59)	8	13 (6.84)	6	6.00 (4.03)	1	5.67 (2.53)	6	4.33 (2.28)	5
2	Cost reduction	6	14 (9.40)	6	25 (11.16)	3	29 (15.26)	3	2.33 (1.57)	9	4.17 (1.86)	7	4.83 (2.54)	4
3	Enhancement of products and services	3	12 (8.05)	7	18 (8.04)	7	10 (5.26)	8	4.00 (2.68)	4	6.00 (2.68)	5	3.33 (1.75)	7
4	Improvement in flexibility, agility and responsiveness	3	17 (11.41)	5	25 (11.16)	3	30 (15.79)	2	5.67 (3.80)	2	8.33 (3.72)	2	10.00 (5.26)	1
5	Productivity improvement and labour efficiency	6	18 (12.08)	3	40 (17.86)	2	26 (13.68)	4	3.00 (2.01)	8	6.67 (2.98)	4	4.33 (2.28)	5
6	Increase competitiveness/growth	3	12 (8.05)	7	4 (1.79)	9	1 (0.53)	9	4.00 (2.68)	4	1.33 (0.60)	9	0.33 (0.18)	9
7	Positive working environment	7	24 (16.11)	1	23 (10.27)	5	12 (6.32)	7	3.43 (2.30)	7	3.29 (1.47)	8	1.71 (0.90)	8
8	Business risk reduction	5	22 (14.77)	2	49 (21.88)	1	50 (26.32)	1	4.40 (2.95)	3	9.80 (4.38)	1	10.00 (5.26)	1
9	Research, development & innovation	3	12 (8.05)	7	23 (10.27)	5	19 (10.00)	5	4.00 (2.68)	4	7.67 (3.42)	3	6.33 (3.33)	3

Legend: 1st – 3rd Position: Highly Significant, 4th – 6th Position: Moderately Significant, 7th – 9th Position: Less Significant

Table 7-2 highlights the most dominant and most relevant PCIaaS business value dimensions across the three cases. Two PCIaaS business value dimensions emerged as the most and second most important categories: business risks reductions and improve flexibility, agility, and responsiveness. Therefore, it is not surprising that these two dimensions emerged as the top PCIaaS business value dimensions. As previously discussed in Section 7.1.1, the business vision and objectives for PCIaaS across the three cases include business risks reduction and improve agility and responsiveness. This finding suggests that business vision and objectives are important in organisations' ability to exploit the potential of PCIaaS to enhance organisational performance. Surprisingly, cost-effectiveness and affordable enterprise-class IT services are the top PCIaaS performance measure, but cost reduction is not among the most dominant PCIaaS business value dimensions.

Business risks reduction emerged as the most important PCIaaS business value dimension across the three cases, appearing in the highly significant categories in the most dominant and most relevant PCIaaS business value dimensions. This finding is not surprising, bearing in mind that the private cloud's preference, popularity, and attractiveness among large organisations are due to the security and privacy concerns of other cloud computing deployment models. Furthermore, four of the five PCIaaS performance measures in this dimension emerged in the top ten measures across the three cases. As previously noted in Section 7.1.2, PCIaaS has dramatically improved disaster recovery and business continuity, including RTO and RPO, across the three cases. More so, PCIaaS offers highly available and reliable IT infrastructure to members in CIT and OU. Similarly, in UCC, the high availability and reliability of the institution’s PCIaaS have led to a dramatic improvement in service offering to members of its institution.

Improve flexibility, agility, and responsiveness emerged as the second most important PCIaaS business value dimension across the three cases, appearing in the highly significant category in two cases and the moderately significant category in the most dominant group. The dimension also appeared in the highly significant category across the three cases in the most relevant group. The importance of improvement in flexibility, agility, and responsiveness to the three cases may be related to their ability to promptly meet not only the needs and requirements of their service users but also the needs of business, particularly the elimination of the procurement cycle of IT hardware which has led to the rapid turnaround time for new products development. For example, CIT highlighted its ability to swiftly provide vServers to meet the needs of members of the institution, including the swift provisioning of vDesktop in meeting the technological needs of its students. The vDesktop offers students has anytime, anywhere access to the computing laboratory environment with the most current and up-to-date software. OU also highlighted its rapidity in providing IT infrastructure to members of the institution and in processing students admission despite the unexpected increase in students application. UCC also highlighted that PCIaaS has made the institution more agile and responsive in meeting the university community's needs, requirements, and demands.

Increase competitiveness and growth emerged as the least important PCIaaS business value dimension, emerging in CIT in the moderately significant category and the less significant category of the most relevant group in OU and UCC. The dimension also emerged in the less significant category across the three cases in the most dominant group. Competitiveness and growth were seldomly mentioned in OU and barely mentioned in UCC. CIT highlighted the importance of PCIaaS in advancing the institution's competitiveness and growth.

The within-case analysis of the PCIaaS organisational performance impact evaluation instrument across the three cases forms the basis of the comparative analysis of the PCIaaS organisational performance categories presented in the following section.

7.1.3 Comparative Analysis of PCIaaS Organisational Performance Categories

This section analysed the performance impact of PCIaaS across two categories of organisational performance. Table 7-3 presents a cross-case comparative analysis of PCIaaS organisational performance impact, as shown in the analysis of the PCIaaS organisational performance impact evaluation instrument in Appendix 22.

Table 7-3: PCIaaS Organisational Performance Categories

Cases	Organisational Performance Categories	
	Operational Effectiveness	Strategic Positioning
CIT	128 (85.91%)	21 (14.09%)
OU	214 (95.54%)	10 (4.46)
UCC	190 (99.48%)	1 (0.52%)

Table 7-3 highlights the organisational performance impact of PCIaaS across two categories. Again, PCIaaS disproportionately enhanced the organisational performance of the three cases, with operational effectiveness being the dominant topology. For example, the most visible top ten list of PCIaaS performance measures across the three cases and combined cases are all operational in value. This finding suggests that tertiary educational institutions are focused primarily on exploiting the potential of PCIaaS to improve their operational effectiveness.

This section evaluated and analysed the organisational performance impact of PCIaaS using 39 PCIaaS performance measures across nine PCIaaS business value dimensions and two categories of organisational performance. The following section summarises the main findings across the three levels of analysis.

7.1.4 Summary and Findings: Organisational Performance Impact of PCIaaS

This section presents the comparative analysis of the organisational performance impact of PCIaaS across the three cases using the PCIaaS organisational performance impact evaluation instrument across multiple levels: 39 PCIaaS performance measures, nine PCIaaS business value dimensions, and two PCIaaS organisational performance typologies. The instrument provided a vehicle for understanding the performance impacts of PCIaaS across the individual cases and enabled an objective cross-case analysis.

Firstly, the analysis of the PCIaaS performance measures (Section 7.1.3) identified four PCIaaS performance measures in addition to the 35 in literature. All 39 PCIaaS performance measures were supported across the three cases, consisting of three categories: highly supported, less supported, and not supported. Also identified in this study are the top and bottom ten PCIaaS performance measures. This study also found that the five most important PCIaaS performance measures are: (1) cost-effective and affordable enterprise-class IT services, (2) better business continuity and disaster recovery, (3) rapid responsiveness to business needs, (4) development of new classes of products, applications, and services, and (5) rapid turnaround time for new product development. In contrast, this study also found that the four least important PCIaaS performance measures are: (1) business process efficiency, (2) lower/eliminate software costs, (3) collective problem-solving, and (4) go green/reduced carbon footprint.

Secondly, PCIaaS business value dimensions were compared across the most dominant and most relevant groups (Section 7.1.2). This study found that the two most important PCIaaS business value dimensions are: (1) business risks reductions and (2) improve flexibility, agility, and responsiveness. In contrast, the dimension of increase competitiveness and growth is the least important. Finally, the analysis of the organisational performance impact of PCIaaS across two categories suggests that operational effectiveness is the dominant topology of the organisational performance impact of PCIaaS. The relatively high percentages of the performance impact of PCIaaS on operational effectiveness across all three cases suggest that tertiary educational institutions focused on exploiting PCIaaS to enhance their operational effectiveness more than their strategic positioning. This study also suggests that PCIaaS have a differential impact on the organisational performance of the three cases. However, having determined the organisational performance impact of PCIaaS, the following sections presents the comparative analysis of organisational factors.

7.2 RQ2 – Comparative Analysis of Organisational Factors

This study categorised the 13 organisational factors identified across the three cases that influence the performance impact of PCIaaS into five dimensions, comprising (1) organisational strategy, (2) organisational power and politics, (3) organisational process, (4) organisational structure, and (5) organisational culture. The within-case analysis of CIT, OU, and UCC has been discussed in Sections 4.2, 5.2, and 6.2 to answer RQ2. Table 7-4 presents the organisational factors discovered across the five dimensions that influenced the performance impact of PCIaaS.

Table 7-4: Organisational Factors that Influenced PCIaaS Performance Impact

Dimensions	Organisational Factors	CIT	OU	UCC	Total
Organisational Strategy	Education and Training	14 (31.11%)	5 (9.62%)	4 (6.06%)	23 (14.11%)
	Business Vision	5 (11.11%)	5 (9.62%)	7 (10.61%)	17 (10.43%)
	Appropriate Strategy and Policy Changes	2 (4.44%)	2 (3.85%)	10 (15.15%)	14 (8.59%)
	Motivational Incentives	0 (0.00%)	4 (7.69%)	2 (3.03%)	6 (3.68%)
	Educational Technology Champions	4 (8.89%)	0 (0.00%)	1 (1.52%)	5 (3.07%)
	Marketing and Advertising	3 (6.67%)	0 (0.00%)	0 (0.00%)	3 (1.84%)

Dimensions	Organisational Factors	CIT	OU	UCC	Total
	Total	**28 (62.22%)**	**16 (30.77%)**	**24 (36.36%)**	**68 (41.72%)**
Organisational Power & Politics	Stakeholder Support/ Resistance	8 (17.78%)	6 (11.54%)	11 (16.67%)	25 (15.34%)
	Top Management Support and Commitment	5 (11.11%)	4 (7.69%)	9 (13.64%)	18 (11.04%)
	IT Leadership	0 (0.00%)	0 (0.00%)	2 (3.03%)	2 (1.23%)
	Total	**13 (28.89%)**	**10 (19.23%)**	**22 (33.33%)**	**45 (27.61%)**
Organisational Structure	Governance and Decision Making	1 (2.22%)	16 (30.77%)	2 (3.03%)	19 (11.66%)
	Total	**1 (2.22%)**	**16 (30.77%)**	**2 (3.03%)**	**19 (11.66%)**
Organisational Processes	Business process and applications redesign	0 (0.00%)	5 (9.62%)	7 (10.61%)	12 (7.36%)
	IT Business Partnerships	0 (0.00%)	0 (0.00%)	5 (7.58%)	5 (3.07%)
	Total	**0 (0.00%)**	**5 (9.62%)**	**12 (18.18%)**	**17 (10.43%)**
Organisational Culture	Institutional Culture and Environment	3 (6.67%)	5 (9.62%)	6 (9.09%)	14 (8.59%)
	Total	**3 (6.67%)**	**5 (9.62%)**	**6 (9.09%)**	**14 (8.59%)**

Table 7-4 highlights the categorisation of the 13 organisational factors identified across the five dimensions and their frequency distribution. Firstly, organisational strategy is the most dominant across the three individual cases and combined cases. Following is the dimension of power and politics. In contrast, the dimension of organisational processes is the least dominant across two of the three cases, but third in one of the cases and fourth in the combined case. Secondly, there is no dominant organisational factor across the three cases. However, education and training are the most dominant in CIT, governance and decision making in OU, and stakeholders support and resistance in UCC. However, the top three organisational factors in the combined cases are: (1) stakeholders support and resistance, with 25 (15.34%) occurrences, (2) education and training, with 23 (14.11%) occurrences, and (3) governance and decision-making have 19 (11.66%) occurrences.

However, the 13 organisational factors identified in this study had differential impacts on PCIaaS performance impact. Therefore, drawing on RBV, this study conducted a comparative analysis of the organisational factors' strengths and weaknesses to determine their impact on the capabilities to exploit PCIaaS. Table 7-5 presents the cross-case comparative analysis of organisational factors showing their prevalence level and impact cluster.

Table 7-5: Cross Case Comparative of Organisational Factors

Dimensions	Organisational Factors	CIT	OU	UCC	Prevalence	Impact Cluster
Organisational Strategy	Education and Training	+*	+***	+	High	Positive
	Business Vision and Objectives	+***	±***	±	High	Varied
	Appropriate Strategy & Policy Changes	+	+	+**	High	Positive
	Motivational Incentives		+	+	Medium	Positive
	Educational Technology Champions	+		-	Medium	Varied
	Marketing and Advertising	+			Low	Positive
Organisational Power & Politics	Stakeholder Support	+**	±**	±*	High	Varied
	Top Management Support/ Commitment	+***	±	±***	High	Varied
	IT Leadership			+	Low	Positive
Organisational Process	Legacy Business Processes/ Applications		-***	-	Medium	Negative
	IT/Business Partnerships			+	Low	Positive
Organisational Structure	Governance and Decision-Making	+	±*	+	High	Varied
Organisational Culture	Institutional Culture and Environment	+	+***	-	High	Varied

Legend: Positive Impact (+), Varied Impact (±), Negative Impact (-), Most Visible (*), Second Most Visible (**), Third Most Visible (***)

Table 7-5 highlights the organisational factors identified across the three cases, their prevalence levels and impact clusters. The following sections discuss each of the organisational factors.

7.2.1 Education and Training

Education and training were vital to integrating PCIaaS into the business operations and processes of the three cases. Education and training is one of the two organisational factors that emerged in the positive impact and highly prevalent clusters (see Table 7-5). PCIaaS integration into the three cases' business operations and processes was not without challenges. Education and training were vital in overcoming these challenges. First, key stakeholders and top management across the three cases lacked the awareness of PCIaaS strategic value. The PCIaaS IT personnel, IT leadership, and educational technology champions were crucial in educating and creating awareness among these key decision-makers. Second, despite the years of IT professional experience and existing technical skills/knowledge of the existing IT personnel, some lacked the requisite cloud computing-related technical skills/knowledge needed to fit into the role of PCIaaS IT personnel. As a result, PCIaaS IT personnel completed additional training to acquire skills/knowledge, especially those specific to the chosen vendor(s) cloud infrastructure.

Third, PCIaaS was intimidating to some lecturers and a specific group of IT personnel, who preferred the conventional way of working. The training and awareness provided to this group of employees of the strategic value of PCIaaS to their job and the entire institution was vital in convincing them to use the PCIaaS services. Similarly, there was a subtle resistance by some of the departments and colleges to PCIaaS. Instead, these departments and colleges preferred their traditional IT infrastructure. Educating, training, consultancy, and advisory services provided by PCIaaS IT personnel to key members of these departments and colleges helped encourage them to subscribe to the centrally provisioned PCIaaS. Fourth, the departmental staff and IT technicians, lecturers, and students lacked the skills/knowledge to support and use the PCIaaS services. As the SMEs, PCIaaS IT personnel provided these institution members with the necessary training, support, and awareness. Fifth, there was also fear and resistance to change coming from some institution's members. Apart from the training of existing IT personnel to fit into the new role of PCIaaS, there was no end-user training of PCIaaS in UCC.

7.2.2 Appropriate Strategy and Policy Changes

Formulating appropriate strategy and policy changes were vital to integrating PCIaaS into the three cases' operations and processes. Appropriate strategy and policy changes is the second organisational factor that emerged in the positive impact and highly prevalent clusters (see Table 7-5). Some of the strategy and policy changes identified across the three cases include cloud-first strategy, cloud services migration policy, cloud acceptable usage policy, and cloud data storage policy. For example, all three cases have a cloud-first strategy that encourages PCIaaS services to develop future IT systems. Cloud-first policy and cloud migration policy enabled users of those services to benefit from cloud technology's potential and enable the institution to rapidly adapt to changes in the educational environment. The cloud migration policy encourages migrating legacy IT systems to PCIaaS to enhance better-quality services to members. The need for a cloud data storage policy was highlighted in UCC, particularly for the research community, discouraged the use of Dropbox and enhanced their ability in getting research funding from research agencies.

7.2.3 Motivational Incentives

Motivational incentives were vital to integrating PCIaaS into the operations and processes in OU and UCC. However, this factor was not mentioned in CIT. The researcher attributes the lack of mention of this factor in CIT primarily to stakeholder's supportiveness of incorporating PCIaaS into the institution's operations and processes. Like any organisational change, introducing new technology and innovation such as PCIaaS into the business operations and processes in OU and UCC are not without challenges. Some of the departments and colleges in OU were subtly or passively resistant to PCIaaS by exercising the decision-making authority granted them by the federated structure of the institution. Similarly, the research community in UCC were reluctant to engage, subscribe, and use the PCIaaS services. Motivational incentives played an influential role in encouraging the institution's members to engage, subscribe and use PCIaaS.

PCIaaS cannot generate business value or improve organisational performance if not used. Therefore, both institutions adopted various motivational incentives to encourage users to subscribe and use the centrally provided PCIaaS services. Some of the motivational incentives identified include: (1) pricing model, (2) carrot and stick approach, (3) free usage quota, (4) subsidised price, (5) cost-effective price, (6) persuasion, (7) encouragement, (8) attractive services offering, and (9) IT staff reduction. Both institutions employed these motivational incentives as a strategic tool to boost, influence, and attract members of their institution to subscribe to or use PCIaaS services and maximise the realisation of business value. For example, Section 6.2.8 revealed that UCC offers a certain free usage quota to its member for projects spanning over a short duration.

7.2.4 Marketing and Advertising

Marketing and advertising was the least visible organisational strategy in this study. This factor is only visible in CIT but not mentioned in OU and UCC. Section 4.1.1.7 revealed that the CIT exploited the potential of several cloud-based educational degree programs, including two vLabs (vDesktop and vCloud). The vCloud replace physical infrastructure laboratories while the vDesktop replace physical computer laboratories. The institution's cloud-based teaching and learning were well publicised and described as the first of their kind in the world (see Appendix 18). Furthermore, Section 4.2.9 revealed that the institution leveraged marketing and advertising strategies to promote and market its innovative products or services to differentiate the institution from its competitors to attract prospective students and their parents by flaunting the financial and educational benefits of vDesktop to its students.

7.2.5 IT Leadership

The contributions of the IT leadership in exploiting the potential of PCIaaS were only mentioned in UCC and not in OU and CIT. Section 6.2.11 highlighted that the institution's IT leadership played a pivotal and instrumental role in incorporating PCIaaS into its operations and processes. Section 6.2.4 revealed that the IT leadership played a vital role in getting the top management. Similarly, Section 6.2.5 also shows that IT leadership played a role in motivating and getting key stakeholders' support for PCIaaS. The support of these critical stakeholders and the institution's top management was vital in exploiting the potentials of PCIaaS, for example, getting the support of a section of the institution's IT professional who was sceptical of how PCIaaS will affect their job. In addition, the role played by the institution's IT leadership was critical to driving its digital transformation initiative in enhancing its competitiveness. Consequently, the institution's IT leadership employed the DevOps initiative to ensure IT works collaboratively with other business units to redesign its legacy business processes and applications to ensure the realisation of the performance impact of PCIaaS. In addition, IT leadership also played a prominent role in its success and in its ability to integrate PCIaaS into the institution's business operations and processes, including (1) creating awareness of the strategic value of PCIaaS among members of the institution and (2) leading the institution's change management and digital transformation initiative.

7.2.6 IT/Business Partnership

IT and business need to work together to realise the optimal performance impact of PCIaaS. A robust IT/business partnership is required to enable the institution to improve its legacy business processes, presently scattered across different departments, and redesign its legacy business applications and systems that are not cloud-native applications. As previously noted in Section 6.2.11 and 6.2.12, the DevOps culture style of collaboration was employed to enhance a robust IT/business partnership to encourage different stakeholders across different functions to work collaboratively to improve the institution's inefficiency and fragmented legacy business processes and develop new products and services. However, IT/business partnership is not among the organisational factors mentioned in CIT and OU. Nevertheless, there was evidence of IT/business partnership in both cases. For example, eliminating the bureaucratic bottlenecks that previously hampered cross-functional project implementation helped improve the partnership between the PCIaaS IT personnel and the various departments and colleges in OU. Similarly, a strong partnership between the PCIaaS IT personnel and the institution members eager to 'cloudify' in CIT resulted in developing several systems and migrating existing legacy systems to PCIaaS.

7.2.7 Business Vision and Objectives

All three cases highlighted the importance of business vision and objectives in generating business value from PCIaaS to improve organisational performance. Organisations make their investment decisions based on and in alignment with their business vision and objectives. Therefore, business vision and objectives are vital concepts central to exploiting PCIaaS for performance impact. However, this study found that business vision and objectives manifest in different ways across the three cases. The researcher identified seven business vision and objectives for PCIaaS across the three cases and categorised as (1) operational and (2) strategic. The business vision and objectives for PCIaaS in CIT encompassed operational and strategic, while OU and UCC were only operational. This finding suggests that CIT have shown potential for using PCIaaS for advancing for strategic value. However, section 4.1.1.13 revealed that the institution derived strategic value from PCIaaS, but the impact of PCIaaS on strategic positioning is still in a minority of the value derived by the institution. The resources that contributed to the vision and objectives of PCIaaS include the PCIaaS IT personnel, IT leadership, and educational technology champions. OU and UCC highlighted the importance of connecting the vision and objectives for PCIaaS to the IT strategy, business strategy, and corporate plan in getting support and funding for PCIaaS. CIT highlighted the importance of sharing the vision for PCIaaS with peers and key stakeholders in getting their support and buy-in.

7.2.8 Educational Technology Champions

The advances in education encouraged some in the academic community to move beyond traditional teaching and learning. However, PCIaaS educational technology champions were mentioned in CIT, absent in UCC, and not mentioned in OU. The PCIaaS educational technology champions in CIT articulated the vision for cloud-based teaching and learning. While calling to investigate their vision for cloud-based teaching and learning, they also played the role of technology evangelists by communicating and propagating their vision to their peers and getting the institution's top management support.

In contrast, Section 6.2.9 revealed that UCC's IT leadership, from his previous employment, gained vast experience and expertise on cloud-based teaching and learning and its value in transforming the traditional methods of teaching and learning in tertiary education. However, the institution is yet to implement vDesktop Lab and cloud-based teaching and learning. As revealed in Section 6.2.9, the blame was partly attributed to the lack of educational technology champions to drive incorporating vDesktops into the institution's programme design.

7.2.9 Institutional Culture and Environment

CIT's institutional culture and environment immensely contributed to its success and ability to generate business value compared to OU and UCC. This study found that OU was one of the most reputable tertiary educational institutions on earth and had a high reputational culture for excellence built over the past centuries. The institution's reputational culture, corporate image, and high-quality and standard work culture for excellence encouraged the delivering quality products and services. In addition, the institution's high-quality work culture helped enhance the reliability and availability of its PCIaaS environments.

CIT's environment and culture are more technologically oriented (practical education). As a result, CIT has a culture that is open and adaptable to change, receptive to innovations and experimenting with new and emerging technologies to improve service delivery. Conversely, UCC's rigid culture, which makes it difficult to embrace change, negatively impacted its ability to generate business value from PCIaaS. However, the institution's IT leadership is putting measures in place to overcome this challenge.

7.2.10 Stakeholder Support

Stakeholder resistance impedes new technology or any organisational change. Stakeholder resistance to PCIaaS hinders an organisation's ability to derive business value from PCIaaS. Stakeholders in CIT were more supportive of integrating PCIaaS into its business operations and processes than their counterparts in OU and UCC. Students in CIT were the driving force behind the institution's PCIaaS. Consequently, the departments have to buy into PCIaaS. Conversely, it was challenging getting the buy-in of many of the colleges and departments in OU and members of the research community in UCC. Instead, they preferred their old and legacy IT infrastructure and the use of Dropbox and unsecured devices.

The reluctance of some stakeholders in OU and UCC to support their respective institution's PCIaaS worked against the institutions' business goal for PCIaaS and its ability to maximise its performance impact. To maximise PCIaaS business value, stakeholders' interests and concerns should be a priority. Their support ensured they understood the value and usefulness of PCIaaS, learned how to use it, and made use of it in their daily activities. The study revealed that although some of the stakeholders across the three cases were initially resistant, education and training helped eliminate their fears and resistance. OU and UCC also leveraged motivational incentives to create awareness, attract, motivate, encourage, and reduce resistance to PCIaaS.

7.2.11 Top Management Support and Commitment

Top management support and commitment is vital to the ability to exploit PCIaaS for performance improvement. The top management of the three cases was receptive to PCIaaS, adopted new ideas and provided the initial funding for the implementation of PCIaaS. However, all three cases highlighted the importance of post-implementation and sustained funding in exploiting the potential of PCIaaS to improve organisational performance. The lack of support and commitment of the top management in OU and UCC to provide sustained and post-implementation funding, probably due to budget or financial constrain, negatively impact the post-implementation improvement and enhancement of PCIaaS in OU and UCC and maximising it organisational performance potential. In contrast, the top management in CIT supported and was committed to post-implementation funding and expansion of vDesktop lab to different departments across the institution.

Furthermore, CIT also highlighted the importance of the role played by top management in leading and championing organisational change management as vital to exploiting the potential of PCIaaS for performance improvement. In OU, the role of its top management in leading and championing change management was not mentioned. However, evidence suggests that the responsibility might have been devolved down the hierarchy of its structure, possibly to the Cloud Services team members, including the PCIaaS IT personnel. Similarly, in UCC, evidence suggests that the institution's IT leadership is leading and championing its change management.

7.2.12 Governance and Decision-Making

Before PCIaaS, each of the three cases had centrally provided IT services, and every department had its own IT Services department, which resulted in the duplication of human and IT resources and the associated costs in terms of maintenance cost and IT personnel costs. The strong governance and decision-making provided by the IT Steering Committee of CIT and OU and the top management of UCC helped enhance the centralisation of PCIaaS and its successes. The IT Steering Committee in OU also enabled the centralisation and integration of its PCIaaS with its strategic plan.

The three cases tailored their PCIaaS to fit their unique governance and decision-making structure. However, Governance and decision-making can have both positive and negative impacts on the realisation of the performance impact of PCIaaS. For example, while CIT and UCC had a centralised governance structure, OU had federated governance. As a result, the governance and decision-making structure in CIT and UCC positively impacted the institutions' ability to integrate PCIaaS into the institutions' operations and processes. In comparison, the governance and decision-making structure in OU negatively impacted the institution's ability to integrate PCIaaS into its operations and processes and its ability to realise its performance impact. For example, Section 5.2.6 revealed that OU's colleges and departments are administratively, legally, and financially independent. As a result, they make their own IT infrastructure decisions, own and manage their individual IT infrastructure, and manage their own IT budget. As a result, some departments and colleges, by exercising their rights, decided not to subscribe to the centrally provisioned PCIaaS, which resulted in inconsistent institutional-wide take-up of the PCIaaS services.

7.2.13 Legacy Business Processes and Applications

Legacy business processes and applications harmed the institution's ability to realise optimal performance impact from PCIaaS. This study found that UCC's fragmented legacy business processes and the running of legacy and non-cloud-native applications on PCIaaS were problematic and hindered its ability to realise its performance impact. One of the main benefits of cloud computing is scalability. Legacy business applications cannot scale up on a PCIaaS platform. Cloud-native applications are designed specifically for the cloud. The redesigning of legacy business processes and applications enabled the integration of PCIaaS into business operations and processes and had the most impact on performance. Therefore, the redesigning of legacy business processes and applications was imperative for realising the optimal performance impact of PCIaaS. IT/business partnership was one of the ways the institution redesigned its business processes and applications.

There was a lack of organisation-wide visibility of the business processes of the various departments and colleges in OU. Therefore, an organisational-wide approach to improving legacy business processes and applications would be challenging due to the institution's federated structure. The lack of an organisational-wide approach to improving legacy processes and systems negatively impacted the performance impact of PCIaaS. In contrast, the impact of legacy business processes and applications were not visible in CIT. However, there is evidence that the institution has migrated its legacy business processes and applications to PCIaaS. For example, the lecturers previously restricted to delivering lectures within the institution's physical boundary now use remote services to deliver lectures to students anywhere in the world. There is also evidence that members of the institution were eager to migrate their legacy processes and systems to PCIaaS, including developing its BI platform that incorporates all manual and paper-based databases.

7.2.14 Summary and Finding: Organisational Factors

This section summarises the organisational factors that influenced the performance impact of PCIaaS. This study identified 13 organisational factors across the five dimensions, including nine organisational factors in CIT and OU and 12 in UCC. Table 7-4 highlights the frequency distribution of the 13 organisational factors across the five dimensions. The dimension of organisational strategy was the most dominant with six organisational factors and the highest number of frequencies, followed by organisational power and politics with three organisational factors and the second highest number of frequencies. This finding suggests that organisational strategy, power and politics, and processes were essential to exploiting PCIaaS to improve performance.

Table 7-5 highlights the three prevalence levels and three impact clusters of organisational factors that emerged in this study. The prevalence levels include high, medium, and low, while the impact clusters include positive impact, varied impact, and negative impact. Education and training and appropriate strategy and policy changes have the most positive impact on the ability to exploit PCIaaS for performance improvement, emerging in the high prevalence and positive impact clusters across the three cases. Motivational incentives have the second most positive impact on exploiting PCIaaS, emerging in the medium prevalence and positive impact clusters in two cases. This finding suggests that education and training, appropriate strategy and policy changes, and motivational incentives are vital to exploiting PCIaaS for performance improvement.

In contrast, legacy business processes and applications are the only organisational factor that negatively impacted the ability to exploit PCIaaS for performance improvement, emerging in the medium and negative impact cluster across two cases. This finding highlights the importance of business process and applications redesign in exploiting the potential of PCIaaS to enhance organisational performance. UCC in Section 6.2.10 highlighted the importance of business process and applications redesign as vital to its ability in exploiting the potential of PCIaaS. The following sections discuss the 13 organisational factors in the context of their contributions to the performance impact of PCIaaS.

Conclusively, the analysis indicates that organisational factors had a differential impact on exploiting PCIaaS across the three cases. Therefore, the researcher concludes that organisations wanting to implement PCIaaS should critically analyse these organisational factors in the context of their strengths and weaknesses.

7.3 RQ3 – Comparative Analysis of PCIaaS IT Personnel

PCIaaS IT personnel is a new role across the three cases, with existing IT personnel undergoing additional training to acquire the necessary skills/knowledge. PCIaaS IT personnel played a significant role in exploiting PCIaaS by performing the five profiles of activities. The within-case analysis of the activities performed by PCIaaS IT personnel through which they contributed to the performance impact of PCIaaS and their skills/knowledge has been presented in Sections 4.3, 5.3, and 6.3 to answer RQ3. The following subsections present the cross-case comparative analysis of the profile of activities and skills/knowledge of PCIaaS IT personnel.

7.3.1 Profile of Activities Performed by PCIaaS IT Personnel

Table 7-6 presents the cross-case analysis of the profile of PCIaaS IT personnel's activities across the three cases.

Table 7-6: Cross Case Comparative of PCIaaS IT Personnel Activities Profile

Categories	Profiles of Activities	CIT	OU	UCC
Operational Orientation	Architecture Builder	X*	X*	X*
	Systems Provider	X*	X	X*
	Project Coordinator	X	X	X
Strategic Orientation	Partner	X	X*	X
	Technological Leader	X	X	X

***Most Visible**

PCIaaS IT personnel across all three cases perform all five profiles of activities. However, there were commonalities and differences in the most visible profile of activities. The architecture builder's profile was the most visible profile of activities performed by private cloud IT personnel across the three cases. This finding is not surprising because the activities performed under the architecture builder's profile were the primary daily duties and responsibilities of PCIaaS IT personnel. The systems provider's profile was the second most visible profile of the activities performed by private cloud IT personnel across the three cases. Finally, the partner was the third most visible profile of the activities performed by private cloud PCIaaS IT personnel in the three cases.

7.3.1.1 Architecture Builder

The primary activities performed by PCIaaS under this profile were purely technical. According to the analysis, core activities performed under this profile across the three cases were building and managing the PCIaaS environments. As part of these broad activities, PCIaaS IT personnel also managed and planned systems development and implementation. They also provided support hardware and software installation, including their configuration and maintenance. Also of vital importance was the production of technical documentation and crisis management. These activities required a combination of skills/knowledge in both dimensions of competencies despite being technical. For example, teamwork and communication skills were vital in performing the activities under this profile.

7.3.1.2 Systems Provider

The primary activities performed under this profile were providing and delivering IT services to meet the services users and business's needs and requirements. Although the systems provider's profile was purely technical, PCIaaS IT personnel also required a mix of skills/knowledge in the dimensions of technical and business management competencies. However, this study reveals that PCIaaS IT personnel needed to be knowledgeable in the institution's business area to perform the activities under this profile effectively. For example, project management skills, systems analysis and design, business area, and communication skills were vital in performing the activities under this profile. In addition, PCIaaS IT personnel needed to be good communicators as this profile required them to engage, interrogate and communicate with business users and possibly investigate the purpose for which the systems requested were made and provide tailored IT services that best fit their purpose.

7.3.1.3 Partner

The activities performed by PCIaaS IT personnel under this profile played a vital role in exploiting PCIaaS to improve organisational performance. PCIaaS IT personnel played a vital role in ensuring proper implementation of change management and crafting a strategic and operational vision for PCIaaS. PCIaaS IT personnel also educated and trained system and service users to enhance the services' usability. Educating and training users enhanced the proper implementation of change management. Surprisingly, in UCC, no evidence was found that its PCIaaS IT personnel performed any activities under this profile. In contrast, PCIaaS IT personnel in OU and CIT performed several activities under this profile, including educating members of other departments and colleges, working collaboratively with other departments and colleges in system development, and extending vDesktop to other departments.

The activities performed by PCIaaS IT personnel under this profile were also of particular importance to OU due to its devolved and federated governance structure. As SMEs of the technology, the institution's PCIaaS IT personnel worked collaboratively with business users, provided consultancy and expert advisory services, and encouraged the various departments and colleges to subscribe and use the centrally provisioned PCIaaS. PCIaaS IT personnel also needed a mix of technical and business management competencies (such as project management, interpersonal communication, teamwork, collaboration skills, and knowledge) to perform their activities under this profile effectively.

7.3.1.4 Technological Leader

The primary activities performed under the profile of technological leader were the strategic application and integration of PCIaaS into the fibre of business processes and operations. Some of the main activities were investigating, exploring, identifying, experimenting with new and emerging technologies and exploring and identifying new business and strategic opportunities to exploit new technological innovation for competitive advantage. Under this profile, PCIaaS IT personnel played a vital role in getting buy-in and support from stakeholders and top management. IT personnel required a mix of technical and business management skills/knowledge to perform this profile's activities. The activities performed under this profile also required interpersonal communication, teamwork, and collaboration skills, vital in building relationships and engaging with business partners. PCIaaS IT personnel needed industry and business area skills/knowledge to effectively perform the activities under this profile.

7.3.1.5 Project Coordinator

The activities of the project coordinator involved working with the business users in the implementation of projects. According to the analysis, under this profile, the main activities performed by PCIaaS IT personnel were to lead and participate in the implementation of projects. PCIaaS IT personnel also guided the implementation of IT-related projects that required the use of PCIaaS services. Consequently, they had to engage, liaise, and collaborate with internal and external parties and manage relationships. Furthermore, PCIaaS IT personnel worked closely with service users to implement projects aimed at designing new solutions. To ensure that the new solutions met the users' requirements, PCIaaS IT personnel interrogated and worked collaboratively with users to understand their problems, requirements, and what they intended to achieve. Consequently, they were able to proffer appropriate IS solutions and design solutions that best meet user needs. PCIaaS IT personnel required technical and business management skills/knowledge to effectively perform the activities under this profile. Besides being SMEs for PCIaaS, PCIaaS IT personnel required communication and interpersonal, project management, and business skills/knowledge.

The skills/knowledge of PCIaaS IT personnel are fundamental to their ability in performing the five profiles of activities. The following section compares the skills/knowledge of PCIaaS IT personnel across the three cases.

7.3.2 Skills/knowledge of PCIaaS IT Personnel

This section presents the cross-case comparative analysis of PCIaaS IT personnel's skills/knowledge requirements to effectively manage and support the PCIaaS environments of their respective institutions. PCIaaS IT personnel across the three cases required a combination and a broad set of skills/knowledge across the dimensions of technical and business management competencies enabling them to contribute to the performance impact of PCIaaS. Table 7-7 presents a cross-case comparative analysis of skills/knowledge of PCIaaS IT personnel identified across the three cases across the two dimensions of competencies and three categories of competency.

Table 7-7: Cross Case Comparative of Skills & Knowledge of PCIaaS IT Personnel

Dimension of Competencies	Skill & Knowledge	CIT	OU	UCC	Categories of Competency
Technical Competencies	Vendor(s) Cloud Infrastructure	X	X	X	Essential
	SAN	X	X	X	
	Networking	X	X	X	
	Virtualisation	X	X	X	
	Programming Language		X	X	Desirable
	Automation and Orchestration		X	X	
	Troubleshooting/Problem-Solving	X	X		
	Systems Integration		X	X	

Dimension of Competencies	Skill & Knowledge	CIT	OU	UCC	Categories of Competency
	IT/Cloud Security		X	X	
	Active Directory		X		Beneficial
	Software-defined everything		X		
Business Management Competencies	Interpersonal and Communication	X	X	X	Essential
	Project Management	X	X	X	
	Teamwork	X	X	X	
	Systems Analysis and Design		X	X	Desirable
	Business Domain	X	X		
	Customer Service and Relationship Management		X	X	
	Data Regulation and Compliance		X	X	
	Analysis and Judgement	X	X		
	IT Management		X		Beneficial
	Leadership		X		
	Agile			X	
	Dynamic			X	
	Flexible			X	
	IT Contract Management			X	
	Change Management			X	
	Sense of Humour		X		
	Adaptable			X	
	Time Management		X		
	Self-Motivated		X		

Table 7-7 shows a comparative analysis of the skills/knowledge of PCIaaS IT personnel across two dimensions of competencies and three categories of competency. Business management competencies are most dominant with 19 skills/knowledge, while technical competencies are less dominant with 11 skills/knowledge. The three categories of competency include (1) essential skills, (2) desirable skills, and (3) beneficial skills. The seven skills/knowledge visible across the three cases are essential skills/knowledge, the ten skills/knowledge visible across any two cases are desirable, and the 13 skills/knowledge visible in only one case are beneficial. The seven essential skills/knowledge consist of (1) four technical competencies and (2) three business management competencies. The ten desirable skills/knowledge consist of five technical competencies and five business management competencies. Finally, the 13 beneficial or advantageous skills/knowledge include two technical competencies and 11 business management competencies.

7.3.2.1 Technical Competencies

The study reveals that PCIaaS IT personnel underwent additional studies to acquire the four essential skills/knowledge in technical competencies across the three cases. Training in the chosen vendor cloud infrastructure is vital to PCIaaS IT personnel to acquire skills/knowledge specific to the chosen vendors cloud infrastructure. Interestingly, the four essential skills/knowledge were transferrable skills/knowledge applicable to cloud computing's deployment and service models and its possible 12 combinations. The researcher concludes that to fit into the new role of PCIaaS IT personnel, existing IT personnel needed to undergo additional training to acquire the essential technical skills/knowledge. These skills/knowledge would make PCIaaS IT personnel more successful in their workplace and more competitive in the global market.

7.3.2.2 Business Management Competencies

Traditionally, IT personnel typically required technical skills/knowledge to perform technical activities. However, PCIaaS has bridged the gap between technical skills and business management skills. In performing the five profiles and activities, PCIaaS IT personnel required skills/knowledge in technical and business management competencies. Moreover, as the PCIaaS SMEs, PCIaaS IT personnel needed business area skills/knowledge to analyse business needs and user requirements. For example, Sections 4.2.8, 4.3.1.4, and 4.3.1.5 highlight the vital role played by PCIaaS IT personnel in contributing to all three capabilities identified in CIT, particularly in incorporating PCIaaS into the institution's operations and processes.

7.3.3 Summary and Findings: PCIaaS IT Personnel

This section presents a comparative analysis of PCIaaS IT personnel. PCIaaS IT personnel is a new role in the IT Services department across the three cases tasked with managing and supporting PCIaaS. PCIaaS IT personnel serve as the glue that binds PCIaaS and the organisational factors into robust and functional IT services that are fit for purpose. PCIaaS IT personnel were investigated from the perspective of ACM, comprising of the activities they performed and their skills/knowledge. The activities performed by PCIaaS IT personnel were: (1) architecture builder, (2) systems provider, (4) project coordinator, (4) partner, and (5) technological leader. By performing these five profiles of activities, PCIaaS IT personnel contributed to PCIaaS performance impact. However, the two most visible profiles of activities across the three cases were: (1) architecture builder and (2) systems provider, in order of dominance.

The study also found that PCIaaS IT personnel required a combination of skills/knowledge in both dimensions of competencies, including technical and business management. Both dimensions of competencies were vital to PCIaaS IT personnel's ability to perform the five profiles' activities. For example, the architecture builder's profile, although purely technical, required skills/knowledge in technical and business management competencies. The business management competencies of PCIaaS IT personnel enabled them to interpret business problems and design appropriate technical solutions to meet the business's needs. PCIaaS IT personnel were strategic business partners and change agents who worked collaboratively with institution members to align PCIaaS to its strategic business objectives. The activities performed by PCIaaS IT personnel and their skills/knowledge were evident across all three capabilities.

This study identified 30 skills/knowledge required by PCIaaS IT personnel, consisting of 11 technical competencies and 19 business management competencies. PCIaaS IT personnel required skills/knowledge in both competencies to better contribute to PCIaaS performance impact. However, business management competencies were the most dominant, while technical competencies were less dominant. This study also identified the three categories of competency visible across the three cases. The essential skills/knowledge are the most dominant, visible across the three cases. The desirable skills/knowledge are visible in any two cases, while the beneficial skills/knowledge are the least dominant, visible in only one case.

However, according to the conceptual research model developed and used in this study, the capabilities for exploiting PCIaaS for organisational performance are developed from the combination of the activities performed by PCIaaS IT personnel and enabling organisational factors. The following section presents the capabilities for exploiting PCIaaS, highlighting the combination of resources that make up each capability.

7.4 RQ4 – Comparative Analysis of Organisational Capabilities

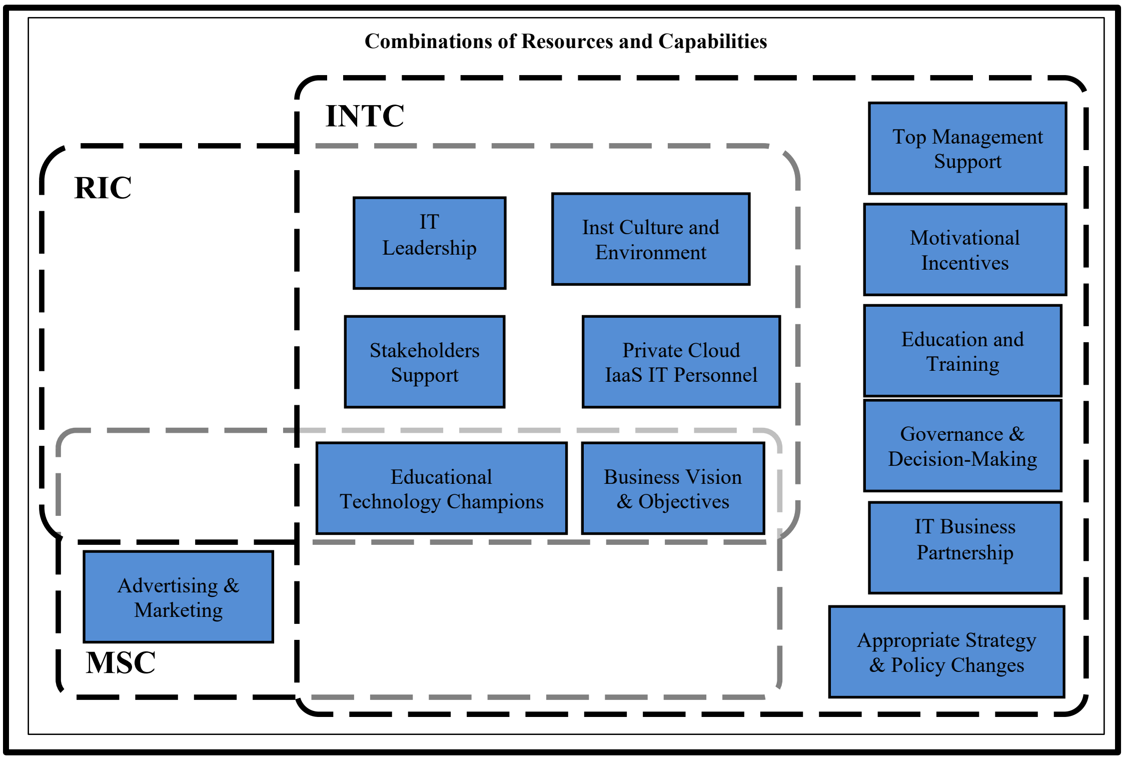
This section presents a cross-case comparative analysis of the capabilities required to exploit the potential of PCIaaS. Table 7-8 presents the three capabilities identified across the three cases, showing the combination of resources that make up the capabilities.

Table 7-8: Comparative Analysis of PCIaaS Capabilities

Resources	Organisational Factors/Activities Profiles	CIT	OU	UCC
Organisational Factors	Education and Training	INTC	INTC	INTC
	Business Vision and Objectives	RIC/MSC/INTC	RIC/INTC	RIC/INTC
	Appropriate Strategy & Policy Changes	INTC	INTC	INTC
	Motivational Incentives		INTC	INTC
	Educational Technology Champions	RIC/MSC/INTC		
	Marketing and Advertising	MSC		
	Stakeholder Support	INTC	INTC	RIC/INTC
	Top Management Support/ Commitment	INTC	INTC	INTC
	IT Leadership			RIC/INTC
	IT/Business Partnerships			INTC
	Governance and Decision-Making	INTC	INTC	INTC
	Institutional Culture and Environment	RIC	INTC	
PCIaaS IT Personnel	Architecture builder	INTC	INTC	INTC
	Systems Provider	INTC	INTC	INTC
	Partner	INTC	INTC	INTC
	Project coordinator	INTC	INTC	INTC
	Technological leader	RIC	RIC	INTC

The three capabilities visible across the three cases were (1) research and innovation capabilities (RIC), (2) market sensing capabilities (MSC), and (3) integration capabilities (INTC). Most of the organisational factors and the profiles of activities of PCIaaS IT personnel across the three cases contributed to integration capabilities, while few contributed to research and innovation capabilities and marketing capabilities. However, some organisational factors were either absent or not mentioned in some of the three cases. The organisational factors and the profiles of activities of PCIaaS IT personnel that combined in developing research and innovation capabilities across the three cases were: the technological leader activities profile of PCIaaS IT personnel, business vision and objectives, IT leadership, educational technology champions, stakeholder support, and institutional culture and environment. The three organisational factors that combined in developing market sensing capabilities were: business vision and objectives, educational technology champions, and marketing and advertising.

Research and innovation capabilities and integration capabilities were the dominant (core) capabilities, visible across the three cases, while market sensing capabilities were less dominant (secondary) and only visible in one case. The researcher concluded that market sensing capabilities, including some of the associated organisational factors contributing to the capabilities, were rare and strategically valuable. Figure 7-1 presents the combination of resources and capabilities across the three cases.



NOTE: Research and Innovation Capabilities (RIC), Integration Capabilities (INTC), Market Sensing Capabilities (MSC)

Figure 7-1: Combination of Resources and Capabilities for PCIaaS

Figure 7-1 highlights the combination of resources involved in developing the three capabilities identified in this study. In addition, it highlights the importance of business vision and objectives and educational technology champions as intersecting all three capabilities. Also highlighted is the importance of IT leadership, stakeholders support, PCIaaS IT personnel, and institutional culture and environment in developing research and innovation capabilities and integration capabilities. The following sections discuss each of the three PCIaaS capabilities, beginning with research and innovation capabilities.

7.4.1 Research and Innovation Capabilities

All three cases highlight the importance of research and innovation as central to incorporating PCIaaS into their business operations and processes. The six organisational resources that contributed to research and innovation capabilities across the three cases were: (1) PCIaaS IT personnel, (2) institutional culture and environment, (3) educational technology champions, (4) business vision and objectives, (5) stakeholders support, and (6) IT leadership. However, the combination of these resources differs across the three cases. For example, sections 4.2.8 and 4.2.2

show that the PCIaaS educational technology champions in CIT articulated the vision and called for investigating cloud-based teaching and learning.

Section 4.2.7 revealed that CIT's institutional culture and environment is receptive and encourages experimenting with new technologies and innovations. Sections 4.3.1.5 showed that the PCIaaS IT personnel testing and experimentation with PCIaaS was the bedrock of incorporating PCIaaS into CIT. Section 5.3.1.5 discussed how PCIaaS IT personnel explored the usefulness of PCIaaS in solving internal business problems and how this led to incorporating PCIaaS into OU. Section 5.2.5 also showed that the actions of the institution's PCIaaS IT personnel might not be in isolation but due to the growing demand by critical stakeholders in the institution. In contrast, IT leadership in UCC called for incorporating PCIaaS into the institution (Section 6.2.11).

Furthermore, the focus of the research and innovation capabilities of the three cases were two-fold: (1) to solve internal business problems and challenges (operations), and (2) to transform teaching and learning, and to sense, seize, and pursue new and emerging business opportunities in education (strategic). This aspect of the CIT's vision and objectives for PCIaaS differentiated the institution from OU and UCC. This study also found that research and innovation drive the vision and objectives for PCIaaS.

7.4.2 Market Sensing Capabilities

Market sensing capabilities is an aspect of research and innovation capabilities aimed at exploring new and emerging business opportunities in the educational industry, e.g., cloud-based teaching and learning. Section 7.2.7 indicates that the business vision and objectives of OU and UCC's research and innovation were operationally focused. In comparison, CIT were operationally and strategically focused. The latter was the foundation of the institution's market sensing capabilities.

Market sensing capabilities encompassed transforming teaching and learning and the sensing, seizing, and pursuing new and emerging opportunities in education, e.g., cloud-based teaching and learning. Three organisational factors contributed to developing market sensing capabilities, including (1) business vision and objectives, (2) educational technology champions and (3) marketing and advertising. Market sensing capabilities and the associated combination of resources were only visible in CIT. First, Section 7.2.8 revealed that PCIaaS educational technology champions were only visible in CIT, absent in UCC and not mentioned in OU. Second, Section 7.2.4 also revealed that marketing and advertising were only visible in CIT and not mentioned in OU and UCC. Third, Table 7-8 revealed that CIT is the only case with a strategic business vision and objectives. From the perspective of RBV, resources and capabilities that are valuable, rare, inimitable, and non-substitutable are sources of competitive advantage. Market sensing capabilities are only visible in CIT but not in OU and UCC. The researcher concludes that educational technology champions and marketing and advertising, and thus market sensing capabilities, were sources of competitive advantage to CIT. Market sensing capabilities help explain the differential organisational performance impact of PCIaaS across the three cases, particularly in the topology of strategic positioning.

7.4.3 Integration Capabilities

Integration capabilities are the abilities to direct, control, manage, and encourage desirable behaviour in incorporating PCIaaS into business operations and processes across the organisation's length and breadth. PCIaaS IT personnel, in addition to ten organisational factors, contributed to the development of integration capabilities. The organisational factors were (1) business vision and objectives, (2) education and training, (3) IT leadership, (4) top management support and commitment, (5) stakeholder support, (6) governance and decision-making, (7) appropriate strategy and policy changes, (8) educational technology champions, and (9) motivational incentives. The researcher concludes that PCIaaS IT personnel and organisational factors were critical to integrating PCIaaS into organisational operations and processes.

Education and training were vital in integrating PCIaaS into the business operations and processes of the three cases. As a new and emerging technology, PCIaaS created a new role in the IT services of all three cases. However, the existing IT personnel and PCIaaS IT personnel lacked the requisite skills/knowledge to fit into this new role. Similarly, there was also a knowledge gap on other members of the three cases, including top management and key stakeholders such as departmental IT technicians, lecturers, students. Therefore, all three cases needed to send their existing IT personnel and PCIaaS IT personnel for additional training to acquire the needed cloud computing-related technical skills/knowledge to support PCIaaS effectively. Further analysis also revealed that PCIaaS IT personnel, as the SMEs and other organisational factors such as IT leadership and educational technology champions, were vital in acquiring, preserving, disseminating, and integrating knowledge. For example, IT leadership and educational technology champions educated their peers and top management to gain their support.

The centralised governance and decision-making structure in CIT and UCC were vital to integrating PCIaaS into their institutions. In contrast, the federated structure in OU variedly impacted its ability in integrating PCIaaS into the institution. For example, the autonomy and authority enjoyed by the different departments and colleges in the institution prevented the consistent take on of PCIaaS across the institution's length and breadth. Formulating appropriate strategy and policy changes such as a cloud-first policy, cloud service migration, and cloud data storage policy enhanced data and legacy systems' migration to PCIaaS. Motivational incentives were the second most visible organisational factor that contributed to integrating integration capabilities. OU and UCC used motivation incentives to influence desired behaviour toward PCIaaS and to mitigate against resistance to change. For example, a free storage quota was given to members of the institution's research community undertaking a little project to encourage them to subscribe to PCIaaS. Although least visible across the three cases, IT leadership and IT/business partnership also played a significant role in integrating PCIaaS into business operations and processes.

7.4.4 Summary and Findings: Organisational Capabilities

This section presents the comparative analysis of the organisational capabilities to harness the potential of PCIaaS to improve organisational performance, highlighting the organisational factors and the profiles of activities of PCIaaS IT personnel that combined to develop three PCIaaS capabilities: (1) research and innovation capabilities, (2) market sensing capabilities, and (3) integration capabilities. This study found that business vision and objectives and educational technology champions intersect all three capabilities. This finding makes the researcher conclude that business vision and objectives and educational technology champions are the most important in exploiting PCIaaS for performance improvement. In addition, IT leadership, stakeholder support, PCIaaS IT personnel, and institutional culture and environment were visible across two capabilities: research and innovation capabilities and integration capabilities. This finding makes the researcher conclude that IT leadership, stakeholder support, PCIaaS IT personnel, and institutional culture and environment are the second most important in exploiting PCIaaS for performance improvement.

Research and innovation capabilities and integration capabilities were visible across the three cases, but market sensing capabilities were only visible in CIT. Based on the conceptualisation of the two topologies of capabilities developed in Section 2.5.1, market sensing capabilities are examples of strategic (outside-in/external) capabilities but only visible in CIT. As a result, CIT has operational (inside-out/internal) capabilities and strategic (outside-in/external) capabilities for exploiting PCIaaS, while OU and UCC have operational (inside-out/internal) capabilities. By having both capabilities, CIT stands a better chance for exploiting the potential of PCIaaS in improving its operational effectiveness and strategic positioning.

7.5 Chapter Summary and Key Findings

This chapter presented the findings from the cross-case analysis, of which the main objective is to investigate the organisational performance impact of PCIaaS, the organisational resources involved and the associated capabilities. A conceptual research model based on Grant's (1991) indirect model of RBV was developed and used as the theoretical lens for this study. This model consists of three main variables: (1) organisational resources, (2) organisational capabilities, and (3) organisational performance. Grounded in Barney (1991), this study classified organisational resources into (1) PCIaaS (a proxy of technology resources), (2) PCIaaS IT personnel (a proxy of human capital resources), and (3) organisational factors (a proxy of organisational capital resources). From this perspective, PCIaaS is a commodity exploited to improve organisational performance by the capabilities developed from the combination of PCIaaS IT personnel and organisational factors.

Section 7.1 compared the organisational performance impact of PCIaaS across the three cases using three levels of analysis: (1) PCIaaS performance measures, (2) PCIaaS business value dimensions, and (3) PCIaaS organisational performance categories. This study provided a detailed understanding of the organisational performance impact of PCIaaS across 39 PCIaaS performance measures, nine PCIaaS business value dimensions, and two PCIaaS organisational performance categories. This study identified the top five PCIaaS performance measures, the top two PCIaaS business value dimensions, and the top PCIaaS organisational performance category. The three cases exploited the potential available in PCIaaS in enhancing their operational effectiveness than their strategic positioning, except CIT, a small and relatively new tertiary institution compared to UCC and OU rooted in centuries of history and fame. This study shows that operational effectiveness is the dominant organisational performance impact of PCIaaS.

Section 7.2 presents the organisational factors that impacted the performance impact of PCIaaS. This study identified 13 organisational factors across the three cases and categorised them into the five dimensions of organisational factors. Organisational strategy emerged as the most dominant with six organisational factors, followed by organisational power and politics with three organisational factors. An analysis of the organisational factors' strengths and weaknesses identified three prevalence levels and impact clusters of organisational factors. Legacy business processes and applications are the only organisational factor that failed to contribute to the performance impact of PCIaaS. In contrast, education and training have the most influence on exploiting PCIaaS for performance improvement.

Section 7.3 discusses the skills/knowledge and the activities performed by PCIaaS IT personnel across all three cases. The skills/knowledge required by PCIaaS IT personnel consist of (1) seven essential skills/knowledge, (2) ten desirable skills/knowledge, and (3) 13 beneficial skills/knowledge across the dimension of technical and business management competencies. Thus, three categories of competency emerged: essential, desirable, and beneficial. Also identified are the activities performed by PCIaaS IT personnel through which they contribute to the performance impact of PCIaaS, including (1) architecture builder, (2) systems provider, (3) partner, (4) technological leader, and (5) project coordinator.

Section 7.4 highlights the combinations of resources that made up the capabilities for exploiting PCIaaS for performance improvement. Three capabilities emerged from the combination of the five activities performed by PCIaaS IT personnel and the 12 organisational factors that positively or variedly impacted performance: (1) research and innovation capabilities, (2) market sensing capabilities, and (3) integration capabilities. Business vision and objectives and educational technology champions were visible across all three capabilities. IT leadership, stakeholders support, PCIaaS IT personnel, and institutional culture and environment were noticeable across two capabilities, research and innovation capabilities and integration capabilities. In addition, this study also found that research and innovation capabilities and integration capabilities were the dominant PCIaaS capabilities, noticeable across all three cases, while market sensing capabilities were the less dominant PCIaaS capabilities, noticeable in only one case.

In conclusion, Sections 7.1, 7.2, 7.3, and 7.4 present the cross-case analysis of the organisational performance and the resources and capabilities involved. The resources and capabilities available to organisations determined the organisational performance impact of PCIaaS. Despite all three cases having a common commodity, PCIaaS. The PCIaaS IT personnel across the cases performed similar activities and had similar skills/knowledge. However, the three cases differed in organisational factors and their attributes and characteristics and thus PCIaaS capabilities. This finding suggests that organisational factors account for the differences in capabilities and the performance impact of PCIaaS.

Chapter Eight - Cross Case Analysis

8.0 Introduction

This chapter presents the overall conclusion of this research study. First, Section 8.1 presents the research objective and research questions. Second is Section 8.2, which presents the pathways from resources to performance. Third, Section 8.3 discusses the research contributions to theory and practice. Finally, Section 8.4 presents the limitations and recommendations for future research.

8.1 Research Objective and Research Questions

The main aim of this study was to create awareness of the organisational performance impact of PCIaaS in tertiary educational institutions. PCIaaS enables large organisations to exploit the potential of cloud computing within the organisation's firewall, but the organisational performance impact and the organisational resources and capabilities involved are not well understood. This research seeks to address these research gaps. Therefore, this study's objective was to:

Investigate the organisational performance impact of PCIaaS and the organisational resources and capabilities involved

Given the research objective, the researcher adopted RBV theory, a strategic management theory for investigating the link between organisational resources, capabilities, and performance, as its theoretical lens. The study achieved its objective by answering the following four research questions formulated in this study.

8.1.1 RQ1 – Organisational Performance

What is the organisational performance impact of PCIaaS?

CC has become the dominant computing infrastructure for organisations and citizens alike. However, PCIaaS' popularity, adoption, use, prominence, and attractiveness are still growing among large organisations. Due to PCIaaS enormous potential, it has become imperative to understand its value to organisations (Barenfanger et al., 2014; Mahler & Westergren, 2018). This study operationalised the organisational performance impact of PCIaaS by classifying it into operational effectiveness and strategic positioning (see Table 2-14). Through the analysis of the data collected from three cases, this study provided empirical evidence and awareness of the organisational performance impact of PCIaaS, particularly in tertiary educational institutions.

8.1.2 RQ2 – Organisational Factors

What are the organisational factors that influenced the organisational performance impact of PCIaaS?

Prior studies have highlighted the critical role of organisational factors on cloud computing adoption, implementation, and performance (Low et al., 2011; Gupta et al., 2018). Based on a review of the extant literature on organisational factors in ITBV research, this study adopted five dimensions of organisational factors from prior studies (Cao, 2008, 2010; Cao et al., 2011; Wiengarten et al., 2013): (1) organisational culture, (2) organisational strategy, (3) organisational processes, (4) organisational structure, and (5) organisational power and politics. Although prior studies found that these five organisational factors influenced IT's organisational performance impact, no study has empirically applied these factors to investigate the performance impact of PCIaaS. This study identified 13 organisational factors across the five dimensions that impacted the capabilities and performance impact of PCIaaS. In addition to identifying the organisational factors that influenced the performance impact of PCIaaS, the activities performed by PCIaaS IT personnel as enhanced by their skills/knowledge was key to deriving the organisational performance impact of PCIaaS.

8.1.3 RQ3 – PCIaaS IT Personnel

What are the contributions of PCIaaS IT personnel to the organisational performance impact of PCIaaS?

PCIaaS is a new paradigm in the use of IT in large organisations. So also, PCIaaS IT personnel is a new and emerging role in the IT Services department. This study adopted the Activity Competency Model (ACM) (Wu et al., 2004, 2005, 2007; Chen & Wu, 2011) as a framework to investigate this new and emerging role, focusing on their skills/knowledge and the activities performed. This study also identified the skills/knowledge of PCIaaS IT personnel across the two dimensions of competencies and three categories of competency. This study also found that PCIaaS played a vital role in exploiting PCIaaS to improve organisational performance by performing the five profiles of activities.

8.1.4 RQ4 – PCIaaS Capabilities

What organisational capabilities are required to improve organisational performance through PCIaaS?

This study broadly categorised organisational capabilities into (1) operations (inside-out/internal) capabilities and (2) strategic (outside-in/external) capabilities. By combining the resources involved in exploiting PCIaaS for performance improvement, three capabilities emerged: research and innovation capabilities, market sensing capabilities, and integration capabilities. The following section presents the configuration of these capabilities in pathways to the organisational performance of PCIaaS.

8.2 Organisational Performance Impact of PCIaaS

This study draws upon the theoretical foundations of RBV, CC, and ITBV to develop and propose a conceptual research model that highlights the three main variables in the indirect model of RBV theory, consisting of (1) organisational resources, (2) organisational capabilities, and (3) organisational performance.

From the perspective of RBV, the available resources and capabilities possessed by firms explain the differences in organisational performance (Barney, 1991; Grant, 1991, 1995; Conner, 1991; Peteraf, 1993; Peteraf & Barney, 2003). PCIaaS IT personnel and combinations of different organisational factors resulted in the development of three PCIaaS capabilities across the three cases: (1) research and innovation capabilities, (2) market sensing capabilities, and (3) integration capabilities. This study highlights the pathways to organisational performance showing the combination and the links from organisational resources and capabilities to performance. Figure 8-1 summarises these pathways and links.

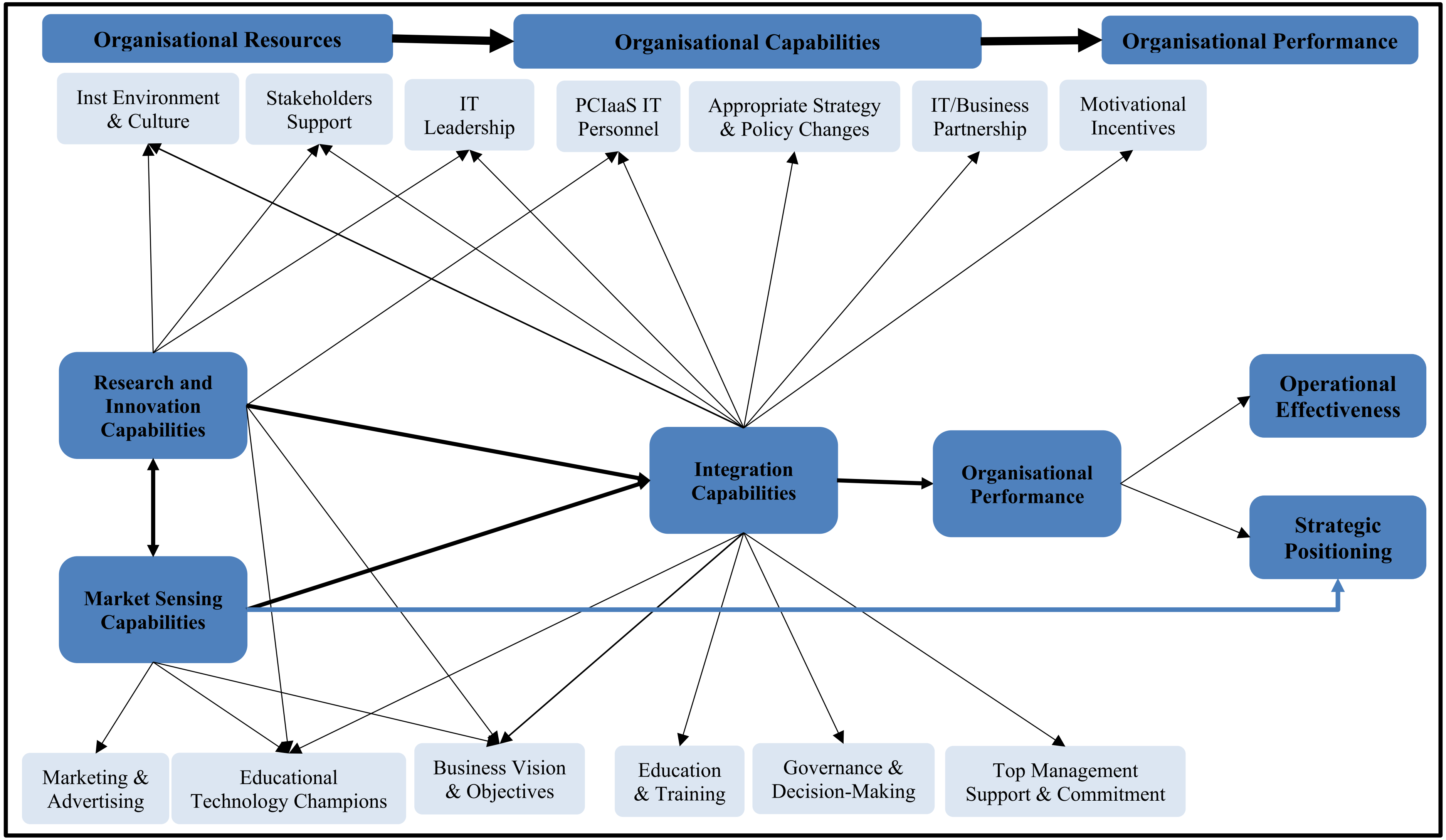


Figure 8-1: Map of PCIaaS Capabilities

Figure 8-1 highlights the pathways and links from organisational resources to capabilities to performance as understood from this study.

8.2.1 Combination of Resources and Capabilities for Performance Impact of PCIaaS

Research and innovation capabilities are the ability to research and innovate using new and emerging technologies, and thus the foundation or gateway through which the three cases incorporated PCIaaS into their operations. The six resources that combined to develop research and innovation capabilities across the three cases were: (1) business vision and objectives, (2) PCIaaS IT personnel, (3) institutional culture and environment, (4) educational technology champions, (5) stakeholders support, and (6) IT leadership. However, the business vision consists of two folds: operational and strategic. All six resources apart from the educational technology champions contributed to the former, while the latter was a vision articulated by the educational technology champions. The business vision and objectives for PCIaaS emanated from the call to adopt PCIaaS by IT leadership and stakeholders, the call to investigate the cloud-based teaching and learning by educational technology champions, the culture that embraces experimenting with new and emerging technology, and the actual experimentation, investigation, and exploration of the PCIaaS by the PCIaaS IT personnel.

Market sensing capabilities are the ability to transform, sense, seize, and pursue new and emerging business opportunities. The combination of resources that contributed to market sensing capabilities were: (1) educational technology champions, (2) business vision and objectives, and (3) marketing and advertising. The educational technology champions articulated the vision to investigate the usefulness of PCIaaS to develop cloud-based teaching and learning. Cloud-based teaching and learning are the foundation of market sensing capabilities, and a rare type of capabilities only observed in one case. Thus, market sensing capabilities are examples of strategic (outside-in/external) capabilities. The vision for cloud-based teaching and learning eventually transformed teaching and learning and enabled the development of several new cloud-based degree programs and two vLabs (vDesktop and vCloud). To further take advantage of the opportunities created by this innovative and strategic invention, marketing and advertising strategies such as product and cost differentiation was leveraged to wow potential students to the institution. However, this study found evidence to suggest that market sensing capabilities and the associated combination of resources were the partway to strategic positioning.

Integration capabilities are the ability to coordinate and integrate PCIaaS into the operations and processes of any organisation. The nine resources that contributed to integration capabilities were: (1) PCIaaS IT personnel, (2) stakeholder support, (3) top management support and commitment, (4) IT leadership, (5) motivational incentives, (5) appropriate policy and strategy changes, (6) educational technology champions, (7) education and training, (8) governance and decision-making, and (9) IT/business partnership.

The development of integration capabilities was influenced by, among other factors, by the willingness of key stakeholders to undergo additional education and in-house training. This study found that training enhances the ability of PCIaaS IT personnel to seek opportunities to integrate PCIaaS into the three cases' operations and processes. The PCIaaS IT personnel underwent additional training to acquire the vital skills/knowledge to effectively manage and support PCIaaS in their respective institutions and disseminate their knowledge to other institution members through end-user training and the provision of consultancy advisory services. Motivational incentive is also a tool to encourage some stakeholders to integrate PCIaaS into their operations and processes. Top management support and commitment to sustained funding also have a significant role in integrating PCIaaS. In addition, their commitment to driving and leading change management is also vitally important. The educational technology champions and IT leadership also played a crucial role in training and creating awareness of the potential of PCIaaS among their peers and colleagues and the top management. The governance and decision-making structure play a vital role in the ability to integrate PCIaaS into any organisation. The governance and decision-making structure is a binding mechanism that helps to ensure a unified and consistent take-on of PCIaaS across the length and breadth of any organisation. PCIaaS is a centrally provisioned infrastructure and is more appropriate for centralised governance and decision-making structure than the federated governance and decision-making structure.

For organisations to reap the potential of PCIaaS and cloud computing, legacy business processes and applications must be redesigned and migrated to PCIaaS, and cloud-native applications developed. The formulation of appropriate policy and strategy changes such as migration policy and cloud-first policy is vitally crucial to integrating PCIaaS into the operations and processes of any organisation, particularly for organisations with legacy business processes and applications. Cloud migration policy and strategy ensures the orderly migration of legacy business applications to PCIaaS while cloud-first policy and strategy ensure and encourage the use of PCIaaS for every development of new business systems and solutions, except on the ground of incompatibility. The vital role of IT/business partnership in redesigning legacy business processes and developing innovative systems to replace legacy business applications is also evident.

Finally, this model highlights the resources and capabilities vital to exploit PCIaaS for organisational performance. This study's overall finding underlined the significant importance of available resources and capabilities in strengthening the attainment of the organisational performance impact of PCIaaS, and thus fulfil the objective of this study. In addition to fulfilling the research objective and answering the research questions formulated, this study contributes to research and practice. The following section discusses the contributions made by this study to research and practice.

8.3 Research Contributions

This study's theoretical foundations intersect the domains of ITBV, CC, and RBV. ITBV has been a domain of ongoing research for more than half a century. CC, a new paradigm in using IT and computing resources and one of the most significant innovations in the IT industry, has revolutionised how organisations use software and IT infrastructure. However, most of the research and literature in the domain of ITBV focused on physical IT infrastructure. Despite the potential of CC, including PCIaaS, a search conducted by the researcher of the title and abstracts of all scholarly papers available online reveals that research and literature are scarce on its organisational performance impact and the associated resources and capabilities involved. Table 8-1 present the summary of this study's contributions to theory and practice.

Table 8-1: Summary of Contributions to Theory and Practice

Contributions	Theory	Practice
Contribution 1: RBV Theory	✚ Extends RBV to the domains of ITBV and CC, and complemented prior studies on the indirect model of RBV but went beyond the linear RBV models and brought more richness to the theory ✚ Highlights the complex connections and combinations of the resources and capabilities to exploit PCIaaS for business value ✚ Provides a platform for future research in improving the continuous adoption of the RBV in IT/CC business value research	
Contribution 2: Organisational Performance (IT/CC Business Value)	✚ Evaluation Instrument for analysing the organisational performance impact of PCIaaS across multiple levels	✚ Highlights the importance of PCIaaS to organisations and policymakers not only in enhancing their internal operations but also their external positioning ✚ The performance measurement tool provides organisations with detailed insight and understanding of the business value of PCIaaS ✚ Defines the top measures, dimensions, and category of PCIaaS performance impact
Contribution 3: Organisational Resources	✚ Extends literature and existing theories to identify and highlight the 30 skills and knowledge and five activities performed by PCIaaS IT personnel, and 13 organisational factors	✚ Provides deep insight to policymakers of the importance of organisational factors to exploiting the potential of PCIaaS ✚ Categorisation of organisational factors into three clusters provides a framework in assessing, understanding, and determining the impact of organisational factors ✚ Provided organisations with a template/ benchmark for defining the skills/knowledge and the activities performed by PCIaaS IT personnel. ✚ Highlighted the essential and desirable skills/knowledge required by PCIaaS IT personnel
Contribution 4: Organisational/ PCIaaS Capabilities	✚ Identifies and highlights the importance of three specific capabilities (RIC, MSC, INTC) to exploit PCIaaS to improve organisational performance.	✚ Provides organisations with a detailed understanding of the attributes and characteristics of the organisational resources and specific capabilities involved in exploiting the potentials of PCIaaS for performance improvement ✚ Identifies those attributes and characteristics of organisational resources and capabilities that enabled PCIaaS to be a source of competitive advantage, especially educational technology champions and MSC

This study makes several significant contributions to the literature and practice as presented in the following subsections.

8.3.1 Contribution 1: RBV for Understanding IT/Cloud Computing Business Value

From the perspective of RBV, PCIaaS IT personnel and organisational factors are the two crucial organisational resources involved in creating the capabilities to exploit PCIaaS for organisational performance (Barney, 1991). This study successfully extended the RBV theory to ITBV and CC to investigate and enhance the understanding of the organisational performance impact of PCIaaS and the resources and capabilities. This study complements prior studies on the indirect model of RBV (Zhang, 2007; Liang et al., 2010; Kim et al., 2011; Kimiti & Kilika, 2018), but takes the indirect model of RBV theory a step forward than previous studies by investigating, identifying, and empirically validating the organisational performance impact of PCIaaS and the associated resources and capabilities. Furthermore, incorporating a multiple case-study approach enabled this study to provide a detailed end-to-end analysis of deriving value from PCIaaS. Starting with an initial linear RBV model developed in the literature, this study uncovers the complex connections and combinations of the necessary resources to derive value from technology. As a result, it further develops the RBV model developed in Chapter Two to create a map of PCIaaS capabilities. This study provides a unique perspective on CC value creation and provides a platform for future research to investigate the organisational performance impact of any other technologies.

Researchers acknowledge the difficulty of applying RBV to the domain of CC (Wang et al., 2016). For example, Wang et al. (2016, p. 44) argued that "*it is difficult to apply RBV on cloud computing because cloud computing is essentially a service provided by vendors and not the organisation's private resources*". This study contributes to the literature by successfully developing a research model ground in RBV theory to investigate the organisational performance impact of PCIaaS and the resources and capabilities involved.

8.3.2 Contribution 2: IT/Cloud Computing Business Value

Researchers have called for more studies on the organisational performance impact of IT (Schryen, 2013; Barenfanger et al., 2014; Mahler & Westergren, 2018; Jean et al., 2021) and CC (Musa & Walker, 2013; Chen et al., 2016; Liu et al., 2016; Bayramusta & Nasir, 2016; Lynn et al., 2020). This study contributes to the literature by investigating the organisational performance impact of PCIaaS, a constituent of cloud computing. Although this study identified 35 PCIaaS performance measures from the extant literature on cloud computing (see Table 2-13), an additional four emerged from the data to provide a detailed insight into the value of PCIaaS. The study also identified nine dimensions of business value and two categories of organisational performance. The study incorporated the 39 PCIaaS performance measures with the nine PCIaaS business value dimensions and the two PCIaaS organisational performance categories in developing the evaluation instrument for evaluating and analysing the organisational performance impact of PCIaaS. This instrument enabled the researcher to identify the organisational performance impact of PCIaaS across multiple levels, adding additional four PCIaaS performance measures from data gathered across the three cases. As a result, the value pattern of PCIaaS to organisations emerged.

This study contributes significantly to practice by providing organisations with detailed insight and understanding into the value of PCIaaS across multiple levels: 39 PCIaaS performance measures, nine dimensions of PCIaaS business value, and two PCIaaS organisational performance categories. For example, this study highlighted the top five PCIaaS performance measures: (1) cost-effective and affordable enterprise-class IT services, (2) better business continuity and disaster recovery, (3) rapid responsiveness to business needs, (4) development of new classes of products, applications, and services, and (5) rapid turnaround time for new product development. Also highlighted are the top two PCIaaS business value dimensions: (1) business risks reductions and (2) improve flexibility, agility, and responsiveness. In addition, PCIaaS tends to focus on operational effectiveness overwhelmingly in comparison to strategic positioning. Tallon et al. (2000, p. 15) highlighted the dominance of operational effectiveness when they argued that "*operations-focus emerges as a dominant goal for IT, indicating that a significant number of firms are still primarily using IT to reduce operating costs, improve quality and increase productivity*". Research have also highlighted the operational value and the strategic value proposition of CC (Son & Lee, 2011; Gai, 2014; Kathuria et al., 2018). The empirical foundation provided by this study extends the operational value to performance impact across any organisation (private or public). Consequently, organisations are now well informed of the impact of PCIaaS on their organisational performance. Organisations can also use the PCIaaS organisational performance impact evaluation instrument as a blueprint to gauge the value of PCIaaS.

8.3.3 Contribution 3: Organisational Factors in IT/Cloud Computing Business Value

This study contributes to the literature by adopting the five dimensions of organisational factors identified in the literature to investigate the organisational performance impact of PCIaaS. This study identified 13 organisational factors from the case studies, of which organisational strategy emerged as the most dominant. Prior studies have also highlighted the importance of business strategy to organisational capabilities and performance in the context of SaaS (Rodrigues et al., 2021), which further underpins the need to develop suitable strategies that will exploit the full potential of PCIaaS. This study identified strategies adopted by tertiary educational institutions for exploiting the potential of PCIaaS, including: (1) connecting PCIaaS to the strategic plan and strategic business value, (2) employing DevOps culture and teams for the digital transformation, and (3) exploiting the potential in PCIaaS in developing systems that transform teaching, learning, and research such as cloud-based teaching and learning, virtual computing and infrastructure laboratories, and research repository and collaboration websites and digital archives.

The presence, absence, weakness, or strength of organisational factors also account for variations in the capabilities and performance impact of PCIaaS across the three cases. For example, the presence or absence of educational technology champions and marketing and advertising account for variations in the capabilities and performance impact of PCIaaS. The lack of top management sustained funding also influenced the failure to invest or innovatively use the potential available in PCIaaS. Centralised governance and decision-making structures are most suited for the consistent take-up of PCIaaS than federated governance and decision-making structures. This study supports the position of prior researchers which noted that "*federated governance also creates structural barriers to alignment between the central and unit IT*" (Williams & Karahanna, 2013, p. 934) and "*is not effective because IT employees within the faculties do not report to the central IT*" (Scalabrin Bianchi et al., 2021, p. 22).

Business vision and objectives are vital to the ability to exploit PCIaaS for performance improvement. The business value for CC is of two folds: strategic positioning and operational effectiveness (Son & Lee, 2011). As identified in this study, the business vision and objectives for PCIaaS consist of twofold: operational and strategic. The operational vision is to integrate PCIaaS to solve internal business problems and challenges. The strategic vision is to integrate PCIaaS to develop cloud-based teaching and learning and two vLabs (vDesktop and vCloud), which was the source of market sensing capabilities and strategic positioning.

Also highlighted is the importance of education and training in integrating PCIaaS into organisations operations and processes. CC, including PCIaaS, is a new paradigm and a new technology. Therefore, organisations should provide additional education and training to their members to equip them with the skills/knowledge, and awareness to transition from the legacy IT infrastructure to new technology and meet the challenges of the new technology such as resistance, fear of the unknown, and technological intimidation. Other researchers have also expressed a similar opinion. For example, Borkovich et al. (2014, p. 8) argued that "*continuous education of management, staff, and users is essential to maintain corporate commitment and to convince the stakeholders of the value and purpose of the new technology*". Identifying these organisational factors that influenced the organisational performance impact of PCIaaS enables future researchers to explore their impacts on other studies in ITBV research or on other combinations of CC's deployment and service models.

This study contributes to practice by highlighting the impact of organisational factors on exploiting PCIaaS for performance improvement. The findings of this study will enable organisations to assess how organisational factors will impact their ability to exploit the PCIaaS for performance improvement. This study provides deep insight to policymakers considering adopting PCIaaS, particularly how organisational factors will influence their ability to exploit PCIaaS to improve their performance.

Organisational factors can strengthen or undermine the ability to exploit PCIaaS to improve organisational performance. Three clusters of the impact of organisational factors emerged: positive impact, varied impact, and negative impact. Legacy business processes and applications are the only organisational factors in the negative impact cluster. However, establishing the DevOps culture and team, an IT/business partnerships initiative to redesign legacy business processes, and developing a new system helped reduce or eliminate the negative impact of legacy business processes/applications on the performance impact of PCIaaS. This study supports the position of prior researchers that have highlighted the importance of DevOps culture and team in the continuous improvement of business processes, development of new systems, and organisational competitiveness (Gruhn & Schafer, 2015; Crowley et al., 2018; Wiedemann & Wiesche, 2018; Wiedemann et al., 2019). The categorisation of the impact of organisational factors into three clusters is also a significant contribution to practice that organisations can apply as a framework in assessing, understanding, and determining the impact of organisational factors on their ability to exploit any technology and therefore take adequate measures to mitigate any organisational factors in the varied impact and negative impact clusters.

This study found that PCIaaS is a commodity readily available to large organisations that can afford it and have common characteristics irrespective of the organisation. However, PCIaaS IT personnel, irrespective of organisation, have similar skills/knowledge and perform similar activities. Therefore, organisations' ability to exploit PCIaaS to improve performance depends on PCIaaS IT personnel and organisational factors. Organisational factors are resources specific and unique to organisations that cannot be purchased or easily copied by other organisations. This study shows that organisational factors are the crux of organisations' ability to develop the capabilities for exploiting the potential of PCIaaS for performance improvement and therefore account for variations in PCIaaS performance impact. This finding confirms the position of several researchers (Cao, 2010; Cao et al., 2011; Wiengarten et al., 2013; Prasad, 2020). For example, Cao, 2010, p. 268) noted that "*the extent of IT business value can be affected by a number of organisational factors within a firm*". In addition, Wiengarten et al. (2013, p. 33) also noted that *without organisational factors, IT resources alone have little direct impact on firm performance, or the full potential of ITBV is less likely to be realised*". Congruently, Prasad (2020, p. 341) asserted that organisational factors are essential "*differentiators which explain why some firms are more successful than others"* Therefore, organisations should focus on organisational factors to develop the capabilities that improve performance. The following section discusses the contributions to the literature on IT personnel.

8.3.4 Contribution 4: IT Personnel and PCIaaS IT Personnel

This study contributes to the literature on IT personnel by suggesting an additional taxonomy of skills/knowledge (legal and regulatory) to the existing four taxonomies proposed by Lee et al. (1995). This additional taxonomy of skills/knowledge is essential considering the growing importance of data protection and governance.

However, PCIaaS IT personnel is a new and emerging role in the IT department of organisations. Existing IT personnel lack the technical and business competencies to exploit PCIaaS effectively. This study contributes to the literature of IT personnel by investigating the new and emerging role of PCIaaS IT personnel in the IT department of organisations using PCIaaS. This study also enhances the understanding of how PCIaaS IT personnel contributes to the organisational performance impact of PCIaaS.

Prior studies have identified the lack of expertise as one of the challenges large organisations face in implementing PCIaaS (Rightscale 2016, 2017). This study contributes to practice by providing organisations with a detailed understanding of the skills/knowledge and the activities performed by PCIaaS IT personnel. It identified 30 skills/knowledge of PCIaaS IT personnel, consisting of 11 technical competencies and 19 business management competencies. Three categories of competency emerged, including essential, desirable, and beneficial skills/knowledge, using industry competency standards. The categorisation will enable employers to determine the knowledge gap in the existing IT personnel. This study also highlighted how PCIaaS exploit PCIaaS to improve organisational performance by identifying and categorising the activities performed into the five profiles of activities through which IT personnel contribute to ITBV. This study also contributes to practice by drawing on prior studies (Guillemette & Pare, 2007, 2012a, 2012b; Guillemette et al., 2008, 2017; Koffer et al., 2015; Wiedemann et al., 2017; Pare et al., 2020) to investigate and classify the activities performed by PCIaaS IT personnel (see Table 2-5). This research proposes a template for defining the skills/knowledge and the activities performed by PCIaaS IT personnel. The categorisation will also provide organisations with a benchmark to assess and determine the skills/knowledge requirements and activities performed by PCIaaS IT personnel in their organisation.

8.3.5 Contribution 5: PCIaaS and Organisational Capabilities

Organisational capabilities are a crucial determinant of the performance impact of IT (Ross et al., 1996; Bharadwaj, 2000; Bhatt & Grover, 2005; Aral & Weill, 2007; Radhakrishnan et al., 2008; Wei et al., 2014; Chae et al., 2018), and CC (Gai, 2014; Kathuria et al., 2018). Researchers have also called for the need to identify the capabilities needed in realising the business value of CC (Wang et al., 2016). This study identified and provided a deep understanding of the specific capabilities for exploiting PCIaaS: research and innovation capabilities, market sensing capabilities, and integration capabilities. This study also highlighted the combination of resources that contributes to these three capabilities. Organisations endowed with these three capabilities are most likely to achieve superior organisational performance and competitive advantage.

Research broadly categorised organisational capabilities into two taxonomies (Day, 1994; Wade & Hulland, 2004; Blois & Ramirez, 2006; Hulland et al., 2007; Sharma et al., 2007; Radhakrishnan et al., 2008; Stoel & Muhanna, 2009; Liang et al., 2010; Neirotti et al., 2013; Wei et al., 2014; Chen & Ong, 2015; Neirotti & Raguseo, 2017; Fink et al., 2017; Liu et al., 2018). For example, these researchers broadly categorised organisational capabilities into internally and externally focused capabilities (Blois & Ramirez, 2006; Hulland et al., 2007; Sharma et al., 2007; Stoel & Muhanna, 2009; Liu et al., 2018). In addition, Fink et al. (2017) also categorised organisational capabilities into operational and strategic capabilities. In contrast to the two broad generic categorisations of capabilities in literature, this study identified three specific capabilities to exploit PCIaaS to improve organisational performance. All three capabilities were visible across the three cases except market sensing capabilities, only present in one of the three cases. Such capabilities enable an organisation to sense, seize, and pursue new and emerging business opportunities and are therefore a pathway to competitiveness and growth.

This study contributes to practice by highlighting the importance of research and innovation capabilities and market sensing capabilities in exploiting the available potential in PCIaaS to improve organisational performance. In addition, these capabilities enabled the three cases to adapt to changes and transform their existing ways of doing things, such as transforming the traditional teaching method and learning and conducting research. Finally, this study also contributes to practice by identifying those attributes and characteristics of organisational resources that enabled PCIaaS to be a source of competitive advantage, e.g., visionary educational technology champions, marketing and advertising, and business vision and objectives. The following section discusses the limitations of this study and recommendations for future research.

8.4 Limitations and Recommendations for Future Research

One of the inherent limitations of a case study research strategy is its lack of generalisation. However, following the recommendation of Rowley (2002), this study is informed by existing theory to overcome the inherent limitation of case study generalisation and therefore add to the established theory. Therefore, this study adopts a case study research strategy it extends RBV theory by incorporating other theories and models in investigating the organisational performance impact of PCIaaS and the resources and capabilities involved.

This study demarcated cloud computing into 12 possible combinations using the 4x3 metrics. This study focuses on the PCIaaS component of cloud computing. So, it might be necessary to extend the research to other components of cloud computing. Similarly, there is a need to extend the research to more tertiary educational institutions and other private and government organisations in other parts of the world. This study also makes the following recommendations to practice and opportunities for future research.

- Future research on RBV of IT business value, in general, should apply and test the conceptual research models developed in this study in parts or wholly to determine their relevance.
- This study developed and proposed an evaluation instrument for measuring the PCIaaS organisational performance impact. The instrument consists of 39 PCIaaS performance measures, comprising 35 measures from extant literature on cloud computing and additional four measures from empirical data, across nine PCIaaS business value dimensions and two PCIaaS organisational performance categories.
- Future research may consider an in-depth investigation on how tertiary educational institutions can leverage PCIaaS to develop new educational programs and enhance the delivery of vLabs, particularly in the VLE area.
- This study has proven that PCIaaS can improve organisational performance. Therefore, the researcher recommends that tertiary educational institutions consider investing in PCIaaS rather than traditional IT or public cloud (PuC).

- Tertiary educational institutions should consider providing their PCIaaS IT personnel with appropriate training on the relevant PCIaaS vendor(s) technologies before adopting or implementing PCIaaS in their institution.

Organisations should conduct a SWOT analysis of the possible organisational factors capable of influencing the performance impact of PCIaaS before adopting and implementing PCIaaS or any new technology. Such analysis will help to enhance the success and ability to improve organisational performance.

Finally, this research study relates to the organisational performance impact of PCIaaS in tertiary educational institutions. However, researchers can apply the analysis of organisational factors in the context of any new technology or innovation across any industry.

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