# IT Controls in the Public Cloud: Success Factors for Allocation of Roles and Responsibilities

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## LIST OF PUBLICATIONS

As a result of this research, three papers were published in two international peer reviewed journals and a conference. Published papers are as follows:

- **Khan, S.**, Nicho, M., & Takruri, H. (2016): IT controls in the public cloud: Success factors for allocation of roles and responsibilities, Journal of Information Technology Case and Application Research, DOI: 10.1080/15228053.2016.1237218

- **Khan, S.**, Nicho, M., Cooper, G., "A Role Allocation Model for IT Controls in a Cloud Environment", Review of Business Information Systems (RBIS) Journal 19(1), 5-14, 2015.

- **Khan, S.**, "Impact of Cloud Computing on The IT Portfolio Management: UAE Case Study", International Business Information Management Conference (19th IBIMA), Spain, 2012.

# LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ACM | Association for Computing Machinery |
| AIS | Association of Information Systems |
| AMOS | Analysis of Moment Structures - an add-on module for SPSS software |
| AR | Accountability and Responsibility |
| BS 7799 | Standard containing the best practices for Information Security Management |
| CMMI | Capability Maturity Model Integration |
| COBIT | Control Objectives for Information and Related Technology |
| COSO | Committee of Sponsoring Organizations |
| CSP | Cloud Service Provider |
| $EMC^2$ | EMC Corporation - an American multinational corporation |
| ERM | Enterprise Risk Management |
| GRC | Governance, Risk, and Compliance |
| IaaS | Information as a Service |
| IEC | International Electrotechnical Commission |
| IS | Information System |
| ISACA | Information Systems Audit and Control Association |
| ISO | International Organization for Standardization |
| IT | Information Technology |
| ITG | IT Governance |
| ITIL | IT Infrastructure Library |
| ITSM | IT service management |
| MENA | Middle East and North Africa region |
| MIS | Management Information Systems |
| NIST | National Institute of Standards and Technology |
| OWASP | Open Web Application Security Project |
| PaaS | Platform as a Service |
| PMBOK | Project Management Book Of Knowledge |
| RACI | Responsible, Accountable, Consulted, Informed |
| RAM | Resource assignment matrix |
| SaaS | Software-as-a-Service |
| SF | Success Factor |
| SLA | Service Level Agreement |
| SOX | Sarbanes-Oxley Act |
| U.S.A | United States of America |
| UAE | United Arab Emirates |
| VM | Virtual Machine |
| VOA | Velocity-Of-Attack |

## DECLARATION

This dissertation is an original and authentic piece of work from me. I have fully acknowledged and referenced material incorporated from secondary sources. It has not been submitted elsewhere for assessment.

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## ABSTRACT

The rapid adoption of cloud computing by organizations has resulted in the transformation of the roles and responsibilities of personnel in managing the information technology (IT) resources (via IT governance controls) that have migrated to the cloud. Hence, the objective of this research is to provide a set of success factors that can assist IT managers to allocate the roles and responsibilities of IT controls appropriately to personnel to manage the migrated IT resources. Accordingly, this study generated a set of success factors from behavioral and information systems (IS) literature. These success factors were validated using in-depth interviews of executives from the United Arab Emirates (UAE), and ranked using Delphi technique. The empirical intervention suggests that the role allocation is driven predominantly by people's skills, competencies, organizational strategy, structures, and policies. In addition, the research made clear that the most significant competency and skill for a person allocated to IT controls is to be able to evaluate and manage a cloud service provider, especially in terms of risks, compliance, and security issues related to public cloud technology. The findings of this study not only offer new insights for scholars and practitioners involved in assigning responsibilities but also provide extensions for IT governance framework authorities to align their guidelines to the emerging cloud technology.

# CHAPTER 1

# INTRODUCTION

# 1 CHAPTER 1: INTRODUCTION

The rapid adoption of cloud computing by organisations worldwide has brought the issue of Information Technology (IT) resource control into focus. IT control is a procedure that provides a reasonable assurance that the IT used by an organisation operates as intended, that data is reliable and that the organisation is in compliance with applicable laws and regulations. Two organisations (cloud user and cloud provider) have different perspectives of IT control over the IT resources that have been migrated to the cloud. In this regard, the issue of allocation of roles and responsibilities of IT controls to appropriate staff in the cloud user organisation becomes very important. In the absence of guidelines for IT practitioners of cloud, this thesis investigates the key drivers of success that would guide IT decision makers in allocating staff to roles and responsibilities of relevant IT controls in a cloud environment.

There is an unceasing research and development into cloud computing across the globe and it has rapidly become one of the hottest topics in the field of IT (Puthal, Sahoo, Mishra, & Swain, 2015). While some industry experts are predicting more than 60% of enterprises to have at least half of their infrastructure on cloud-based platforms by 2018 (Columbus, 2015), by the same year at least half of the IT spending is predicted to be on cloud (Cherrayil, 2016). Businesses are no longer asking the question "should we put our applications in the cloud?" but rather "which aspects of our business can be run more effectively in the cloud?" (Hamid, 2014, para. 7).

Cloud technology represents a key tool in the global race for innovation across industries (Ramel, 2014) and thus it cannot be overlooked. With considerable growth and huge investments made in this technology globally, there is no doubt that the cloud is here to stay. Nevertheless, many organisations remain cautious about using the cloud, thus providing a solid impetus for this research. Currently, organisations govern IT systems through the use of internal IT controls by assigning personnel to the roles and responsibilities for these controls. However, the migration of organisational IT systems to the cloud raises concerns, especially in relation to the changing roles and responsibilities of the staff concerned with the governance of the relevant IT controls. The purpose of this chapter is to introduce the reader to the rationale for conducting this research, thereby leading to the aims and objectives of the study. Expected contributions of the study will be briefly discussed at the end of the chapter.

## 1.1. Research motivations

Motivations for doing this study include lack of guidelines for practitioners regarding the allocation of personnel to the IT controls in the cloud environment and lack of clarity regarding people's changing roles, accountability and responsibilities of IT controls, when migrating IT resources to the cloud, resulting in the issue of failed cloud projects. These issues are discussed in detail below.

- **Lack of guidelines:** The allocation of people to the roles and responsibilities is an IT Governance (ITG) activity, since it involves leadership, control, and directions from those with authority within an organisation (Webb, Pollard, & Ridley, 2006). Role allocation in the form of Responsibilities, Accountability, Consulted, and Informed (RACI) charts has been used in IT controls and processes, within such ITG and security models as Control Objectives for Information and related Technology (COBIT) **(**ISACA**,** 2012**)**, Information Technology Infrastructure Library (ITIL) (Rudd & Loyd, 2007), and in Project Management Body of Knowledge (PMBOK) (Schwalbe, 2014). Moreover, the RACI charts has been employed in outsourcing (Ramakrishnan & Pro, 2008; Simonova & Zavadilova, 2011) and managing governance in outsourcing (Meng, He, Yang, & Ji, 2007) too. While these governance frameworks use RACI to assign various roles and responsibilities in completing tasks or deliverables, in COBIT, its implementation is too generic for practical use (Zhang & Le, 2013). In PMBOK, allocation is left up to the decision maker's experience, judgment and authority, whereas in ITIL, only generic guidelines for employing RACI in the non-cloud environment are provided. Apart from a few general attributes given in ITIL (Rudd & Loyd, 2007), no guidelines have been found in COBIT, ITIL or PMBOK that can be used to allocate staff to the roles and responsibilities of IT controls in a cloud (Khan, Nicho, & Takruri, 2016). To address this concern, ITG frameworks need to provide guidelines that can assist IT decision makers to allocate the roles and responsibilities of IT controls appropriately to personnel to manage the migrated IT resources.

- **Accountability and responsibility concerns:** Migration to a cloud environment involves a myriad of potential Governance, Risk, and Compliance (GRC) issues (Farrell, 2010) with 'accountability' as the foremost risk among the top ten cloud risks (OWASP, 2011). When an organisation places selected organisational assets in the custody of a Cloud Service Provider (CSP), it cedes control over these assets to the CSP, yet retains

accountability for security and regulatory compliance (Julisch & Hall, 2010). In this regard, one major issue organisations are facing is the data owner's loss of control during movement to the cloud (Hughes, 2014). Laudon and Laudon (1999, p. 457) suggest that "Accountability is a feature of systems and social institutions: It means that mechanisms are in place to determine who took responsibility of actions". In other words, accountability is closely aligned with responsibility. The introduction of cloud services does not absolve an organisation from its accountability and responsibility of IT functions in the cloud, neither does it relieve it of its responsibility for managing the relevant IT controls for voluntary or regulatory compliance. It does, however, require an extension of these responsibilities to incorporate the unique elements of applying ITG to third-party service providers (Becker & Bailey, 2014). Accordingly, ITG frameworks need to extend and provide guidelines to organisations, in order to ensure the accountability and responsibility of migrated IT resources.

- **Failure of cloud projects:** Organisations have been moving to the cloud in huge numbers. However, despite its enormous potential, many organisations struggle to make effective use of the cloud (Marston, Li, Bandyopadhyay, Zhang, & Ghalsasi, 2011). Given the lack of guidance available to IT practitioners from either the academic or the non-academic forums, cloud migration projects are fraught with challenges (Rashmi & Sahoo, 2012) resulting in striking numbers of failed or stalled cloud projects. With Infrastructure as a Service (IaaS) implementation failure rates as high as 63% (Ramel, 2014), most businesses believe that their private clouds have failed (World, 2015).

Cloud projects are facing obstructions and failures not only because of the lack of understanding (Opara-Martins, Sahandi, & Tian, 2014), but also because of the lack of skills and experience of the deployment team and a lack of talent (Linthicum, 2013). Gartner reported a 'failure to focus on people' as one of the six reasons for the failure of private cloud projects (Bittman, 2015). According to another report, all Gartner clients have faced challenges with the human side of project success (Rollings, 2013). Cloud failures have been attributed to the actions and inactions of senior leadership in understanding how new roles will really work (Glaser, 2005) and by not allocating people with the right skills to the cloud projects (Venkatraman, 2014).

Uptake of cloud computing depends on the IT practitioners and their skills (Søndergaard et al., 2012) as this technology is transforming the knowledge, skills and abilities of most

IT job roles at an alarming rate (Marquis, 2015). Adoption of cloud by organisations not only requires the redefinition of the roles of staff and the skills they need, but it is also essential to identify the skill gaps that should be filled in order to successfully utilize cloud services (EMC, 2014). Since IT leaders today have to deal with managerial issues, there is a need to update job descriptions under these changing circumstances (Marquis, 2015). Organizations are advised to be prepared to manage a significant change in their IT staffing and roles (IDC, 2015). However, it has been observed that researchers and practitioners are not keeping up with the changes brought in by this technology in relation to the people's roles and responsibilities of IT controls. In this regard, a lack of emphasis on people and their required skills is a great concern. Therefore, there is a need to understand new roles and responsibilities of people involved, and accordingly allocate people with the right skills or talents to all cloud initiatives.

- **Less emphasis on non-technical aspects:** Cloud computing is more than a technological enabler (Iyer & Henderson, 2010), but industries have been focusing too much on the technical outcomes, and failing in areas like mapping the demand of the organisation to the right cloud solution (Cruiser, 2014). Ignoring the development of non-technical skills of IT practitioners has similarly been a common obstacle to the success of cloud projects (Rollings, 2013). A re-examination of IT management is required to meet the needs of twenty-first-century cloud users.

## 1.2. Research gap

Researchers as well as practitioners have identified a gap in the ITG guidelines on the roles and responsibilities allocation mechanism, in the cloud environment.

- **Practitioners' perspective:** Industries pursue technological scalability by moving their enterprise architectures to the next level of the cloud. In this regard, Schmuck (1940, p. 8) stated: "You can't do business today with yesterday's tools and be in business tomorrow". Thus, one critical pre-requisite for a great plan of technological scalability is a good governance model. In today's age of digital metamorphosis, governance policies and procedures must be aligned in a dynamic fashion. If new technologies have governed our own thought processes, they have given IT governance authorities an advanced outlook of policies and procedures. Despite of updating their guidelines, ITG authorities have not come

up with guidelines for allocating people to roles and responsibilities in a cloud environment. Therefore, these governance policies need to be extended, or an ITG guideline produced, aligned to the scalable cloud technology. Such research will help the community by producing Information Systems (IS) research that is relevant to practice (Kuechler & Vaishnavi, 2011), especially to policymakers (Gallivan & Aryal, 2012), and thereby reducing the gap between academic research and information systems practice.

- **Research perspective:** A title search using the words, *roles and responsibilities*, *IT governance*, and *cloud computing* in the Association of Information Systems (AIS) database spanning the years 2008 to 2014 was performed to identify relevant literature on allocation of roles and responsibilities of IT controls in a cloud environment. The search resulted in papers focusing on the identification of necessary steps for implementing the appropriate IT governance for a cloud environment (Becker & Bailey, 2014) and driving factors of success for the service recipient of IT outsourcing (Hodosi & Rusu, 2013). The resulting outputs provided topics discussing organisational integration of green IS through specific roles and responsibilities (Loeser, 2013), suggestions to help IT practitioners in organisations to look beyond Sarbanes-Oxley Act (SOX) regulations at governance of end-user developed content (Leon, Abraham, & Kalbers, 2010), organisational change resulting from IT innovations (Suo, Techatassanasoontorn, & Purao, 2011) and the importance of adequate IT management capabilities, manifested in IT governance (Kim, Shin, Kim, & Lee, 2011). The search in Google Scholar using similar words, spanning the years 2008 to 2014, but did not yield any relevant results. However, changing the search to *roles and responsibilities in IT governance*, between 2008 and 2014, within Google Scholar, generated four results. One article proposed an IT governance (ITG) model for partnering and value co-creation (Karayilan, 2013), another investigated implementing and continually improving ITG (ISACA, 2010), yet another gave only an overview of the impact of this technology on the IT leadership (Khan, 2012). Since the allocation of IT decision rights between IT units and business units remains an important IT governance challenge, Winkler and Brown (2013) addressed this at the application level, including the governance of applications delivered on premise versus those delivered with a software-as-a-service (SaaS) model. These search results revealed that, there is no research conducted to guide practitioners on the allocation of the roles and responsibilities of staff, for resources that have migrated to the cloud.

Although cloud computing has been examined from several specific business perspectives, including pricing models, resource allocation for IaaS and critical adoption capabilities, its impact on people's roles and responsibilities has remained unexplored. Cloud related concerns, stated in the previous sections (1.1 and 1.2) directed the researcher to the subsequent research question.

## 1.3. Research question

Governance in the cloud requires the definition and implementation of mechanisms with well-defined roles for the responsibilities of information technology management, business processes, and applications, since these elements migrate from the traditional IT environment into the cloud (Becker & Bailey, 2014). No matter how detailed and complete a project plan may be, the confusion or omission of participant's roles and responsibilities can cause major problems (Kantor, 2012). Consequently, the lack of expertise to handle IT controls that have been migrated to the cloud, is a major challenge (Weins, 2016). In this regard, IS researchers have been encouraged to analyse, suggest and prescribe skill requirements for changing IT roles (Palvia & Vemuri, 2016). Looking at the strong potential, but with the high concerns and research gaps related to people's roles and responsibilities allocation in the cloud environment, leads to the research question: ***What are the key success factors in the allocation of staff to the roles and responsibilities for the control of cloud based IT resources?*** The term 'success factors' in this question refers to those inputs to the management system that lead directly or indirectly to the success of a project or business (Cooke-Davies, 2002) or that determines the success or failure of IT implementations (Roztocki & Weistroffer, 2011). This research question led the researcher to the following research aim, four sub-research questions and corresponding objectives of the research.

## 1.4. Research aim and sub-questions

The aim of this study is to provide a set of success factors that can guide IT decision makers to allocate the roles and responsibilities of IT controls appropriately to staff to manage the migrated IT resources. This current study is focused on all cloud services (Information as a Service [IaaS], Platform as a Service [PaaS], and Software-as-a-Service [SaaS]) of the public cloud deployment model, because transformation of people's roles and responsibilities relates in the same manner, to all service models.

To address this aim, this research is built around four sub-research questions:

1. What is the impact of cloud computing on the roles and responsibilities of people in charge of IT controls?

2. What are the current mechanisms inherent in ITG frameworks for allocating people to roles and responsibilities of IT controls in non-cloud as well as in cloud environments?

3. What are the success factors inherent in determining the allocation of staff to the roles and responsibilities for the control of cloud based IT resources, specific to the UAE public cloud environment?

4. What is the perceived ranking of these success factors in terms of their importance?

## 1.5. Research objectives

To meet the aim of the research and answer the research questions, five objectives have been formulated, as follows:

1. Identify the impact of cloud computing on the roles and responsibilities of people in charge of IT controls *(aligned to sub-research question 1*). This will help in identifying new roles and responsibilities for managing IT controls for cloud based resources.

2. Identify the popular ITG frameworks. Evaluate the existing mechanisms used by them to allocate people to roles and responsibilities of IT controls in non-cloud and cloud environments *(aligned to sub-research question 2)*. This will help in identifying the guidelines provided by ITG frameworks and used by organisations for the allocation of people to roles and responsibilities of IT controls.

3. Propose the key success factors to allocate staff to roles and responsibilities for the control of IT resources that have been moved, are being moved or are planned to be moved to the public cloud environment *(aligned to sub-research question 3)*. This will help in providing guidelines to organisations on the allocation of people to roles and responsibilities of IT controls in a cloud environment.

4. Validate the success factors using in-depth interviews with IT decision-makers working within UAE organisations that have migrated their IT resources to the cloud

*(aligned to sub-research question 3)*. This will help in providing guidelines that are validated by IT practitioners and which are relevant to the UAE market.

5. Re-validate and rank the success factors using Delphi technique with IT practitioner's working at the operational (IT and business management) levels of the organisation *(aligned to sub-research question 4)*. This will help in providing organisations with success factors which are ranked in the order of their importance.

## 1.6. Expected contributions

This PhD study is the first of its kind that strives to obtain an understanding of the success factors in allocating people to the roles and responsibilities of IT controls in a cloud context. This study aims to make a significant contribution to research and practice, in the following ways:

- **Contribution to practice:** This research expects to identify the changes that cloud technology brings to staff roles and responsibilities. In addition, IT decision makers, responsible for roles and responsibilities allocation, will be presented with a set of ranked success factors for allocating people to the IT controls that have been moved to the public cloud. Besides allocation, research results will also help IT decision makers to assess their existing workforces' capabilities, to meet their business needs. Results of this research will guide IT decision makers to make informed decisions on hiring and allocating right people to increase the chances of success of their cloud projects.

Governance in the cloud requires the definition of policies and the implementation of well-defined roles and responsibilities of these migrated IT assets. On evaluating the guidelines provided by popular ITG authorities like COBIT, ITIL and PMBOK, it was observed that all three of them use RACI charts for allocating roles and responsibilities. However, none of them provides any criteria or factors based on which IT decision-makers can allocate their people to RACI charts, for IT controls that have been migrated to the clouds. This research expects to address the gap by providing the success factors that can be used by ITG authorities as an extension to their existing guidelines to organisations on RACI chart allocations, for cloud based IT controls.

IS researchers have raised concerns about a gap between academic research and the world of practice (Constantinides, Chiasson, & Introna, 2012; Gallivan & Aryal, 2012; Kuechler

& Vaishnavi, 2011). Bridging this gap, the researcher expects to determine the success factors that can guide practitioners in allocating personnel to the roles and responsibilities of IT controls in a public cloud environment.

- **Contribution to theory:** The researcher expects the proposed success factors to develop academic research in three directions. Firstly, industry experts are predicting massive shifts to cloud adoption by businesses in the UAE (D'Mello, 2015), thus making it relevant to determine success factors specific to UAE public cloud environment. However, it would be useful to examine the proposed success factors at a global level, encompassing countries of diverse cultures. Secondly, while the proposed success factors can provide guidance on roles and responsibilities allocation in a cloud environment, there is a need to know how this is done in a classical data structure (non-cloud environment). Thirdly, while this study contributes by contributing to the academic research on ITG, its scope is limited to the public deployment model. It provides a ground for future researchers who can modify these success factors for other cloud deployment models (private and hybrid) as well.

## 1.7. Organisation of the thesis

This thesis provides a review of the literature in the subject area, it explains the methodology used, gives details of data collected, results of the data analysis, proposes a set of success factors for roles and responsibilities allocation and finally provides directions for further research work. This thesis is structured into eight chapters. A brief description of each chapter is given below:

**Chapter 1: Introduction**: The purpose of this chapter is to provide the motivation behind starting this research, eventually leading to the research gap, research questions, aim and objectives of conducting this research. Expected contributions to theory and practice are also discussed in this chapter.

**Chapter 2: Literature review**: In this chapter, the researcher explores the ITG and its frameworks. Based on a triangulation method of academic research and survey analysis, the researcher identifies the three most popular ITG frameworks, and subsequently examines them for guidelines on the roles and responsibilities allocation of IT controls in a cloud environment.

**Chapter 3: Theoretical factors from the literature:** This chapter investigates the literature in IS and the behavioural domain to determine the driving factors of success that influence how organisations allocate staff to the roles and responsibilities of IT controls. Justifications for using these theoretical lenses for the development of the proposed factors are provided.

**Chapter 4: Research methods:** This chapter explains and justifies in detail the research methods undertaken, by presenting the research approach, philosophy, strategies and data collection methods. The data analysis approach is planned in this chapter. Three case studies from the literature are presented, with the purpose of finding the correlation of this study with the work of others.

**Chapter 5: Data collection and analysis - 1:** Success factors are validated through two-phase interviews with IT decision makers. An overview of the interview respondents and their organisations is provided here. This chapter lists the driving factors of success that emerged during interviews, validates the list derived from the literature and then both lists are analysed using first three analytical stages of 'tidying up', 'findings items', and 'creating stable sets of items'.

**Chapter 6: Data collection and analysis - 2:** Chapter six presents the results of the last two analysis stages of 'creating patterns' and 'assembling structures', with a primary focus on the presentation of the key success factors. Finally, using the Delphi technique, this chapter presents the re-validated and ranked driving factors of success.

**Chapter 7: Findings and critical evaluation:** Chapter seven presents a summary of the study findings and critical evaluation, while linking the findings to the existing literature. Proposed success factors are compared to the related guidelines provided by an ITG framework.

**Chapter 8: Conclusions and future work:** Chapter eight highlights the research findings, presents the reliability and validity measures of the research, displays the important code of ethics followed in this study, summarizes the contributions of this thesis, points out limitations of the current work and discusses the important directions of future work. Finally, it brings the thesis to a conclusion.

# CHAPTER 2

# LITERATURE REVIEW

# 2 CHAPTER 2: LITERATURE REVIEW

The research question 'What are the key success factors in the allocation of staff to the roles and responsibilities for the control of cloud based IT resources?' links two main domains, namely cloud computing and ITG (IT controls) through a roles and responsibilities allocation model called the RACI chart. When organisations move their IT resources to the cloud, the issue of IT controls on those resources became an issue, which in turn raises questions of how to allocate these resources, which this research aims to answer.

Cloud computing offers great potential while being increasingly used in industry, academia and wider society (Zhan et al., 2015). Dating back to 1960, its popularity increased with Amazon's publication of the Elastic Compute Cloud (EC2) in 2006 (Barr, 2006) and by the official launch of Google Docs service in July 2009 (Taylor & Hunsinger, 2011), with further increase by the launch of iCloud in 2011. Large multinational organisations such as Facebook, LinkedIn, eBay, Salesforce.com and telecom service providers already operate in the cloud making it a safe alternative for others. With rapid growth in cloud computing adoption (Baburajan, 2011; Repschlaeger, Zarnekow, Wind, & Klaus, 2012), it was considered a big trend in enterprise IT during 2012 (Injazat, 2012), predicted to be one of the top 10 strategic technology trends during 2014 (Gartner, 2014), the hottest topic in the field of IT in 2015 (Puthal et al., 2015) and predicted to form half of IT spending during 2016 (Cherrayil, 2016). In spite of the growth of cloud technology, organisations are facing high rates of cloud project failures.

When organisations move their IT resources to the cloud, the relevant IT controls and processes adopted by organisations are also subject to review. These IT controls relate to ITG frameworks, project management models, and security standards like ISO 27K series. When IT assets and processes shifts to the cloud, the issue that concerns IT management is the methodology of allocation of personnel to the roles and responsibilities of relevant IT controls, due to the addition of the cloud company which hosts the organisation's IT assets. In this regard, ITG concepts and related models play a major role in roles and responsibilities allocation.

Due to the shift in controlling IT resources, the main challenge faced by organizations, in this regard, is related to people. A lack of understanding of how new roles will work, not being able to identify and staff people with right technical and non-technical skills and

capabilities have resulted in failed cloud projects. This indicates the need for a better understanding of the cloud technology and its impact on people's roles and responsibilities, which is the focus of Section 2.1. Cloud model with most security, risk and compliance concerns, along with all IaaS, PaaS and SaaS is shortlisted for this study.

Besides, the understanding of the cloud computing and its impact on people's roles and responsibilities, organizations need guidelines on the kind of skills and capabilities needed to ensure accountability and control in the cloud. This pinpoints the desire to evaluate the current ITG frameworks in detail to identify the guidelines provided by them for the allocation of people to roles and responsibilities of IT controls. Section 2.2 focuses on the different perspectives on ITG to evaluate the nature of allocation of personnel to IT controls, the relevant IT controls frameworks deployed, and the nature of roles and responsibilities allocation factors in the different ITG frameworks.

## 2.1. Cloud computing deployment and service models

Researchers, practitioners, IT organisations and market research firms (like Forrester, IBM, Sun Microsystems, Gartner) have provided various definitions of cloud computing. While researchers Buyya, Yeo, Venugopal, Broberg, and Brandic (2009, p. 3) have defined it as:

> A type of parallel and distributed system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resource(s) based on service-level agreements established through negotiation between the service provider and consumers.

Others (Rittinghouse & Ransome, 2016, p. xxvii) consider it as the "delivery of computational resources from a location other than the one from which you are computing". Wang et al. (2008, p. 3) have also defined it as "a set of network enabled services, providing scalable, QoS guaranteed, normally personalized, inexpensive computing platforms on demand, which could be accessed in a simple and pervasive way".

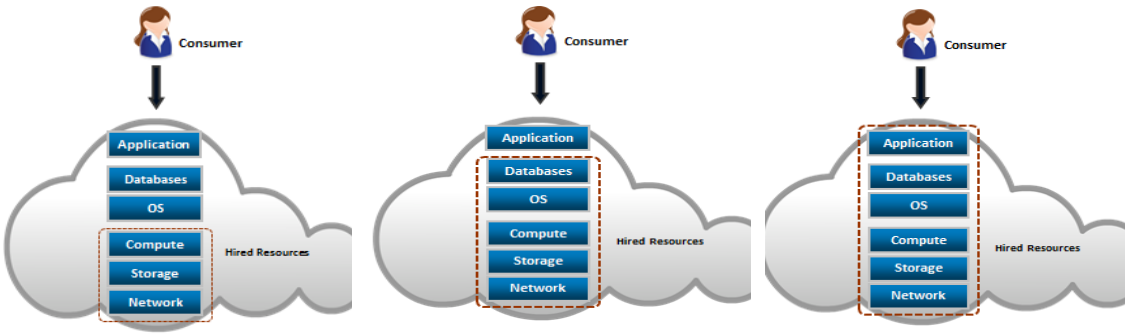
However, summarizing the given definitions, the National Institute of Standards and Technology (NIST) gave a simple, comprehensive and widely accepted definition, describing cloud computing as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing 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, 2011, p. 2).

Cloud computing thus helps in leveraging shared services of 'commodity' applications across functional organisations, allowing organisations to redirect management attention and resources towards value-added activities. In order to analyse the management of IT controls in a cloud environment, it is necessary to evaluate cloud computing deployment and services models. The management of computational resources in an organisation is broadly characterised by the cloud deployment model adopted by the organisation (Jansen & Grance, 2011). A variety of deployment models of cloud services have evolved in the marketplace (Krieger, McGachey, & Kanevsky, 2010; Vanmechelen, Depoorter, & Broeckhove, 2011; Venkatraman, 2013), with public, private, hybrid and community cloud deployment models being the most popular ones. While a private cloud is a shared multi-tenant environment built on a highly efficient automated and virtualised infrastructure using in-house resources and can belong to an organisation solely (Pathak et al., 2012), a public cloud represents a publicly accessible distributed system hosting the execution of applications and providing services billed on a pay-per-use basis (Mattess, Vecchiola, Garg, & Buyya, 2011). Some of the major public cloud players are Amazon (EC2 and S3 services), Google (App Engine PaaS) and Microsoft (Azure cloud services) (Pathak et al., 2012). Public clouds will play a significant role in fulfilling conventional enterprise compute needs, but organisations may not want to move their key differentiating applications out of the enterprise because of their mission-critical or business-sensitive nature. Such organisations can use hybrid clouds, combining both private and public clouds whenever private/local resources are overloaded (Mattess et al., 2011). Lastly, there are instances where the cloud infrastructure is shared by several organisations and supports a specific community that has shared concerns. Such a community cloud may be managed by the organisations themselves or by a third party (Credle et al., 2013; Schmotzer & Donovan, 2011).

**Public cloud model – focus of this study:** The main thrust of cloud computing has been to provide a vehicle for outsourcing parts of the organisational computing environment to an outside party via a public cloud (Jansen & Grance, 2011). Chief Information Officers (CIOs) are looking to the ubiquitous public cloud for future growth. Currently, 16% of enterprise workloads running in the public cloud are expected to triple over the next five years (BI Intelligence, 2016). According to "Worldwide and Regional Public IT Cloud Services 2012-2016 Forecast", public IT cloud services will observe a compound annual growth rate of 26.4% between 2012 to 2016, which is five times the IT industry overall

(Burns, 2012). However, given the growth of public cloud adoption, concerns about security, privacy and legal are highest in this deployment model (Ferrer & Montanera, 2015). Because computing resources are shared, data is arguably more susceptible to hacking and theft, and unauthorised users can more readily intrude on applications. With a strong potential, but highest security concerns, the role of IT controls significantly changes in the public cloud deployment model. Therefore, the current study is focused on all the services (IaaS, PaaS and SaaS) of the public deployment model.

Just as deployment models dictate an organisation's control over the computational environment, cloud service models also constitute an important consideration. Cloud computing services are often classified by the type of services being offered. Three popular cloud services are IaaS, SaaS and PaaS.




Infrastructure as a service Platform as a service Software as a service

Figure 2.1: Cloud computing service models (EMC, 2014)

In Figure 2.1, IaaS is the base layer of the cloud stack. It serves as the foundation for the execution of the other two layers, SaaS and PaaS. In this layer, the consumer does not manage or control the underlying cloud infrastructure directly, but instead has control over the operating systems and deployed applications. Consumers upload both applications and platform software to the cloud. In the PaaS model, the consumer does not manage or control the underlying cloud infrastructure, such as network, servers, operating systems and storage but controls the deployed applications and possibly the application-hosting environment configurations. In terms of software, only the platform software is provided by the Cloud Service Providers (CSPs); consumers export their applications to the cloud. SaaS is the top layer of the cloud computing stack, which is directly consumed by the end user. The cloud provider will host and manage the required infrastructure and applications to support these services. For SaaS, applications and platform software are provided by the CSPs.

It has been noticed that in spite of the enormous growth of all deployment models of cloud computing, organisations are struggling with cloud project failures (Ramel, 2014). Failures of cloud projects have been attributed to the challenges with the human side of project success (Rollings, 2013), lack of focus on people skills, failure to focus on people (Bittman, 2015), ineffective use of people, lack of talent (Linthicum, 2013) and inefficient human resource management (Schwalbe, 2014). Therefore, to ensure the success of the growing cloud ventures within organisations, and to address the main concern related to this technology, it is important to study the impact of cloud computing on the roles and responsibilities of the people in charge of IT controls (*objective # 1*).

### 2.1.1. Impact of cloud computing on people's roles and responsibilities

An IT control is a procedure that provides a reasonable assurance that the IT used by an organisation operates as intended, that data are reliable and that the organisation is in compliance with applicable laws and regulations (Rouse, 2010). One of the five elements of ITG is 'resource management', which determines if adequate activities are being performed to align the use of people to meet the needs of the business. Currently, organisations govern IT systems through the use of internal IT controls by assigning roles and responsibilities for them. When IT controls are migrated to the cloud, during and after cloud migration, there is a corresponding restructuring of roles and responsibilities relating to changed internal IT controls in the new cloud data centre. Cloud security, which used to be the main challenge of cloud users, is now replaced by a lack of expertise (Weins, 2016) required to handle the IT controls that have been migrated to the cloud environment. As more organisations are placing greater workload on the cloud, the need for expertise has grown and IT organisations are challenged by a shortage of trained resources needed to fuel the growth. Moreover, it has been realised that the success of a cloud project directly depends on the skills and experience of the team deploying it. Therefore, to be successful in their cloud migration projects, IS researchers are advised to suggest skill requirements for people in changing IT jobs (Palvia & Vemuri, 2016) and organisations need to understand the importance of human resource management and take actions to make effective use of people (Schwalbe, 2014).

The roles and responsibilities of the IT practitioners undergo changes (CSA, 2011) with IT departments changing from being technical solution providers to business integrators, and non-IT managers becoming more exposed to IT issues (Gefen, Ragowsky, Licker, &

Stern, 2011). Many tasks that staff would normally undertake are outsourced in a cloud environment, thus requiring people to have different sets of skills and capabilities than those required previously. For example, staff require skills in contracting, outsourcing and managing vendors rather than engaging in in-house development (Gefen et al., 2012). Demand and capacity management skills are emphasised for successful cloud projects (Cruiser, 2014), while people need the capabilities to identify cloud-suitable workloads and transition them onto the cloud (Bhattacharya, 2011). Moreover, emphasis needs to be put on the non-IT skills of the IT practitioners for the success of cloud projects (Rollings, 2013) and people with change management skills and domain expertise will be sought after (Gartner, 2012). Even though IT controls are moved to the CSPs, their accountability, responsibility and assurance of regulatory compliance still lies with the organisation (Julisch & Hall, 2010), thus requiring unique elements of applying ITG to the CSPs (Becker & Bailey, 2014). Researchers have suggested that organisations staff cloud initiatives with people who have the appropriate skills and experience, and emphasis has been placed on the development of the non-technical skills and capabilities of their IT staff. There is also a growing sense among organisations that academia is not preparing graduates adequately for the needs of industry (Gefen et al., 2012). Industry not only needs graduates with IS skills but employees who know how to contract and manage vendors, who have an ability to do business analytics and who can do all this in a business context (Ragowsky, Licker, & Gefen, 2012).

With the roles and responsibilities of IT staff undergoing significant changes in the cloud environment, and the allocation of roles and responsibilities being an ITG activity (Webb et al., 2006), an examination of ITG frameworks will assist in analysing the methodology adopted by these frameworks in roles and responsibilities allocation. In this regard, popular ITG frameworks will be first identified and then evaluated to explore the mechanisms used by them in allocating the roles and responsibilities of IT controls in both non-cloud and cloud environments (***objective # 2***). This objective will be pursued through a detailed exploration of research publications and ITG frameworks guidelines.

## 2.2. IT Governance

IT has become crucial for the support, sustainability and growth of organisations (Lazic, 2011) and is considered to be the major enabler (Weill, 2004; Xue, Ray, & Gu, 2008) and critical factor (Chen, Mocker, Preston, & Teubner, 2010) for their strategic success. Given

the important role IT plays for the creation of business value, it is important to understand how IT can be effectively governed. Even though the concept of ITG did not feature in literature until the late 1990s (Brown & Grant, 2005), it is an important issue on the agenda of many organisations (Simonsson, Johnson, & Wijkstrom, 2007). Effective ITG is seen as a vital way to ensure improved organisational performance (Dahlberg & Kivijarvi, 2006) and is considered as a key enabler as well as the single most important predictor of the value an organisation generates from IT (Haes & Grembergen, 2009). ITG, which is an integral part of corporate governance, has become a focal point in every business (Willson & Pollard, 2009). In this regard, an evaluation of ITG perspectives can assist in delving deep into the success factors for role allocation of IT controls.

Definitions of ITG are broad and ambiguous (Simonsson & Johnson, 2006). However, according to one of the most widely cited definitions:

> IT Governance is the responsibility of the Board of Directors and executive management. ITG is an integral part of enterprise governance and consists of the leadership and organisational structures and processes that ensure that the organisation's IT sustains and extends the organisation's strategies and objectives (ITGI, 2007, p. 1).

Grembergen and Haes's (2006) definition conforms to the ITGI definition while adding relational mechanisms for the support of business/IT alignment and business value creation. Effective ITG requires its responsibilities to be clearly defined and assigned (Satidularn, Tanner, & Wilkin, 2011). Viewing from the 'roles and responsibilities' perspective, ITG can be used in forming decision-making structures and roles and responsibilities matrices to minimise and balance risks (ITGI, 2000). ITG is also defined as the patterns of authority for key IT activities in business firms, including IT infrastructure, IT use, and project management (Sambamurthy & Zmud, 1999, p. 261). Considering this wide field of ITG, it is not surprising that it has been explained in many different ways (Haes & Grembergen, 2008; ITGI, 2007; Peterson, 2004).

ITG frameworks provide a set of IT controls. These IT controls define what needs to be managed in each IT process to address the business requirements of ensuring IT delivers value, risks are managed and requirements are met. ITG is based on three constructs namely structures, processes, and relational mechanisms (Grembergen, Haes, & Guldentops, 2004; Haes & Grembergen, 2008; Peterson, 2004; Weill & Ross, 2004).

These processes, structures and relational mechanism have been explained by various researchers in their own perspectives, as can be seen in table 2.1.

Table 2.1: ITG constructs

| Constructs | Use | Sources |
|---|---|---|
| Processes | – to ensure the effective and efficient use of IT<br>– that deal with strategic IT decision making<br>– that enable an organisation to achieve its goals<br>– to set priorities and to allocate IT resources<br>– that help in managing external partners<br>– to ensure regulatory compliance<br>– to provide detailed guidelines<br>– to lay out IT budgets, prioritise IT functions, control IT resource-planning and define the roles and responsibilities | (Grembergen & Haes, 2009; ITGI, 2013; Karimi, Somers, & Gupta, 2001; Peterson, 2004; Sambamurthy & Zmud, 1999) |
| Structures | – to design and implement effective organisations<br>– for distributing IT-related decision making rights<br>– to speed up decisions<br>– to execute critical actions<br>– to harmonise the competing interests of corporate IT users<br>– implies control and direction<br>– to distribute responsibilities of IT staff | (Haes, Grembergen, & Debreceny, 2013; ITGI, 2013; Martins, Moura, da Cunha, & de Figueiredo, 2010; Sambamurthy & Zmud, 1999; Smits, Fairchild, Ribbers, Milis, & Geel, 2009) |
| Relational mechanisms | – are used in forming a link between business and IT<br>– provide proper directions to corporations on the use of technology for delivering business opportunities for achieving competitive advantage<br>– are used for maximising the value of IT | (Haes & Grembergen, 2009; Lazic, 2011) |

Even though most of the ITG definitions focus on processes and the distribution of decision-making rights and responsibilities to govern the IT function, there is still no unique and broadly accepted definition (Martins et al., 2010), and it is still considered a maligned and misused term with multiple meanings in different contexts (Rau, 2004).

Drawing from the literature review and based on the constructs identified in table 2.1, the researcher of this study formulated a comprehensive definition of ITG as follows:

> ITG is defined as a set of IT controls, with clearly defined and assigned roles and responsibilities, geared towards the right use of technology to meet the strategic goals of the organization.

The derived ITG definition distilled from extant literature emphasises the predominant role of ‘responsibilities of IT control’. With the numerous ITG frameworks available, it is

challenging to identify the success factors and criteria used by all ITG frameworks to allocate people to the roles and responsibilities of IT controls, for cloud as well for non-cloud environments. Therefore a list of available ITG frameworks will be first identified, and then top three frameworks will be shortlisted and examined to evaluate the role allocation methods used in these frameworks.

### 2.2.1. Three popular ITG frameworks

A detailed study was conducted to identify the popular ITG frameworks and then shortlist the top three. Using survey analysis and academic research, top three ITG frameworks were selected, based on the popularity and their widespread usage. Each of these selected frameworks is examined to understand the factors/criteria used by them for the allocation of the roles and responsibilities of IT controls that have been migrated to the cloud environment.

- **Survey analysis to identify top ITG frameworks**

Detailed surveys initiated by the ITG Institute (ITGI) were conducted by a leading research company (PricewaterhouseCoopers) during the years 2003, 2005, 2007 and 2011 (ITGI, 2011; Steuperaert, 2004). The objective of these surveys was to identify the frameworks that are considered leaders in the ITG environment and marketplace. Results of the study presents a list of fourteen available popular ITG frameworks (standards/best practices will be referred to as frameworks in this study) as shown in table 2.2.

Table 2.2: Trends in usage of ITG frameworks

| Frameworks | 2003 | 2005 | 2007 | 2011 |
|---|---|---|---|---|
| ITIL | 6% | 13% | 24% | 28% |
| ISO 17799, ISO 27000 or other security frameworks | 6% | 9% | 10% | 21% |
| Six Sigma | N/A | 5% | 2% | 15% |
| COBIT (ISACA) | 11% | 9% | 14% | 13% |
| PMI/PMBOK | N/A | 3% | 1% | 13% |
| Risk IT (ISACA) | N/A | N/A | N/A | 12% |
| IT Assurance Framework (ISACA) | N/A | N/A | N/A | 10% |
| CMM or CMMI | 6% | 4% | 4% | 9% |
| ISO 38500 | N/A | N/A | N/A | 8% |
| BMIS (Business Model for Information Security, ISACA) | N/A | N/A | N/A | 8% |
| PRINCE2 | N/A | N/A | 2% | 6% |
| Val IT (ISACA) | N/A | N/A | N/A | 5% |
| TOGAF | N/A | N/A | N/A | 3% |
| COSO ERM | 1% | 4% | 1% | 2% |

According to the surveys conducted, prior to 2003 a large percentage (75%) of organisations were using a variety of local or internal solutions instead of internationally known ITG frameworks. Around 30% of organisations had no apparent framework or solution in place. Among the internationally known frameworks, COBIT was used by a majority (11%) of the organisations surveyed. An analysis of the surveys conducted during 2005 shows that one third of the participants used or were considering using an internally developed framework. Nearly one quarter of the participants had not yet decided which framework to use. The use of the ITIL framework has been experiencing steady growth each year. The results of the 2007 survey indicate an increase of more than 50% in COBIT awareness, while its adoption and use remained around 30%. According to the 2011 report, ISO 20000 was the external standard most frequently mentioned as the basis for an enterprise's governance of its IT approach, followed by the Information Security Framework ISO 17799/ISO 27000, or other security standards.

An analysis of the four surveys conducted over a period of eight years (table 2.2) revealed an increase in the acceptance of frameworks and standards as tools for achieving ITG. However, there is no single framework recognised as the market leader, and organisations tend to look at multiple sources for guidance. The survey results revealed the top five governance frameworks to be ITIL, ISO 27K COBIT, Six Sigma, and PMBOK. Shortlisted ITG frameworks are examined to find the guidelines used by them to allocate roles and responsibilities of IT controls that have been migrated to the cloud. Apart from statistical results, this study subsequently considers numerous perspectives of ITG researchers to shortlist the three commonly deployed ITG frameworks.

- **Researchers' perspective for identifying the top ITG frameworks**

Among the range of ITG frameworks, COBIT and ITIL are considered well-known frameworks that support the implementation of effective ITG processes (Coelho & Rupino da Cunha, 2009; Othman, Chan, & Foo, 2011; Stevens, 2011). By adopting and implementing these, organisations can achieve alignment between business and IT, resulting in a possible positive effect on business performance, competitive advantage and increased profitability (Marrone, Hoffmann, & Kolbe, 2010; Marrone & Kolbe, 2011; Mohd Fairuz Iskandar Othman, Chan, Foo, Nelson, & Timbrell, 2011). Using COBIT and ITIL together links proven IT best practices (ITIL) to COBIT's regulatory and business requirements and makes the process improvement task much more achievable (Consulting, 2005). ITIL

relates primarily to management rather than governance and to tactics rather than to strategy (Haes et al., 2013).

COBIT is less detailed than ITIL for operational matters, yet it provides a structured, high-level approach to ITG. The COBIT framework is often quoted in the literature (Simonsson & Johnson, 2006) as the best known ITG framework (Drews, Morisse, & Zimmermann, 2013; Etzler, 2007; Hobbs & Scheepers, 2010; Leon et al., 2010; Nicho, 2008; Ridley, Young, & Carroll, 2004). COBIT lists a set of IT control practices and instruments in four domains: Planning and Organisation, Acquisition and Implementation, Delivery and Support, and Monitoring and Evaluation. Although COBIT describes decision-making structures, it emphasises control over the IT function. The control is implemented using a collection of control objectives for IT processes over the entire ITG life cycle (ITGI, 2007). COBIT has been mostly used by large organisations with the support of consultants in order to adjust its recommendations to specific contexts (Guldentops, 2006).

In addition to COBIT and ITIL, organisations use ISO 27K to address security issues to mitigate risks, while some recommend adopting ITG best practices such as PMBOK (Martins et al., 2010; Smits & Hillegersberg, 2013). Organisations attain certifications like ISO/IEC 27K to facilitate many of the legal and regulatory requirements, to gain competitive advantage and to obtain an objective validation by an impartial certifying body (Brenner, 2007). Authors such as Nfuka and Rusu (2013) suggest certifications like ISO together with COBIT as best practices for ITG. Some organisations adopt ISO 27001 to increase staff awareness of information security, mitigate threats and provide better data and privacy protection (Othman et al., 2011).

Another framework that can be used by management along with COBIT for guidance in establishing and maintaining a well-controlled information technology environment is Committee of Sponsoring Organizations (COSO). While COSO/ERM is recognised as a very good framework for general internal control, its impact on IT business alignment is limited (Haes & Grembergen, 2008). Even though researchers are unanimous in asserting that a universal best ITG structure does not exist (Brown & Grant, 2005), there are some frameworks which are much more popular and widely accepted and used than others. Six frequently cited frameworks include COBIT, ITIL, ISO/IEC 270K, CMMI and BS 7799 (Smits & Hillegersberg, 2013). Most of the researchers have identified COBIT and ITIL as the most commonly used frameworks for ITG implementations. However, combined

perspectives of survey analysis and academic research is considered to shortlist the top three.

From the researcher's perspective, it is evident that COBIT and ITIL are the most widely accepted and used control framework available to align information systems to business goals. Other frameworks identified by researchers are PMBOK, COSO, ISO 27K and CMM. COBIT is an umbrella framework which covers all of these as the major supporting reference. An analysis of the surveys conducted by leading IT consultants revealed an increase in acceptance of frameworks as tools for achieving ITG. Survey results revealed the top five governance frameworks to be ITIL, ISO 27K, COBIT, Six Sigma and PMBOK. Looking at the combined research and survey results (table 2.3), it is evident that out of a plethora of frameworks, COBIT, ITIL and PMBOK are three prominent and popular ITG frameworks selected.

Table 2.3: List of ITG frameworks endorsed by analysts and researchers

| Frameworks | Smits & Hillegersberg, 2013 | Stevens, 2011 | Othman et al., 2011 | Marrone et al., 2010 | Consulting, 2005 | Wallhoff, 2004 | Martins, 2010 | Wittenburg et al., 2007 | Brenner, 2007 | Hobs et. al., 2011 | Ridley et al., 2004 | Nicho, 2008 | Leon et. al., 2010 | Drews et al., 2013 | Datardina , 2005 | Etzler, 2007 | Rouyet, 2008 | Woertman, 2006 | Etzler, 2007 | Summerfield , 2005 | Haes & Grembergen, 2008 | ITGI 2003, 2005, 2007, 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COSO** | | | | | | | | | | | | | | | ✓ | | | | | | ✓ | ✓ |
| **COBIT** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **CMM** | | | | | | | | | | | | | | | | | | | | | | ✓ |
| **ITIL** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | | | ✓ |
| **CMMI** | | | | | | | | | | | | | | | | | | | | | | ✓ |
| **BS 7799** | ✓ | | | | | | | | | | | | | | | | | | | | | |
| **PMBOK** | ✓ | | | | | | ✓ | ✓ | | | | | | | | | | | | | | ✓ |
| **Six Sigma** | | | | | | | | | | | | | | | | | | | | | | ✓ |

## 2.2.2. An evaluation of IT governance frameworks

Having identified COBIT, ITIL and PMBOK as three top ITG frameworks, each will be explored in detail to identify the factors used by them for the allocation of roles and responsibilities of IT controls.

- **Roles and responsibilities allocation factors in COBIT**

COBIT identifies 37 processes spread over governance and management domains, a governance area with 5 processes and a management area with 32 processes. Relevant to the research question, assignment to processes with the documented responsibility levels in

COBIT takes place in the form of responsibility, accountability, consulted and informed (RACI) charts (ISACA, 2012). There is a RACI chart defined for each of the 37 COBIT processes. COBIT also handles the continual improvement of governance of enterprise IT, accomplished using the seven-phase implementation life cycle. Thus, overall, there is a RACI chart for the key activities of each of the 37 governance processes and for each of the seven phases of the implementation life cycle. Figure 2.2 shows the RACI chart of phase 1. COBIT provides similar charts for all the rest of six phases.

| | **Responsibilities of implementation role players** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Key Activities** | **Board** | **IT Executive Committee** | **CIO** | **Business Executives** | **IT Managers** | **IT Process Owners** | **IT Audit** | **Risk and Compliance** | **Programme Steering** |
| Identify issues triggering need to act (CI 1) | C/I | A | R | R | C | C | C | C | R |
| Identify business priorities and strategies affecting IT (CI3). | C | A | R | R | | | C | C | R |
| Gain management agreement to act and obtain executive sponsorship (CI7). | C | A/R | R | C | I | I | I | I | R |
| Instill the appropriate level of urgency to change (CE10). | I | A | R | R | C | C | C | C | R |
| Produce convincing outline business case (PM3). | I | A | R | C | C | C | C | C | R |

Figure 2.2: Roles and responsibilities in phase 1 (ISACA, 2012)

In this regard, an evaluation of RACI chart deployment in COBIT elicited mixed responses. It has been stated that RACI charts' definitions of the roles and responsibilities of different stakeholders for IT processes are at a very high level, which is too generic for practical use (Zhang & Le, 2013). Moreover, an analysis of COBIT literature and guidelines does not provide any guidelines on the methodology, criteria or factors for allocating roles and responsibilities of IT controls in a classic data centre or in the cloud. In an effort to find the allocation factors used by RACI charts in COBIT, a title search using the words *roles and responsibilities* and *RACI* was conducted in the Association of Information Systems (AIS) journal's database (www.ais.com) and Google Scholar spanning the years 2008 to 2014. While a search for research on *allocation of roles and responsibilities in COBIT* yielded no result, a search with the key words *roles and responsibilities allocation in COBIT* resulted in a very poor response, with a research paper proposing improvements to enhance the perception of "responsibility" in COBIT RACI charts (Feltus, Petit, & Dubois, 2009) and a paper pointing to a need for more studies to look at different ITG mechanics, IT-related capabilities and contingent factors that provide benefits at the process and firm levels (Prasad, Heales, & Green, 2009). This clearly indicates a research gap

in terms of the allocation of roles and responsibilities in RACI charts in the COBIT framework. The deficiency of academic research on ITG in general (Lazic, 2011; Marrone et al., 2010) and on COBIT specifically has also been underscored by several researchers (Al Omari, Barnes, & Pitman, 2012; Haes et al., 2013).

Moreover, for a governance solution to be effective, it needs to be implemented and deployed in the organisational context (Jewer & McKay, 2012). Various iterations of COBIT are based on original research, on widespread use of experts in workshops and workgroups and on input from cognate frameworks. This approach does not portray a complete sampling of real-world conditions (Haes et al., 2013). This study led to the researcher's affirmation of a lack of guidance on the responsibility allocation factors of the IT controls. This study further confirmed a significant lack of research on the COBIT framework and its deficiency in portraying real-world conditions. Additionally, it was necessary to study the other two (ITIL and PMBOK) top-identified ITG frameworks for roles and responsibilities allocation factors.

- **Roles and responsibilities allocation factors in ITIL**

ITIL provides best practices related to the effective and efficient management of IT operations (Anthes, 2004; Gama, Sousa, & da Silva, 2013) and IT service management (ITSM). The framework of ITIL contains seven service life cycle stages, including service support, service delivery, planning to implement service management, security management, ITC infrastructure management, application management and the business perspective (Shang & Lin, 2010). For the successful execution of each of the ITSM lifecycle stages, roles and responsibilities of various activities are defined by using a RACI (Figure 2.3), RACI-VS (Verifies & Signs-off) or RASCI (Supportive) chart (Rudd & Loyd, 2007).

| | **Director Service Management** | **Service Level Manager** | **Problem Manager** | **Security Manager** | **Procurement Manager** |
|---|---|---|---|---|---|
| **Activity 1** | AR | C | I | I | C |
| **Activity 2** | A | R | C | C | C |
| **Activity 3** | I | A | R | I | C |
| **Activity 4** | I | A | R | I | |
| **Activity 5** | I | I | A | C | I |

Figure 2.3: Sample RACI matrix in ITIL (Rudd & Loyd, 2007)

One of the activities in building the RACI chart is to define and identify the functional roles. To work effectively and efficiently, ITIL service design requires all people assigned

to roles within ITSM to have specific skills (management, meeting, communications, articulate, negotiation, customer service and analytical skills), attributes (business awareness, IT awareness, IT-business dependency awareness) and competencies (role specific competencies and knowledge and the ability to adhere to best practice, policies and procedures). Based on this set of criteria people are assigned to roles (Rudd & Loyd, 2007). Roles are then assigned to processes and finally gaps or overlaps are identified for right chart distribution. Size and volatility of the organisation are two other identified important factors on which the roles and responsibilities depends on (Rudd & Loyd, 2007). The size of the organisation will define the number of roles people are assigned to. There may be a single person with several roles or a single role assigned to many persons. Moreover, a fast changing and volatile environment also has the potential to affect the organisation's method of allocation (Rudd & Loyd, 2007).

Despite ITIL providing these guidelines for the allocation of roles and responsibilities to IT controls, organisations find it difficult to implement the ITIL framework (Ying, Lijun, & Wei, 2009) because it is not organisation-specific (McNaughton, Ray, & Lewis, 2010; Shang & Lin, 2010) and it only provides guidelines, thereby leaving implementation issues to the practitioners themselves (Cox, 2013; Pereira & Silva, 2010; Ying et al., 2009). Provided criteria are very generic and not specific to a cloud environment. Since PMBOK has been identified as one of the three top ITG frameworks, it also needs to be studied for the roles and responsibilities allocation factors.

- **Roles and responsibilities allocation factors in PMBOK**

ITG and project management are interconnected as most of the IT projects as well as ITG implementations follow prescribed PMBOK methodology. A well-defined governance model is essential for project management to fulfil its governance role. In an effort to explore the factors used by organisations to allocate roles and responsibilities for project tasks, the researcher undertook the evaluation of PMBOK. This framework has been recommended as one of the best (Martins et al., 2010; Smits & Hillegersberg, 2013), most prominent and most popular ITG frameworks (Kadam, 2012), especially in Asia. Resource assignment matrix (RAM) in PMBOK is a matrix that maps the connection between the project tasks or activities and its team members. RACI matrix (Figure 2.4), a type of RAM, describes the participation by various roles in completing tasks or deliverables for a project

or business process (Margaria, Tiziana, Steffen, & Bernhard, 2012), and it defines role assignments more clearly than RAM (Mulcahy, 2015).

| Function | Project Sponsor | Business Analyst | Project Manager | Software Developer |
|---|---|---|---|---|
| Initiate Project | C | | AR | |
| Establish Project Plan | I | C | AR | C |
| Gather User Requirements | I | R | A | I |
| Develop Technical Requirements | I | R | A | I |
| Develop Software Tools | I | C | A | R |
| Test Software | I | R | A | C |
| Deploy Software | C | R | A | C |

Figure 2.4: Sample RACI matrix in PMBOK (Schwalbe, 2014)

It is especially useful in clarifying roles and responsibilities in cross-functional or departmental projects and processes (Brennan, 2009) and particularly when the team consists of internal and external resources (PMBOK, 2013). However, allocating roles and responsibilities in the RACI charts in PMBOK is left up to the project manager's experience, judgment and authority. Therefore, PMBOK lacks factors based on which IT decision makers would be able to allocate resources to the project tasks.

Looking at the volatility of cloud projects, roles and responsibility allocation needs to be agile and based on some well-defined factors. An extensive search of the leading academic research databases did not yield any prior research to explore how project managers should allocate responsibilities to the tasks. For example, a search of the ABI/INFORM Complete database for the keywords *RACI* and *PMBOK* resulted in eight papers covering various topics, but there is a lack of literature addressing the issue under current consideration. The identified eight papers address topics like presenting a model for team evaluation in a mega-project setting (Farahmand, 2011), highlighting best practices in people management (Singh, 2008) and customising the balanced scorecards (Basu, Little, & Millard, 2009). A similar search in the IGI Global database resulted in four papers discussing the risks and challenges of a case study project (Means, Olson, & Spooner, 2013), a proposal of a model for corporate IT risk management (Spremić, 2013), research on the issues of IT value management (Vogt & Hales, 2013) and a proposal of an information security governance model (Nicho, 2012). Therefore, there is a lack of literature on the factors for

allocating roles and responsibilities in RACI charts from PMBOK academic literature. A similar search in the ACM Digital Library resulted in only one paper, discussing how to facilitate people interactions in outsourcing service engagements (Motahari, Graupner, & Singhal, 2010). An extensive search using Google Scholar and the university e-journal database did not identify any further literature addressing this issue.

Therefore, it can be concluded that similar to COBIT and ITIL, PMBOK also uses RACI charts for describing the participation by various roles in completing project tasks or deliverables. However, this allocation of roles and responsibilities is not based on any factors or criteria. It is left to the experience of project managers to determine the allocation. Additionally, RACI chart is generic and does not give any details about the specific elements related to a cloud based project. Searching the leading academic database also did not identify any literature addressing this issue.

## 2.3. Conclusion

Effective ITG requires responsibilities to be clearly defined and assigned. With numerous ITG frameworks available, based on popularity and widespread usage, COBIT, ITIL and PMBOK have been listed as the commonly deployed ITG frameworks by organisations. This selection was based on the survey analysis and exploration of the academic literature. Detailed exploration of each of COBIT, ITIL and PMBOK led to the researcher's affirmation regarding a lack of guidance on roles and responsibility allocation criteria for IT controls in a cloud environment. A study of PMBOK guidelines and an extensive search done using Google Scholar and the university e-journal database also failed to lead the researcher to any literature addressing the current issue.

The RACI charts used in COBIT and PMBOK show the assignment of various roles in completing tasks or deliverables. However, the allocation of roles and responsibilities in the RACI charts is left up to the project decision maker's experience, judgment and authority. It lacks factors based on which IT decision makers could allocate resources to the tasks.

Despite ITIL providing three factors for the allocation of roles and responsibilities to IT controls, organisations find it difficult to implement the ITIL framework because the factors are too generic and do not provide guidance on how roles and responsibilities are to be allocated in an organisation that has adopted a cloud strategy.

To further find answers to the research question, the researcher plans to analyse the existing literature related to the theme of topic: organisational behaviour, cloud computing and ITG, to build a set of success factors that can guide practitioners in allocating appropriate personnel to the roles and responsibilities of IT controls in a public cloud environment (objective #3).

# CHAPTER 3

# THEORETICAL FACTORS FROM THE LITERATURE

# 3. CHAPTER 3: THEORETICAL FACTORS FROM THE LITERATURE

Development of theory is a central activity in organisational research (Eisenhardt & Graebner, 2007). This chapter explores the theoretical models related to organisational, cloud computing, and IT Governance (ITG) domains, to propose the theoretical success factors. A theory is an idea that is suggested or presented as possibly true but that is still not proven to be true (MWD) and it is used broadly to encompass conjectures, models, frameworks or bodies of knowledge (Gregor, 2006). Academic researchers develop theories to accumulate knowledge in a systematic manner and subsequently to enlighten professional practices.

A theory is considered to be a special kind of model (Ludewig, 2003) that is intended to account for some subset of phenomena in the world (Weber, 2012). This research aims to develop theory that guides in the allocation of staff to the roles and responsibilities of IT control in a public cloud environment. Following Weber (2012)'s description, the proposed theory is composed of three components: 1) constructs or the success factors with corresponding definitions, 2) associations between these proposed success factors, and 3) scope of the results with regard to the allocation of IT control roles and responsibilities that have been migrated to the public cloud environment.

Researchers have developed theories to extend existing models and also utilised frameworks from other disciplines (Alborz, Seddon, & Scheepers, 2003). Developing theory with a strong grounding is also expected both by the leading journals (Gregor, 2006) and researchers (Lewin, 1945). The study of IT control roles and responsibilities in a cloud environment is at the intersection of knowledge related to technology/machines and humans. Therefore, this research attempts to investigate the existing theories that have emerged based on the interaction of technological and social systems. Subsequently, in order to answer the main research question, the researcher draws upon theories based on the three IS domains, namely organisational theories, cloud computing and ITG (Figure 3.1), in order to develop roles and responsibilities allocation success factors.

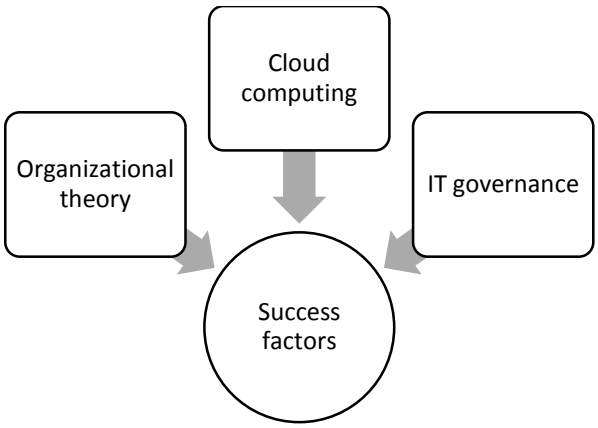



Figure 3.1: Research themes

This chapter is divided into five sections. Sections 3.1 to 3.3 provides the theoretical background for the development of the factors by looking at relevant organisational, cloud computing and ITG theories, respectively. Section 3.4 provides the proposed Success Factors (SFs) for the allocation of people's roles and responsibilities for IT controls in a cloud environment. Section 3.5 brings the chapter to a conclusion.

## 3.1. Organisational theory

Migration to the cloud is fundamentally an organisational issue (Beserra, Camara, Ximenes, Albuquerque, & Mendonca, 2012). Therefore, the researcher looked at the Stafford Beer's Viable System Model (VSM) (Stafford, 1985) that enables people to address organisational issues. It was considered because of its usefulness for organisations using technology to distribute work among a geographically dispersed workforce (Hilder, 1995). VSM has been used earlier as an ITG-base model (Lewis & Millar, 2009) for evaluating ITG models (Davies, 2002) as well as for discussing theories of ITG (Dowse & Lewis, 2009). However, on detailed study, it was found to be very generic and therefore was not found suitable for use in ITG activity of role allocation. Migration to the cloud is also an organisational strategy (Iyer & Henderson, 2010), therefore, the researcher considered the strategic alignment model of Henderson and Venkatraman (1993). However, this model was found to focus more on the role of IT in organisational transformation rather than on role allocation. Since cloud migration affects both technology and people, the sociotechnical theory of Bostrom and Heinen (1977) was considered. Closer examination revealed that it concentrates only on providing guidelines from a system design approach. Another information systems theory providing technology acceptance model (TAM) (Davis, 1989)

was studied. But this model presents factors that influences how users come to accept and use a technology, but it does not provide factors based on which people will be allocated to roles and responsibilities. Focusing on a human resources approach to role allocation, the researcher analysed the human resource framework of Lepak and Snell (1999), but found that it instead identifies forms of human capital that can be used as a source of competitive advantage. Likewise, the task-technology fit model of Goodhue and Thompson (1995) could not be used to explain role allocation, since it instead provides guidance on the impact of IT on user performance. Therefore, it was observed that even though above theories were related to the current topic, they could not be used to model roles and responsibilities allocation.

It has been noticed that organisational design influences the decision-making process (Rowland & Parry, 2009), including decisions related to roles and responsibilities allocation or personnel decisions (Carley, Prietula, & Lin, 1998). It has also been found to help in reshaping and channelling organisational structures and roles to meet the business strategy. Organisational design is about creating roles, processes, and formal reporting relationships in an organisation. It defines jobs, shapes work processes and motivates performance. Organisations are composed of individuals, therefore, organisational performance depends substantially on its resources and capabilities (Sharma & Vredenburg, 1998). Some view organisations as a unique bundle of heterogeneous resources and capabilities (Barney, 1991; Jones, Jimmieson, & Griffiths, 2005). Channeling of these resources can be dictated by organisational design decisions. Nadler and Tushman (1997, p. 14) convey this observation as they explain the relationship between organisation designs and work that people in the organisation do, as:

> The goal of organisational design is to fashion a set of formal structures and processes that, together with an appropriate informal operating environment, will give people the skills, direction and motivation to do the work necessary to achieve the strategic objectives.

Considering the above arguments, a conscious decision was made to study organisational theories that can be used to provide input on roles and responsibilities allocation. The widely accepted organisational 'Star Model' (Galbraith, 1995, 2011) as shown in Figure 3.2, has been found to be used for channeling resources (Nadler & Tushman, 1997) and as such was useful in provided allocation factors for this research.


Figure 3.2: The "Star Model" (Galbraith, 2011)

The Start Model has been used for identifying the right people to manage innovation efforts (Deschamps, 2005), for driving business growth through new capabilities (Schuster & Kesler, 2011), for shaping human resources processes (Ulrich, 1998) and as a guide to redesign activities at hundreds of firms facing challenges with global functioning (Mohrman, 2007). This framework provides tools for management to shape resource allocation and other management decisions effectively. According to this model, growth strategies can fail if resources are not realigned to deliver new value in a changing market, and to handle increased complexity from size, variety, and change. This model is based on five design principles, which are related to *strategy*, *structures*, *processes*, *rewards* and *people* (Table 3.1). Since the Star Model provides basic guidelines for role allocation, the researcher evaluates the five principles to elicit relevant factors related to the cloud.

- **Strategy:** The strategy of an organisation needs to be geared towards providing a competitive advantage, which means offering better value through lower costs or better services (Porter, 1918). This competitive edge can be achieved either by building superior internal capabilities in terms of skills, processes, technologies or human abilities, or by exploiting external capabilities available in the form of cloud services. The strategy of an organisation determines the tasks to be performed.

- **Structures:** Structures determine the locus of decision-making power and authority by setting out the reporting relationships, power distribution and communication channels. Structures outline the 'specialisation' that determines the type and numbers of job

specialties used in performing the work; 'shape' refers to the number of people constituting the departments at each level of the structure; 'distribution' of power determines the movement of power either to the department dealing directly with issues critical to its mission or the centralisation or decentralisation of this authority; and 'departmentalisation' is the basis for forming departments at each level of the structure.

When organisational assets are geographically dispersed through the cloud, system units tend to have a greater number of interactions between units to get work done (Lawler III & Worley, 2011). These complex organisations with more surface area will not spontaneously self-organise (Galbraith, 2011). Employees in these large and complex organisations are unlikely to be able to gain a broad view to make the right decisions about how units should be configured and who should interact with whom. It is therefore the job of IT decision-makers to manage the complexity created by the organisation's size by having clear roles and responsibilities allocation in place.

- **Processes:** Processes are connected set of activities that show the movement of information. Some of the planning activities include tasks used for the allocation of talent to the business needs. When these processes cut across organisational boundaries as is the case in a cloud environment, clear articulation of roles and responsibilities at the boundary interfaces is essential. Galbraith (2011) suggests using networks, teams, integrative roles and matrix lateral connections in addition to processes to build interpersonal relationships and bridge barriers across organisations. Among the numerous interpersonal relationships building methods, management encourages using job rotation of assignments to bring knowledge, relationships, and culture from one unit to another and thus create understanding and appreciation for different organisational perspectives.

- **People:** Human resource policies influence and frequently define the employees' mind-set and skills to execute the strategic directions of the organisation. The fundamental set of competencies required from employees at all levels include capabilities such as negotiation, collaboration, conflict resolution, advocacy, relationship and network building skills.

- **Rewards:** Rewards are used to motivate people to perform in order to achieve organisational goals. Tangible and intangible rewards both have a significant effect on the nature of responsibilities undertaken by staff.

The principles of Galbraith's Star Model have been used to study how people's roles depend upon the strategy, structure, processes, people and rewards in an organisation. Based on detailed analysis, it is evident that these five design principles of the Star Model, summarised in table 3.1, have a deep impact on the allocation of roles to different IT controls to meet the strategic objectives of the organisation. Therefore, these are included in the proposed success factors.

Table 3.1: Role allocation factors deduced from organisation design (Galbraith, 2011)

| Success factors | | Definitions |
|---|---|---|
| **1. Strategy** | – | Defines whether to build capabilities (e.g. skills, processes, technologies and human abilities) internally or exploit external capabilities available in the form of cloud services. The strategy of an organisation determines the tasks to be performed. |
| **2. Structure** | – | Outlines the specialisation which determines the type and numbers of job specialties used in performing the work. |
| | – | Defines the shape that refers to the number of people constituting the departments at each level of the structure (size). |
| | – | Determines the distribution of power either to the department dealing directly with issues critical to its mission or the centralisation or decentralisation of this authority. |
| **3. Processes** | – | Connected set of activities that show the movement of information. When these processes cross the organisational boundaries in a cloud environment, clear articulation of roles and responsibilities at the boundary interfaces is required. |
| **4. People** | – | Fundamental set of competencies, skills and mind-sets required from employees at all levels. |
| **5. Rewards** | – | To motivate people to perform and address organisational goals. |

## 3.2. Cloud computing theories

Although cloud computing is examined from several specific business perspectives like pricing models, resource allocation for Infrastructure as a Service (IaaS) and critical adoption capabilities, its impact on the roles and responsibilities has remained unexplored (Khan et al., 2016; Khan, 2012). The researcher could not find any cloud computing theories related to the topic. However, the cloud has been described as a method of computational "outsourcing" (Lei, Liao, Huang, & Heriniaina, 2014) and the latest trend to outsource part or complete IT operations to run a business from the public cloud (Dhar, 2012). Therefore, the researcher decided to address the research question by studying the literature on IT outsourcing.

### 3.2.1. IT outsourcing and its governance

IT outsourcing is "the practice of turning over all or part of an organisation's IT functions to an outside vendor" (Gottschalk & Solli-Sæther, 2005, p. 685). It helps organisations focus on core business activities, while outsourcing other services to third-party vendors. It helps in reducing costs, compensating for lack of technical skills, while achieving strategic goals and gaining a competitive advantage. Outsourcing has been used by organisations for decades, but it gained popularity among organisations starting 1989 when Kodak outsourced their IT services (Fjermestad & Saitta, 2005). Outsourcing firms are increasingly shifting specific components of their IT infrastructure away from a "hierarchical" mode towards a "market" mode of governance (Loh & Venkatraman, 1992).

Outsourcing has its highest impact on IT management and professionals whose role is transitioning from being technology-centred towards serving as a bridge between the strategic needs of the organisation and the technology (Hunter, 2010). Rather than the role of IT being demoted by outsourcing, IT has emerged as the business integrator in outsourcing. Outsourcing, in the form of offshoring relationships regarded as a "moving target", requires dynamic governance strategy to drive success in the offshoring relationship (St. John, Guynes, & Vedder, 2014). Therefore, for effective IT outsourcing governance, it is necessary to redefine roles and responsibilities in light of the need to allocate personnel with the right skills and guidance required for its success (Endeavor Management, 2011).

Since governance brings in responsibilities, allocation of responsibilities in the form of RACI charts has also been used for managing governance in outsourcing (Meng et al., 2007; Ramakrishnan & Pro, 2008; Simonova & Zavadilova, 2011). The RACI matrix used in outsourcing captures cross-vendor dependencies, and defines roles and responsibilities for all vendors (Ramakrishnan & Pro, 2008). However, the criteria/factors for allocation of roles and responsibilities for IT controls are not evident in the outsourcing literature. However, the IT outsourcing relationship (Alborz et al., 2003) model (Figure 3.3) presents factors that influence IT outsourcing relationship.

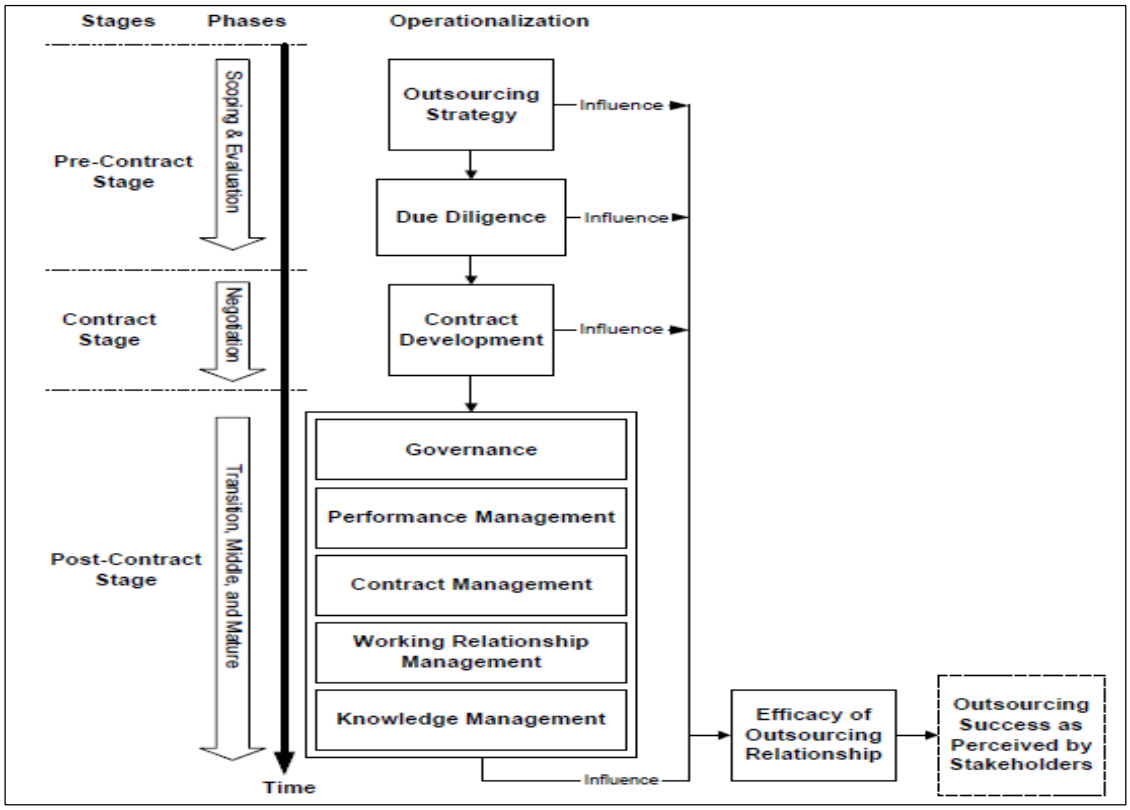



Figure 3.3: IT outsourcing relationships model (Alborz et al., 2003)

Alborz et al. (2003)'s model contributed factors such as 'strategy', 'contract management', 'governance', 'performance management' and 'knowledge management' that influence the efficacy of an outsourcing relationship between vendors and clients. Researchers including Feeny and Willcocks (1998) also identified IS capabilities required to capitalise on the external market's ability to deliver cost-effective IT services in an outsourced environment. . 'Due diligence' factor given in the model includes supplier evaluation, selection and development activities. By combining the perspectives of model and those of others researchers, the researcher developed nine factors (Table 3.2) depicting the Information Systems (IS) capabilities required of people working in such outsourced environments.

Table 3.2: Roles and responsibilities allocation factors in an IT outsourced environment

| Success factors | Definitions | Sources |
|---|---|---|
| **1. Strategy** | – IT management needs to have a clear outsourcing strategy so that the level of services received are aligned with the business strategic needs. | (Alborz et al., 2003; Aubert, Rivard, & Patry, 2004; Laabs, 1993; Parkes, 2004) |
| **2. Supplier management** | – Skills required for handling activities to evaluate and select CSPs. | (Alborz et al., 2003; Chaudhury, Nam, & Rao, 1995) |
| **3. Contract management** | – Skills to structure contracts for effective pricing, access rights, data ownership, risk management and for ensuring the availability of data and reports. Specific SLA can be added to the contract. | (Alborz et al., 2003; Ho, Ang, & Straub, 2003); Macneil, 1978; Williamson 1985; (Parkes, 2004; Rivard & Aubert, 2015) |
| **4. Governance** | – Requirements of sound governance attributes like senior management role and support, management structure and teams, management style, management skills and the establishment of appropriate processes and procedures. | (Alborz et al., 2003; Smith & McKeen, 2009) |
| **5. Technical competencies** | – Competencies to evaluate the on-demand, self-service cloud based solutions, coordinate and integrate the cloud services with the existing systems. | (Endeavor Management, 2011; Feeny & Willcocks, 1998; Lacity & Reynolds, 2014) |
| **6. Negotiation skills** | – Skills required to negotiate the contract terms to ensure the organisation's rights and obligations for both parties. | (Anne & Will, 2004) (Kim; Zhao & Watanabe, 2008) |
| **7. Performance management** | – Competencies required for setting quality levels, monitoring the CSP against the SLAs and rating the CSP performance | (Alborz et al., 2003; Fitzgerald & Willcocks, 2009) (Parkes, 2004); Anne & Will, 2004) |
| **8. Conflict management** | – Skills to assess and avoid negative impact of establishing new business ties or terminating the existing business with a CSP. | (Anne & Will 2004)(Kim; Zhao & Watanabe, 2008) |
| **9. Knowledge management** | – Skills required for sharing or transferring knowledge to the supplier to build trust, which will result in the supplier's improved commitment and thus better results. | (Alborz et al., 2003) |

Cloud computing, considered to be the latest outsourcing trend (Dhar, 2012), inherits the "roles and responsibilities" factors from outsourcing (Table 3.2). However, outsourcing differs from cloud computing by not being able to provide the self-service, on-demand IT resource consumption model that organisations require to react quickly to business needs and to defer capital IT expenses (Reeves, 2009). These unique characteristics of cloud computing like multi-tenancy, resource pooling, ubiquity, metered services on-demand and rapid provisioning of computing resources require a unique set of capabilities and skills to manage them effectively.

### 3.2.2. Roles and responsibilities allocation factors specific to the public cloud

Public cloud computing generates increased quantities of customer data, increased dependency on remotely provided third-party IT services and complex chains of responsibility management. The administrators of cloud computing are principally concerned with security and compliance (Modi, Patel, Borisaniya, Patel, & Rajarajan, 2013; Puthal et al., 2015). This introduces a number of cloud-related risks and threats (Khan, 2012; Zissis & Lekkas, 2012), thus leading to a shift in the roles of the staff (Gefen et al., 2012; ISACA, 2011; Pearson et al., 2012) in response to such concerns. In order to manage the increasing business and operational risks inherent in a complex global environment, integrated governance risk and compliance has become one of the most important business requirements for organisations (Vicente & da Silva, 2011). Therefore, making the cloud secure involves proper risk management and compliance to local regulations.

**Cloud security**: Security concerns such as multi-tenancy and "Velocity-Of-Attack" (VOA) are high in the public cloud environment (Pearson et al., 2012) where services can be used by competing clients and where the number of cloud users is much higher. Other security threats specifically related to the use of virtualisation in cloud computing lead to concerns like Virtual Machine (VM) theft, VM escape (EMC, 2014) and Hyper Jacking (Jasti, Shah, Nagaraj, & Pendse, 2010) to name a few. Information assurance, data privacy and data ownership (Liu, Sun, Ryoo, Rizvi, & Vasilakos, 2015) are other security concerns for public cloud adopters. Cloud users need to be aware of security counter measures, access control and data privacy mechanisms that are compliant with the regional legal regulations.

**Cloud risks**: When operating in a public cloud environment, it is important to identify all potential risks (Buyya et al., 2009) that may be associated with critical assets like theft of intellectual property and personally identifiable information that will be stored with the Cloud Service Provider (CSP). Based upon the asset risk assessment, a client could consider formulating the terms and conditions of the contractual agreement with the CSP. For example, a client might insist on having its data placed within certain geographical regions by the CSP.

**Cloud compliance**: In public cloud computing, services are outsourced to a third party, making it even more difficult to maintain data security and privacy and demonstrate compliance (Hashizume, Rosado, Fernández-Medina, & Fernandez, 2013). National and international regulations could constrain the flow of information in the cloud. For example, European data protection laws impose additional restrictions on the handling and processing of data transferred to the U.S.A An organisation needs to have the capabilities to assess the implications of establishing new business ties or terminating the organisation's existing business with a CSP to ensure internal and external compliance in the cloud and a process to ensure that this is effectively achieved. In addition, there are external compliance policies including legislation and industry regulations. All these concerns emphasise the relevance of security, risk and compliance management and that cloud users need to have capabilities to ensure the effective implementation of IT controls that respond to these concerns. Therefore, as shown below, three factors (Table 3.3) have been appended to the factors (listed in table 3.2).

Table 3.3: Roles and responsibilities allocation factors in the public cloud environment

| Success factors | Definitions | Sources |
|---|---|---|
| **1. Security management** | – Competencies to handle security concerns in a public cloud where services can be used by competing clients and where the number of cloud users is much higher.<br>– Competencies to handle cloud security concerns like information assurance, data privacy and ownership issues arising in public clouds due to the risk of an unauthorised data disclosure and lack of user control over client data.<br>– Competencies to ensure the deployment of data privacy mechanisms by CSPs that are compliant with the regional legal regulations. | (EMC, 2014; Jasti et al., 2010; Liu et al., 2015; Pearson et al., 2012) |
| **2. Risk management** | – Competencies to identify all potential risks that may be associated with critical assets like intellectual property, personally identifiable information etc. that will be stored with the CSP. | (Buyya et al., 2009; EMC, 2014; Pearson et al., 2012) |
| **3. Compliance management** | – Knowledge of internal and external organisational policies and ensuring the maintenance of same compliance, even when operating in cloud.<br>– Knowledge of national and international regulations that constrain the flow of information and mandate the vulnerability assessment of data in the public cloud.<br>– Competency to assist holding cloud (and other) service providers accountable for how they manage personal, sensitive and confidential information in the public cloud. | (EMC, 2014; Hashizume et al., 2013; ISACA, 2011; Pearson et al., 2012) |

An analysis of the IT outsourcing relationship models and the academic and practical literature on outsourcing in the context of public cloud computing resulted in the induction of twelve factors (Tables 3.2 and 3.3) that impacts upon the allocation of people to roles and responsibilities in a cloud environment. The allocation of roles and responsibilities of IT controls is an ITG decision making mechanism (Sambamurthy & Zmud, 1999). Therefore, the researcher also explored the ITG domain for identifying role allocation criteria.

## 3.3. IT governance theory

Commonly deployed frameworks such as COBIT and ITIL support the implementation of effective ITG processes (Coelho & Rupino da Cunha, 2009; Stevens, 2011). Implementation of IT processes and controls in COBIT and ITIL are commonly achieved through the deployment of RACI charts, which define the roles and responsibilities of different stakeholders of the IT processes. However, this approach does not provide criteria for its usage.

Governance identified as a role allocation factor in cloud computing literature, is based on three constructs (Figure 3.4) namely structures, processes, and relational mechanisms (Grembergen et al., 2004; Haes & Grembergen, 2008; Peterson, 2004; Weill & Ross, 2004).

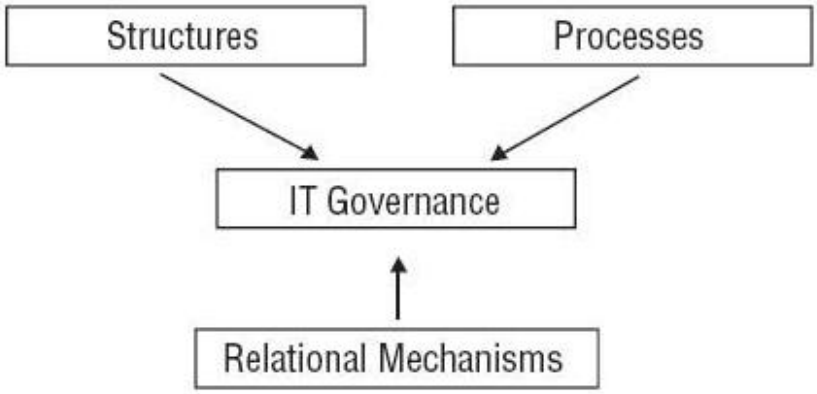



Figure 3.4: ITG framework (Haes & Grembergen, 2008)

Along the lines of Galbraith's model, ITG structures determine the way the IT function is organised and where the IT decision-making authority is located in the organisation (Peterson, 2004). ITG processes are defined as "formalization and institutionalization of strategic IT decision making or IT monitoring procedures" (Peterson, 2004, p. 63). The ITG construct identified as relational mechanisms is about "the active participation of, and collaborative relationship among, corporate executives, IT management, and business management" (Peterson, 2004, p. 65). Looking closely at some of the best practices related to this construct (e.g. job rotation), a clear similarity is evident to the concepts discussed by Galbraith in the 'processes' construct, where he talks about building interpersonal relationships through work rotations to break down organisational and unit barriers. Based on the similarities of concepts in Galbraith's processes design principle and ITG constructs, the researcher grouped the processes that are geared towards building interpersonal and collaborative relationships between business and IT management under the 'relational mechanisms' construct, and, accordingly, one additional construct (Table 3.4) identified by ITG is added to the factors as 'relational mechanisms'.

Table 3.4: Role and responsibility allocation factors from ITG theory

| Success factor | Definition | Sources |
|---|---|---|
| **Relational mechanisms** | Collaboration, relationship, teams, networks, integrative roles and matrix connections building skills to build interpersonal and collaborative relationships among units and organisations. | (Galbraith, 2011; Haes & Grembergen, 2008; Peterson, 2004) |

## 3.4. Success factors for allocation of roles and responsibilities

With the shift in people's roles and responsibilities in a cloud environment, it is vital to identify the factors that influence the allocation of people to roles and responsibilities of IT controls that have been, or going to migrate to a public cloud. In an effort to propose success factors that have strong theoretical grounding, several popular and existing models related to the topic of study were explored. Some of the models include Beer's VSM model, Henderson and Venkatraman's strategic alignment model, Bostrom and Heinen's socio-technical theory model, Lepak and Snell's human resource framework and Goodhue and Thompson's task-technology fit model. All these models are related however none of them is actually focused on the research topic in consideration. Therefore, the theoretical perspectives of organisational design (Table 3.1), cloud computing (Tables 3.2 & 3.3) and ITG (Table 3.4) contribute to the understanding of how firms may manage their roles and responsibilities allocation of IT controls, thus, leading to 19 success factors (Table 3.5). The researcher chose these three theories for their explicit theoretical relevance to the ITG activity of roles and responsibilities allocation. However, each theory offers only part of the underlying logic for understanding the role allocation criteria. Each perspective offers a different lens for understanding how organisations may manage their roles and responsibilities allocation of IT controls that have been migrated to the public clouds.

Table 3.5: Theoretical background for roles and responsibility allocation

| Theoretical perspective | Implications for roles and responsibility allocation | Success factors |
|---|---|---|
| **Organisational theory** | This model emphasises that people's roles within an organisation depend upon the strategy adopted by the organisation (whether to build internal capabilities or to exploit external capabilities);<br><br>Roles and responsibilities also depend on structures that determine type and numbers of job specialities used in performing the work; the number of people constituting the departments at each level of the structure; distribution of power; and basis for forming departments at each level of the structure;<br><br>It emphasises the role of processes, which are defined as connected set of activities that show the movement of information;<br><br>This model emphasises the importance of people's competencies, skills and mind-set required to execute the strategic directions of the organisation;<br><br>According to this model, people are rewarded by allocating them to motivating tasks. | Strategy, structures, processes, people, rewards |
| **Cloud computing theories** | Outsourcing literature emphasises on people's capabilities and skills to build a successful outsourcing relationship and to capitalise on the external market's ability to deliver effective IT services. Additionally, the cloud computing literature encourages skills and capabilities to address the ever-increasing security, risk and compliance management concerns, related to the technology. | Strategy, knowledge management, technical competencies, supplier management, contract management, performance management, negotiation skills, governance, conflict management, security management, risk management, compliance management. |
| **ITG theory** | ITG uses structures for distributing IT-related decision making rights and for distributing responsibilities of IT staff. ITG defines processes as strategic IT decision making or IT monitoring procedures; to allocate IT resources that help in managing external partners and to control IT resource planning. ITG follows relational mechanisms to allocate roles and responsibilities in a way that helps in forming a link between business and IT. | Structures, processes, relational mechanisms |

As shown in figure 3.5, some of the success factors derived from these three IS domains overlap with each other. The 'strategy' factor dictating the differentiating factors of an organisation, has been identified both by cloud computing as well as the organisational theories. A subsequent factor 'structures' defining the shape of the organisation, key roles, power and authority, has been identified as a factor by organisational as well as by the ITG theories. Another common factor between ITG and organisational domain is 'processes', which defines the workflow between the roles. Governance identified as a role allocation factor in cloud computing literature is considered a separate and significant domain for roles and responsibilities allocation.

Aggregating (with redundancies removed) all the success factors derived from cloud computing, organisational theories and the ITG literature resulted in a set of 16 success factors for

the allocation of people to roles and responsibilities of IT controls in a public cloud environment. This will be called success factors (T-version) (Table 3.6). While the skills mentioned in the table are general factors, the competencies are role-specific skills required (Rudd & Loyd, 2007).

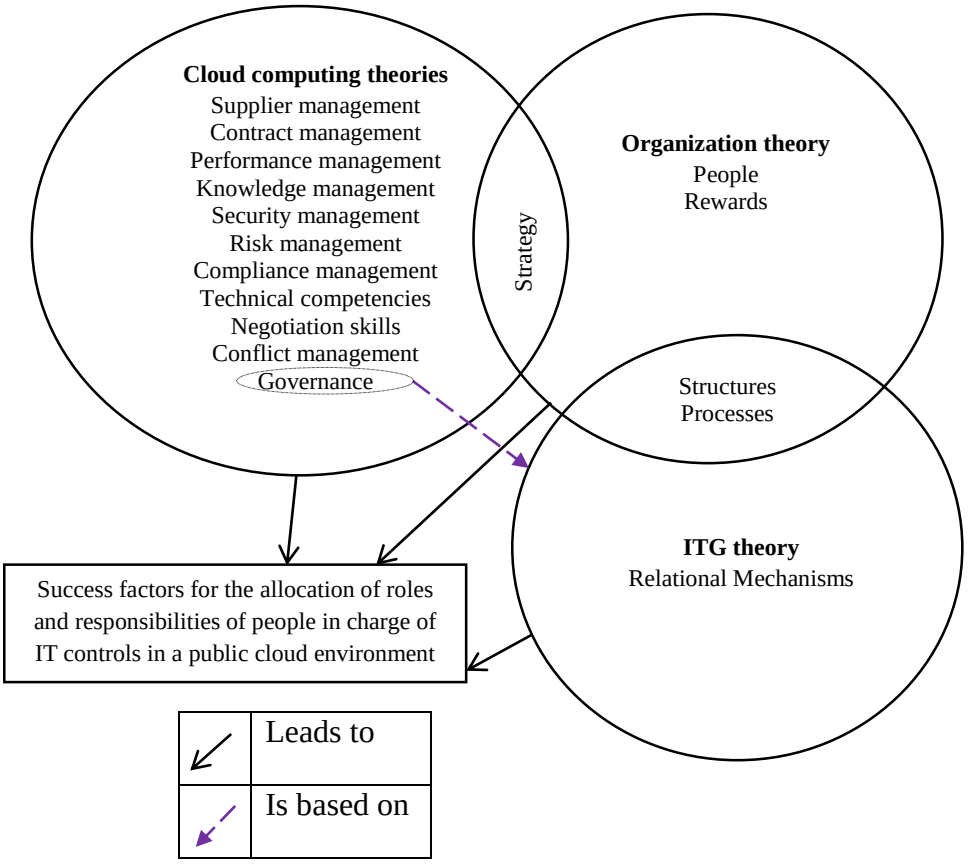



Figure 3.5: Overlapped success factors

Table 3.6: Theoretical success factors (T-version)

| Success factors | Definition | Sources |
|---|---|---|
| **1. Strategy** | – Defines whether to build capabilities (like skills, processes, technologies, human abilities) internally or exploit external capabilities available in the form of cloud services. The strategy of an organisation determines the tasks to be performed. | (Alborz et al., 2003; Aubert et al., 2004; Galbraith, 2011; Laabs, 1993) |
| **2. Structure** | – Outlines the specialisation that determines the type and numbers of job specialties used in performing the work.<br>– Defines the shape that refers to the number of people constituting the departments at each level of the structure (size).<br>– Determines the distribution of power either to the department dealing directly with issues critical to its mission, or the centralisation or decentralisation of this authority | (Alborz et al., 2003; Galbraith, 2011; Smith & McKeen, 2009). |
| **3. Processes** | – Connected set of activities that show the movement of information. When these processes cross the organisational boundaries in a cloud environment, clear articulation of roles and responsibilities at the boundary interfaces is required. | (Alborz et al., 2003; Galbraith, 2011; Smith & McKeen, 2009). |
| 4. **People** | – Fundamental set of competencies, skills and mind-sets required from employees at all levels. | (Galbraith, 2011) |
| 5. **Rewards** | – To motivate people to perform and address organisational goals. | (Galbraith, 1995) |
| **6. Relational mechanisms** | – Collaboration, relationship, teams, networks, integrative roles and matrix connections building attributes to build interpersonal and collaborative relationships among units and organisations. | (Galbraith, 2011; Haes & Grembergen, 2008; Peterson, 2004) |
| **7. Risk management** | – Competencies to identify all potential risks that may be associated with critical assets like intellectual property, personally identifiable information etc. that will be stored with the CSP. | (Buyya et al., 2009; EMC, 2014; Pearson et al., 2012) |
| **8. Compliance management** | – Knowledge of internal and external organisational policies and ensuring the maintenance of same compliance, even when operating in cloud.<br>– Knowledge of national and international regulations that constrain the flow of information and mandate the vulnerability assessment of data in the public cloud.<br>– Competency to assist holding cloud (and other) service providers accountable for how they manage personal, sensitive and confidential information in the public cloud. | (EMC, 2014; Hashizume et al., 2013; ISACA, 2011; Pearson et al., 2012) |
| **9. Security management** | – Competencies to handle security concerns in public cloud where services can be used by competing clients and where the number of cloud users is much higher.<br>– Competencies to handle cloud security concerns like information assurance, data privacy, and ownership issues arising in public clouds due to the risk of an unauthorized data disclosure and lack of user control on client data.<br>– Competencies to ensure the deployment of data privacy mechanisms by CSPs that are compliant with the regional legal regulations. | (EMC, 2014; Jasti et al., 2010; Liu et al., 2015; Pearson et al., 2012) |
| **10. CSP management** | – Skills are required for handling activities to evaluate and select CSPs. | (Alborz et al., 2003; Chaudhury et al., 1995)(Anne & Will 2004) |
| **11. Contract management** | – Skills to structure contracts for effective pricing, access rights, data ownership, risk management and for ensuring the availability of data and reports. Specific SLA can be added to the contract. | (Alborz et al., 2003; Ho et al., 2003; Parkes, 2004; Rivard & Aubert, 2015) |
| **12. Technical competencies** | – Competencies to evaluate the on-demand, self-service cloud based solutions, coordinate and integrate the cloud services with the existing system. | (Anne & Will 2004)(Endeavor Management, 2011; Khan, 2012) |
| **13. Negotiation skills** | – Skills to negotiate the contact terms to ensure the firm's rights and obligations for both parties. | (Anne & Will 2004)(Kim; Zhao & Watanabe, 2008) |
| **14. Performance management** | – Competencies required for setting quality levels, monitoring the CSP against the SLAs and rating the CSP performance | (Alborz et al., 2003; Fitzgerald & Willcocks, 2009; Parkes, 2004)(Anne & Will 2004) |
| **15. Conflict management** | – Skills to assess and avoid negative impact of establishing new business ties or terminating the existing business with a CSP. | (Anne & Will 2004)(Kim; Zhao & Watanabe, 2008) |
| **16. Knowledge management** | – Attributes required for sharing or transferring knowledge with the CSP, to build trust which will result in supplier improved commitment and thus better results. | (EMC, 2014; Khan, 2012; Pearson et al., 2012) |

## 3.5. Conclusion

The adoption of cloud computing by organisations poses challenges in terms of the reassignment of roles and responsibilities related to changed internal IT controls in the new environment. Articles in both academic and professional journals related to organisational, cloud computing and ITG theories were analysed. This thorough overview of the existing literature relevant to the research domain led the researcher to build a set of success factors for the allocation of roles and responsibilities of IT controls in a public cloud environment. Aggregating (with redundancies removed) all the factors derived from cloud computing, organisational theories, and the ITG literature resulted in the theoretical success factors (T-version) with sixteen factors and twenty-two definitions (some factors are defined by more than one definition) for allocating people to roles and responsibilities of IT controls in a public cloud. The resultant theoretical success factors derived from this study will make novel contributions to the IS field due to the lack of prior theories that provides relevant criteria for the allocation of roles and responsibilities of IT controls in a cloud environment (Weber, 2012).

# CHAPTER 4

# RESEARCH METHODS

# 4 CHAPTER 4: RESEARCH METHODS

The theoretical answer to the research question 'What are the key success factors in the allocation of staff to the roles and responsibilities for the control of cloud based IT resources?' is based on the extant literature. Resulting success factors provide guidelines to IT decision makers on allocating people to roles and responsibilities of IT controls in a cloud environment. In this regard, this research follows the Type V theory of design and action where the primary constructs are users, work context, information requirements and the system architecture (Gregor, 2006). This type of theory is about the methods and tools used in the development of information systems (Gregor, 2002). In order to reach the goals related to design and action, the researcher initially approached this through the theory of explanation (chapter 3) to build the components of the success factors. The success factors (T-version) that emerged through the process of researching the related fields using various sources being theoretical, calls for validation via empirical research. Three phased approach (Figure 4.1) is used to empirically validate (V), refine (R), and rank (R) these theoretical success factors (T-version).

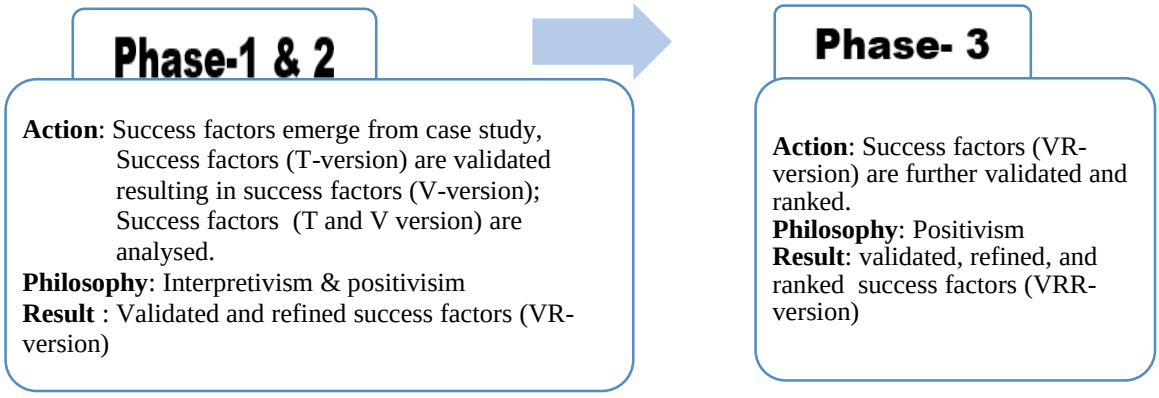



Figure 4.1: Three phased empirical research

Case studies can be used with any philosophical perspective of empirical research, be it positivist, interpretivist or critical. Using a case study approach, the researcher explores the roles and responsibilities allocation factors based on the perspectives of the IT practitioners. The interpretivist philosophy that helps to extend the theory (Reichardt & Cook, 1979) is used in phase-1 of the case study to derive the success factors. Subsequent to this phase, during phase-2, same IT practitioners are shown the theoretical success factors (T-version). The positivist philosophy used for testing the theory (Dubé & Paré, 2003) is used to get the success factors (T version) validated by the same IT practitioners. Phase 1 & 2 results in the validated and

refined success factors (VR-version). Next, during phase-3, Delphi panellists further validated and ranked the success factors (VR-version) in the order of their importance, resulting in final validated, refined and ranked success factors (VRR-version). Therefore, using a three-phased data collection approach led the researcher towards the use of interpretive as well as positivist qualitative philosophies to answer the research question. This chapter on research methods explains the rationale for choosing the methodology to extend, validate and rank the success factors.

This chapter is structured into five sub-sections. Section 4.1, which forms the major part, outlines the research methodology by justifying the underlying research philosophy, the methodological approach and strategies to be adopted as well as the approaches used for data collection and analysis. Section 4.2 presents the reliability and validity measures of this study. In order to assess how the methodological approach used in this study compares with previous studies, methods, section 4.3 reviews the methods used in similar previous research. Through comparison with the methods used in these prior studies, this section further outlines the justifications for the chosen research approach. The last section 4.4 concludes the chapter and sets the scene for the empirical research.

## 4.1 Research methodology

Exploring the answer to the research question 3 ('what are the success factors inherent in determining the allocation of staff to the roles and responsibilities for the control of cloud based IT resources, specific to the UAE public cloud environment?') necessitates looking at the methodological processes in order to validate the theoretical success factors. The research 'onion' approach (Figure 4.2) developed by Saunders, Lewis, and Thornhill (2015), was deemed to be suitable for this research. This has been used by many researchers (Knox, 2004; Venable, 2011) to understand each stage of the research process. The research philosophies, approaches, choices, strategies, time horizons and techniques & procedures for data collection constitute different layers of this onion.

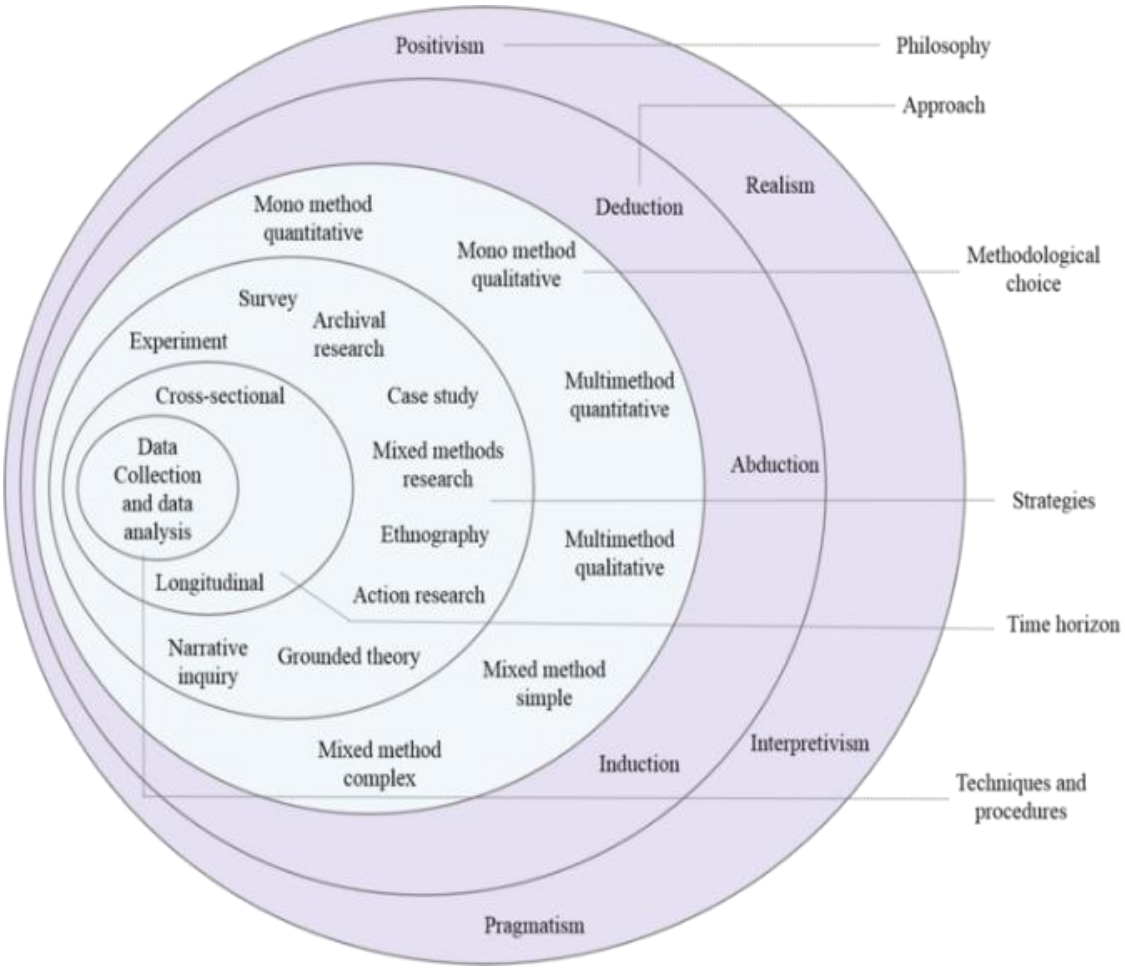



Figure 4.2: The research 'onion'(Saunders et al., 2015).

### 4.1.1 Philosophy

The exploration of the research philosophy aids the researcher in justifying the overall research strategy and evaluating the different methodologies (Easterby-Smith, Thorpe, & Jackson, 2012). The term 'philosophical paradigm' can be explained as a shared way of thinking by different communities about conducting research and creating or gaining knowledge (Oates, 2005). Most research in the IS and computing field is based on one of the following three research paradigms: positivist, interpretive and critical (Oates, 2005; Orlikowski & Baroudi, 2002). The key features of the three paradigms are summarised in table 4.1. The shaded portion of the table represents the appropriate paradigm applicable for validating the theoretical success factors.

Table 4.1: Research paradigms (adapted from Oates, 2005)

| Positivist | Interpretive | Critical | Nature of this study |
|---|---|---|---|
| Aims to identify the universal laws, patterns and regularities. | Concerned with understanding the social context of an IS, as well as the social processes by which it is developed and constructed by people and through which it influences, and is influenced by, its social setting. | Concerned with identifying power relations, conflicts and contradictions, as well as empowering people. | This research is based on the perspectives of the IT practitioners working within organisations in the UAE. |
| The researcher discovers by making observations and measurements and producing models (e.g. hypotheses and theories) of how something works. | Interpretive studies try to identify, explore and explain how factors in a particular social setting are related and interdependent. Language and shared meanings differ across groups and over time. | Critical researchers seek to identify and challenge the conditions of domination, the restrictions and unfairness of the status quo, and any assumptions that are taken for granted. | Using UAE as a case study, success factors are explored, relations between them identified and ranked. |
| Assumes that laws and patterns in this world exist independently of any individual's cognition. | There is no single version of truth. Different groups or cultures perceive the world differently. | N/A. | IT practitioner's perspectives varies from one organisation to another. |
| The researcher is neutral and objective. | Researchers are not neutral and their reflexivity shapes the research process. | Those with power and vested interests shape research projects and areas of development. | Researcher's analysis impacts the results. |
| Research is based on empirical testing of theories and hypothesis, leading to their confirmation or refutation. | Researchers expect to arrive at multiple explanations for what occurs in their study. | Non-performativity intent.<br>Critique of technological determinism. | This research also tests the success factors derived through literature review. Results of this study cannot be generalized. |
| Strong preference for quantitative data analysis. | Strong preference for qualitative data analysis. | N/A. | Qualitative analysis is used in this study |

In research that involves the allocation of roles and responsibilities in a cloud environment, it is appropriate to use the interpretive research paradigm because it relies on identifying, exploring and explaining the existing IT Governance (ITG) practices, based on the experiences of the IT practitioners within organisations. Besides deducing factors from the literature, this study extends theory (success factors (T-version) through social construction (Klein & Myers, 1999). The researcher believes strongly that language and social meanings will differ between interviewees (Weber, 2004). Therefore, multiple versions of realities and a body of knowledge may be uncovered over time. The interpretive paradigm provides a deeper

understanding of the underlying process of organisational change in the context of an IS (Silverman, 1998) and has the potential to produce deep insights into the development and management of IS phenomena (Klein & Myers, 1999). It aids in understanding IT practitioners' thoughts and actions regarding role allocation in organisational contexts. On reflection, it was determined that the interpretive paradigm is best suited to this phase of study.

The only overlapping way in which this study uses the positivist approach concerns the empirical testing/validation of the theoretical success factors, developed by the researcher through the literature review (see Chapter 3). Since this research tests the theory, it can therefore be considered using a positivist paradigm (Dubé & Paré, 2003) during the phase-2 and 3 of the empirical study. Positivist and interpretivist research paradigms can be present simultaneously and be mutually supportive in a single study (Gable, 1994; Kaplan & Duchon, 1988). Therefore, interpretive research has been used for deriving and refining the success factors based on the organisational practices, supported by a positivist paradigm used for validation and ranking of the success factors.

### 4.1.2 Approach to theory development

Based on the reasoning adopted, research approaches are broadly classified into three styles namely deductive, inductive and abductive (Saunders et al., 2015). Researchers can either build explanations from the ground up based on what is discovered (inductive) or begin with broad theories and suppositions and then systematically test their implications (deductive) (Rubin & Rubin, 2011). The previous chapter (chapter 3) employed the deductive approach to arrive at the success factors (T-version), thereby linking the research to the existing body of knowledge in the subject area. However, using solely the deductive approach would mean ignoring the interpretation of the IT practitioners in the region where the empirical study is to be conducted, which is an essential element in this research. Effective application of theory is critical to the development of new knowledge in information systems research (Lim, Saldanha, Malladi, & Melville, 2013), therefore, the inductive method was used not only to determine success factors based on the IT practitioners' perspectives (phase – 1 of empirical research), but also to validate and refine the deduced success factors (phase -2 of empirical research). Therefore, this research uses abduction, which uses both inductive and deductive reasoning (Alrajeh, Fearfull, & Monk, 2012) and is more useful than an inductive or deductive approach (Dubois & Gadde, 2002). By using abduction, past research in the domains of research themes (cloud computing, ITG and organisational theory) were used to build a theo-

retical framework (success factors (T-version)). Success factors validation is via data gathering from IT practitioners at decision-making and operational levels, the data is analysed, themes generated, followed by comparison of the generated themes with those of proposed factors. The result of the empirical research leads to the validation and refinement of the success factors (T-version).

### 4.1.3 Methodological choice

Methodological choice defines the research design selected to answer the research questions. Social research is broadly classified into three possible approaches: quantitative, qualitative and mixed research (Creswell, 2009; Saunders et al., 2015). Table 4.2 details the different perspectives of qualitative and quantitative research. The shaded portion of the table shows the approach taken by the author, with the last column outlining the nature of the proposed study. The strength of qualitative research for both researchers and practitioners is its ability to focus on actual practice, looking at how organisations routinely work (Silverman, 1998) as is the case with this research.

Table 4.2: Evaluating Methodological choice in relation to the present study

| Quantitative research | Qualitative research | Nature of this study |
|---|---|---|
| Data collection technique or data analysis procedure that generates or uses numerical data (Punch, 1998; Saunders et al., 2015). | Data collection technique or data analysis procedure that generates or uses non-numerical data (Punch, 1998; Saunders et al., 2015) | The data collected are not in the form of numbers, but rather in the form of recorded conversations, responses to open-ended questions, and written or scribbled notes. |
| Quantitative research is more concerned with "the measurement of the frequency of phenomena in the social world" (Rowlands, 2005, p. 81). | Qualitative research has been described as an "array of techniques seeking to describe, decode, translate, and somehow come to terms with the meaning of the problem" (Rowlands, 2005, p. 81) | There is no measurement of frequency. Rather, it is an attempt to understand the problem in a real setting through theory testing. |
| Generally associated with assumptions of a single, measurable (countable) and knowable truth (positivism) (Rubin & Rubin, 2011). | Favours multiple perspectives of truth and a constantly changing reality (interpretivism) (Denzin & Lincoln, 2003; Rubin & Rubin, 2011) (Denzin & Lincoln, 2011). | The research uses an interpretive paradigm that may result in multiple perspectives of the interviewees. |
| | Some qualitative research strategies start with a deductive approach to test an existing theoretical perspective (Yin, 2014) and then use an inductive approach. | Uses abduction, which includes both induction to build a theory and deduction to test or modify theory. |
| This methodology often uses probability sampling techniques. | Uses a variety of data collection techniques and analytical procedures. | Methodological triangulation involving literature review, interviews and the Delphi technique is used to generate data. |
| Principally associated with experimental and survey research strategy (Myers, 1997; Saunders et al., 2015). | Principal strategies used include action research, case study research, ethnography, grounded theory, and narrative research (Myers, 1997; Saunders et al., 2015). | A case study strategy is used to investigate cloud customer organisations in order to obtain insight into the roles and responsibilities allocation practices of such organisations. |

Researchers have suggested using a qualitative approach in studies that involve capturing reality in detail within a natural setting (Chan & Ngai, 2007), similar to the current study in which organisations in one country using the cloud are studied. Here, the objective is to understand the phenomenon from the point of view of the IT practitioners working within a particular public cloud user context (Kaplan & Maxwell, 1994). Moreover, the qualitative approach is more suitable for studies that investigate recent technologies (Benbasat, Goldstein, & Mead, 1987) such as cloud computing. Qualitative research has also been used for obtaining insights into regular or problematic experiences of IT decision makers and the meanings attached to their experiences (Leech & Onwuegbuzie, 2007).

Even though qualitative research in the IS field was rare prior to the 1970s (Howe & Eisenhart, 1990), administrative science has witnessed a rapid growth in the use of qualitative techniques (Benbasat, Goldstein, & Mead, 2002). It has been argued that the objective of qualitative research is not to draw inferences about a larger population, but rather to generalise back to a theory or application (Yin, 2014). Interpretative philosophy and the abductive research approach used in this study have a strong preference for qualitative data analysis as it aids the researcher in capturing reality from the point of view of the IT practitioners (Kaplan & Maxwell, 1994; Leech & Onwuegbuzie, 2007). Therefore, the research questions and the philosophy directed the researcher to follow a qualitative methodology using case study, as an appropriate technique for validating the success factors (T-version) (Moulton & Coles, 2003; Yin, 2014).

### 4.1.4 Strategies

A research strategy is a plan followed in order to answer research questions (Saunders et al., 2015). It creates a methodological link between the research philosophy and the choice of the method used to collect and analyse data (Denzin & Lincoln, 2003). Normally, research strategies are associated with particular research philosophies and approaches. For example, "experiment" and "survey" methods are usually linked exclusively to a quantitative research design; "action research", "grounded theory", "narrative inquiry" and "ethnography" to a qualitative research design; and "case study" and "archival" to either or to a mixed design strategy (Saunders et al., 2015).

Case research strategy is well-suited to capturing the knowledge of practitioners and developing theories from it (Benbasat et al., 2002). This study uses case study research approach based on experts' perceptions to identify the success factors that influence how the roles and responsibilities of people in charge of IT control in a public cloud environment are allocated. While the researcher initially explored the problem through the existing background literature, using in-depth interviews with IT decision makers who have experience of working on cloud projects provides relevant practitioners insights into the topic. Semi-structured interviews ensures specific as well as divergent views regarding the themes from the participants.

- **Case study**

Case study methodology used to develop or test theories (Gordon, Blake, & Shankaranarayanan, 2013; Shanks & Parr, 2003) is widely used in the IS discipline and considered to be a very useful research strategy in computing research (Oates, 2005). It is especially useful when examining real-world contemporary phenomena (Lee, 1989). The case study method allows the researcher to answer "how" and "why" questions, that is, to understand the nature and complexity of the processes taking place (Benbasat et al., 1987). Case studies have been used by other researchers for similar studies on the impact of technology on personnel (Land, Detjejaruwat, & Smith, 1983), for the impact of IS on organisational change (Robey, 1981) and for various other IS and computing topics (Markus, 1983; Orlikowski, 1993; Tapia, 2004). It is particularly useful when the phenomenon of interest cannot be easily studied outside its natural setting, and when the phenomenon cannot be readily quantified (Johnston, Leach, & Liu, 1999). The strength of case study is its ability to utilise various sources of evidence and triangulation procedures to demonstrate convergence on one meaning (Johnston et al., 1999).

Generally researchers examine only one case study (Oates, 2005). Using United Arab Emirates (UAE) as a case study to obtain a rich and detailed insight into the process being enacted (Howe & Eisenhart, 1990), this study investigates the methodology of *'*allocating people's roles and responsibilities of IT controls when migrated to the cloud*'* (the research problem), from the perspective of the IT practitioners within organisations in UAE.

- **UAE as a case study**

The UAE is a federation of seven states (Abu Dhabi, Dubai, Ajman, Fujairah, Ras al Khaimah, Sharjah and Umm al Quwain), which were unified on the 2nd of December 1971. Occupying a total area of 83,637 sq. km. and having a population of approximately 9.2 million, UAE's main economy is crude oil and natural gas and it has also started to focus on service sectors such as tourism, wholesale trade and real estate business. The service sector has contributed to the economic growth at an annual rate of 21 percent since 2000, constituting USD 27.6 billion or 74 percent of Dubai's GDP in 2005, reducing the oil industry to 45.3 percent by 2011 (Central Intelligence Agency, 2013). As of 2015, it is reported that the non-oil sectors contribute 75% of the UAE's GDP. UAE is also considered a fast country in adopting technologies, as compared to many other countries. 2015 Networked Readiness Index (NRI) issued by the world economic forum ranked UAE ahead of all Arab states and twenty-third among all 143 countries assessed, moving up one position from twenty-fourth

place in 2014 (UAE Interact, 2015). The success factors (T-version) are targeted at IT practitioners, therefore, validation and adoption of these success factors has to take place in a country with fast uptake of IT. Economic growth figures and the fast adoption of technologies in UAE makes it a country of choice for conducting this research.

Industry experts are predicting a massive shift towards cloud adoption by businesses in UAE (D'Mello, 2015). Cloud traffic is expected to grow at 54 per cent a year in the UAE, from 31 exabytes in 2013 to 262 exabytes in 2018 (Bouyamourn, 2014). In this regard, IT requirements in the UAE continue to expand at a noticeable rate, with growing population and increased income underpinning growth for the foreseeable future (Chamber, 2012). Therefore, it provides great business opportunities for global investors (Chen, 2011) and therefore relevant place for conducting this research.

According to a survey of 60 Chief Information Officers (CIOs) carried out for one of the telecommunications providers in UAE, around one third of UAE organisations have already considered and/or adopted some form of cloud service, while another third of the survey respondents plan to explore the suitability of the cloud this coming year (DU, 2016). Cloud computing is proving attractive for businesses in UAE because of fast and low-cost internet services. Due to rapid broadband and smartphone adoption fueling demand, cloud computing traffic is set to grow faster in the Middle East than anywhere else in the world (CISCO, 2016). UAE, in particular, is expected to grow at a faster rate than some European markets (Cherrayil, 2015). This fast growth rate is leading to increased competition among cloud service providers. Oracle, Cisco and SAP are all competing to contribute to the initiative that will see the city become a more efficient and connected place to live.

In UAE, Dubai is leading the way in cloud uptake and IT governance implementation. In spite of a huge opportunity for customers to switch to the cloud, government organisations have reservations about compliance and data security. Therefore, the Dubai government has created an authority called Dubai Electronic Security Council (DESC) to assist organisations with privacy and other compliance issues related to cloud computing. In the ITG domain, the Dubai government has also created an 'Information Security Regulation' (ISR) framework, built on the standards of COBIT and ITIL, where government authorities in Dubai are obliged to ensure that their processes, risk and governance model are aligned with ISR. Currently, ISR is being brought under DESC, which guides government organisations on the process of risk mitigation and compliance.

There is strong growth for the public cloud model in UAE (Dartnell, 2015). Moreover, it was found that 95% of enterprises having already implemented or plan to implement a cloud computing model (Desk, 2015). Supplementing the above with an advanced state of IT governance implementation in UAE (ISACA, 2009), the selection of UAE as the location of the study is justified.

- **Factors influencing the selection of the organisations**

In order to be able to capture an as broad spectrum as possible of IT governance practice of role and responsibilities allocation, this case study is based on in-depth interviews with IT decision makers in multiple organisations within UAE. The researcher focussed on selecting large private and/or government organisations that have migrated or in the process of migrating to the public cloud. The three factors given below ensured appropriate selection of organisations:

1. Literal replication: Where similar results are predicted; within private organisations in UAE.
2. Theoretical replication: Where contradictory results are predicted (Yin, 2014); within government organisations in UAE. While similar results are predicted within all private organisations, contradictory results are predicted between government and private organisational practices of roles and responsibilities allocation.
3. Organisations that have adopted cloud computing technologies (migrated or in the process of migrating to public cloud).

Qualitative research does not specify any particular sample size as it depends upon the purpose of the study and expected coverage of the phenomenon (Patton, 2002). However, a sample size between four to ten organisations is suggested by Eisenhardt and Graebner (2007). Therefore, the current study targets a sample size of ten organisaitons in the UAE.

### 4.1.5 Time horizon

This study uses a short-term study approach to examine the current state of organisations with regard to the allocation of roles and responsibilities of IT controls when migrating to the cloud. Therefore, the interview is cross-sectional, since interviews take a cross sectional slice of the organisation's views on the topic. It also involves the researcher taking a snapshot in

time (Feather, 2012). As cloud computing is a relatively new technology, a historical or longitudinal study is not relevant to this research, since past processes over a longer time-period do not affect current IT governance processes.

### 4.1.6 Techniques and procedures

Since research in the domain of cloud computing is in its early stages and theoretical models are scarce, this research is exploratory. Exploratory research builds on secondary research (by reviewing available literature), informal discussions with consumers, employees, management or competitors, and more formal approaches through in-depth interviews, focus groups, projective methods, case studies or pilot studies (Haes & Grembergen, 2008). In this regard, the researcher employs method triangulation via literature review, interviews and the Delphi technique. The use of triangulation corroborates findings and enhances the validity of the collected data.

- **Interviews**

This research study involves semi-structured, in-depth interviews conducted on a one-to-one basis (preferably) or via the telephone, (wherever a face-to-face basis was not possible). The researcher had a list of pre-determined themes (derived from literature review) and key questions to be covered during the interviews, which were obtained through deductive research. Using a semi-structured approach helps in understanding the relationships between the factors revealed by the deductive theory, therefore aligning with the interpretive epistemology adopted in this study.

While the interviews follow a pre-determined set of themes, the use and flow of the questions varied between interviews depending on the answers from the questions and the organisational context. All of the interviews are either audio-recorded using digital recorders (if permission was granted), or the researcher taking notes in between responses. The key to a successful interview is preparation (Saunders et al., 2015). In this regard, the researcher is competent enough to interview the target respondents, having gone through the following:

– The researcher had attended five cloud computing conferences;
– The researcher has research topic relevant certification - EMC Cloud Infrastructure and Service (EMC CIS);
– The researcher has been teaching cloud architecture courses at the undergraduate level;

– The researcher is a member of Information Systems Audit and Control Association (ISACA), UAE chapter;

Interviews are used to derive, validate as well as refine the success factors. Subsequently, Delphi technique is used to further validate and rank the final success factors.

- **Delphi technique**

The Delphi method is a consensus seeking methodology that can be described as "as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem" (Linstone & Turoff, 1975, p. 3). It is a group facilitation technique to ''obtain the most reliable consensus of opinion of a group of experts" (Dalkey & Helmer, 1963, p. 1) through a series of structured questionnaires and controlled opinion feedback (rounds). Being exploratory research, Delphi technique is suitable for such studies which involves a new or future trend (Akkermans, Bogerd, Yücesan, & Van Wassenhove, 2003; Okoli & Pawlowski, 2004). In addition, Delphi provides human judgemental input (Wright, Lawrence, & Collopy, 1996), which is suitable for making decisions related to people's roles and responsibilities. Researchers have widely used Delphi technique in policy formations and decision-making (Rowe & Wright, 1999), as well as in IS (Niederman, Brancheau, & Wetherbee, 1991). In particular, Delphi technique has been used for validation and ranking of theoretical models (Haes & Grembergen, 2008; Leape, Freshour, Yntema, & Hsiao, 1992; Scheibe, Skutsch, & Schofer, 2002).

The target focus of Delphi technique are IT practitioners at the operational level where the aim is to consider any one of the three methods to approach the focus group. One method is to approach a relatively large organisation with a very good cloud presence to get access to their IT managers. The second method is to contact relevant IS associations in UAE to get access to their membership database. The third method is to identify a professional market research consulting company to arrange the target group for the Delphi rounds. The number of rounds in any Delphi process varies, though it seldom goes beyond one or two iterations (Rowe & Wright, 1999). Even though two to three rounds is not only the norm (Rowe & Wright, 1999) but also preferred (Proctor, 1998), the researcher aims to conduct rounds until consensus among participants is achieved. According to Taylor-Powell (2002, as cited in Haes & Grembergen, 2008), 10-15 people may be adequate for a focused Delphi process, where participants do not vary a great deal.

## Data analysis

Qualitative data is much more complex, ambiguous and elastic than quantitative data because its meaning depends on social constructionism (Saunders et al., 2015). One of the most important steps in the qualitative research process is hence the analysis of data (Leech & Onwuegbuzie, 2007).

The approaches adopted for analysing qualitative data mainly depend on the research philosophy and strategy used. This research study uses abduction utilising both deductive and inductive research approaches. Using a deductive research approach helped in using the existent literature to identify the factors upon which role and responsibilities allocation depend. There is a possibility that these theoretical factors depart significantly from the views of participants (Bryman, 2004). Nevertheless, this approach has helped in linking the present research to the existing body of knowledge in the organisational ITG field. Therefore, the derived factors were used only as initial thoughts. The researcher was open to additional factors discovered inductively by analysing the collected data and modifying the components of the success factors (T-version) accordingly. Analytical procedures that can be used to analyse qualitative data with a deductive perspective include pattern matching, wherein an empirical pattern is compared with a predicted one (Tellis, 1997) and explanation building, whereby an explanation is built while collecting and analysing data rather than testing a predicted explanation (Yin, 2014).

Inductively based analytical procedures used to analyse qualitative data includes template analysis - which is based on the relationship between themes (King, 2012); discourse analysis - which recognises speech as an explicit linguistic tool constructed and shaped by numerous social or ideological influences (Thorne, 2000); narrative analysis - which recognises the extent to which the stories told provide insight into their experiences (Thorne, 2000); and grounded theory - which explains what is actually happening in practice rather than describing what is going on (Kenealy, 2008). While template analysis involves analysing data from individual interviews, discourse analysis and narrative analysis both rely heavily on speech as the most relevant data form. They draw heavily on theories developed in fields such as sociolinguistics and cognitive psychology (Thorne, 2000). Grounded theory too is unsuitable for the current studies, as it is well suited to understanding the social processes and consequential psychological effects inherent in organisational change dynamics (Kenealy, 2008). Therefore, none of the above-mentioned analytical procedures is deemed appropriate for this study.

There are several generic five-point approaches available to analyse qualitative data that are independent of any specific theoretical approach (King, 2012; Robson, 2011; Saunders et al., 2015; Yin, 2014). One such generic five-point approach derived from the comprehensive guidelines offered by LeCompte (2000) is used in the present study. LeCompte outlined five steps to analyse qualitative data, namely tidying up, finding items, creating stable sets of items, creating patterns, and assembling structures. These are explained below along with the corresponding strategies to be followed in the sub-processes.

- **Tidying up:** Tidying up is the initial stage of preparing data for analysis and it permits researchers to make a preliminary assessment of the data set. Table 4.3 explains the steps involved in this stage.

Table 4.3: Guidelines for tidying up and the corresponding analysis in the present study

| Tasks | Strategies |
|---|---|
| Make copies of all data. | The interviews to be recorded using digital recorders, and subsequently transcribed. Keeping two copies of the interviews and their transcription ensures duplication. One copy to be kept in the researcher's computer and a backup hard drive stores the second copy. |
| File interviews in order of their dates of creation. | Dates and time of each interview to be kept in the meta data file. Transcript creation date follows the operating systems default properties format. |
| Create other files based on data, participants, organisations, subject or topic. | Contextual data to be filed in folders according to the organisations. |
| Catalogue and store all documents and artefacts. | Hard copies such as the consent form and any other relevant materials to be stored separately in the researcher's safe. The interviews to have meta data with details like date, time, location, organisational context, format, and media type, including subsequent transcript validation sessions. This to be put in the same folder, along with any other relevant materials like field notes, if any. |
| Label all files and boxes. | The names of the files to include the interviewer's initials and the organisational code. To maintain confidentiality, the names of the interviewee and the organisations to be saved as initials. The date created to be saved in a separate file. |
| Create an index or table of contents for all data. | An index to be created. |
| Review the research questions, comparing them against the data collected. | The researcher to have a list of pre-determined topics to cover during the interviews. Following this format, ensure correlation with the data collected. . |
| Identify any holes or missing data chunks by determining whether sufficient data were actually collected to answer each research questions. | Transcribed interview data to be compared with the list of topics to be covered, to identify any missing data. |
| Return to the field to collect additional data to fill any gaps in the record. | If any topics are found to be missing, an arrangement to be made to collect the missing data (through a repeat visit or telephone). |

- **Finding items:** Items are the specific things in the data set that researchers code, count and assemble into research results. Identifying items in data sets resembles sifting and sorting through field notes, interviews and text to identify items relevant to the research questions. Concentrating on these items (the researcher calls them themes) in the data involves systematic processes of looking for frequency, omission and declaration (LeCompte, 2000). The transcribed interviews will be transferred to the NVIVO software. Repeated reading through

the transcribed interviews to identify items relevant to the research questions will then identify themes (or termed as nodes in NVIVO). Table 4.4 outlines the steps involved in this stage.

Table 4.4: Guidelines for finding items and the corresponding analysis in the present study

| Tasks | Strategies |
|---|---|
| *Frequency*. Identification of repeated items. | Identifying and grouping of repeated ideas as nodes or sub nodes. |
| *Omission*. The researcher identifies items because they never appear, even though researchers might think it reasonable that they would. | The researcher to take note of pre-determined themes that did not make into the interview. |
| *Declaration*. The researcher identifies significant items pointed out by participants. | The researcher to strive to identify themes that have not been emphasised in the theoretical model, but are identified by respondents as significant. |

- **Creating stable sets of items:** Data items can be organised into groups or categories by comparing and contrasting items (Glaser & Strauss, 2009), mixing and matching them, or forming semantic relationships between items and potential categories (Spradley, 1979). Table 4.5 outlines the steps involved in this stage.

Table 4.5: Guidelines for creating stable sets of items

| Tasks | Strategies |
|---|---|
| *Organising items into groups by mixing and matching or comparing/contrasting.* | If necessary, the researcher to attempt at mixing and matching of the coded themes. Comparing and contrasting between the interviews and the success factors (T-version) to be undertaken |
| *Constructing sets of taxonomies:* Other taxonomies consisting of individual items of behaviour and belief also emerge. | Look out for other categories that may emerge from the respondents' beliefs. |
| *Using research participants to create taxonomies:* using participants to create the "rules" for identifying items and creating taxonomies helps to see that the researchers' categories are meaningful to the people studied. | Involve interviewees in the process of creating categories. |

- **Creating patterns:** Pattern creation involves clumping together categories that relate to each other in ways that begin to resemble a coherent explanation or description of the program, event, or phenomenon under study. Identifying the most important patterns can help to clarify key ways of solving problems in a program or beginning to create explanations for what happened during its duration. Table 4.6 explains the steps involved in this stage.

Table 4.6: Guidelines for creating patterns

| Tasks | Strategies |
|---|---|
| *Similarity and analogy*: sets of items that are identical or serve the same purposes. | This step involves linking together categories that relate to each other and leading to similar explanation. |
| *Co-occurrence:* sets of things that occur at the same time or place. | Undertake identification of patterns formed with categories that links with the same construct. |
| *Hypothesised reasonableness:* patterns researchers think should exist based on prior research, experience, or hunches. | Inclusion of patterns that the researcher has derived from the literature review. |

- **Assembling structures:** This step involves assembling groups of patterns into structures to build an overall description of the identified problem. Assembling such structures can help participants see more clearly, how to solve problems, improve programs, assess their effectiveness or develop theories explaining what happened. Since graphics facilitate structural analysis, the conceptual maps constructed through the LeCompte (2000) methodology to be used to display the relationships among the patterns.

## 4.2 Reliability and validity

Reliability and validity define the strength of the data and are thus relevant to qualitative research. Data are said to be reliable and valid if they are dependable (Lincoln & Guba, 1985), consistent (Robson, 2011) and confirmable (Schwandt, Lincoln, & Guba, 2007). This is achieved by showing readers of research studies the procedures that led to a particular set of conclusions (Seale, 1999) and by providing a clear description of the data sources, and the way they contribute to the findings of the research (Benbasat et al., 2002). The reliability and validity of the data will also be ensured by following Yin (2014) guidelines, which are given in table 4.7.

Table 4.7: Methods for four design tests

| Tests | Tactics | Methodology of Application | Plan for this study |
|---|---|---|---|
| Construct validity | - Use multiple sources of evidence. | Triangulation using multiple sources of evidence. | Use of interviews and the Delphi technique for data collection. |
| | - Establish chain of evidence. | Following the evidence from the research question to the empirical data and tracing it back to the question. | Correlate the evidence between the identified literature (theoretical factors) and empirical data. |
| | - Have key informants review draft report. | Draft report reviewed by participants and informants in the organisations. | A copy of the transcribed notes to be emailed to participants for their use, review and approval. |
| Internal validity | - Do pattern matching.<br>- Do explanation building.<br>- Do time series analysis. | | Creation of patterns to be done by grouping together categories that relate to each other so as to resemble a coherent entity or phenomenon under study. |
| External validity | - Use replication logic in multiple organisations. | Testing of theory through replication of its findings in two or more organisations. | Use of theoretical replication via a set of ten private and government organisations in UAE. |
| Reliability | - Case protocol. | Contains interview procedures and general rules that should be followed when using the instruments and is created prior to the data collection phase. | Section 4.1.6 outlines the analysis protocol in the study. |
| | - Development of a database. | Use of two types of documentation, namely the data or evidentiary base and the report of the investigator. | Data (including interview transcripts and researcher's field notes during data collection) to be coded and stored. |

## 4.3 Methodological review of previous research

Three researches from the literature are presented in order to evaluate the correlation of the present study with similar studies using similar methodology. The studies were selected based on similarity of topic, approach, method and instrument with the purpose of evaluating how similar studies have approached the empirical research. Table 4.8 offers a comparative analysis of the three studies along with the similarities and differences to the present study. The table provides a brief explanation of each study, methodology and findings. Subsequently, similarities with the research are presented to justify further the rationale of the selected research methods.

Table 4.8: Analysis of the three relevant case studies

| | Case study 1 (Haes & Grembergen, 2008) | Case study 2 (Sambamurthy & Zmud, 1999) | Case study 3 (Jewer & McKay, 2012) |
|---|---|---|---|
| **Topic** | An exploratory study into the design of an IT governance minimum baseline through Delphi research | Arrangements for information technology governance: A theory of multiple contingencies. | Antecedents and consequences of board IT governance: institutional and strategic choice perspectives. |
| **Objective/ purpose** | To provide insights regarding the effectiveness and ease of implementation of IT governance practices and provides a minimum baseline of practices that organisations at least should have. | To identify the interacting contingencies and their influence on a particular mode of IT governance. | To explain the antecedents of board IT governance and its consequences. |
| **Approach** | Deductive and inductive. | Deductive. | Deductive and inductive |
| **Research paradigm** | Interpretive philosophy | Positivist philosophy. | Interpretive philosophy. |
| **Methodological choice** | Qualitative. | Qualitative. | Mixed. |
| **Research method** | Exploratory research using multiple case studies | Multiple case studies using survey for selecting the eight cases. | Exploratory research using multiple case studies. |
| **Research question/ hypothesis** | Four research questions. | Three hypothesis. | Five propositions. |
| **Research instrument** | **Literature and pilot case research**: detailed literature search; one in-depth case and five mini-cases based on multiple interviews. These case studies were based on multiple interviews with two to six business and IT managers in each organisation. **Delphi research methodology:** Three rounds of 22 experts | Telephone interviews. | Interviews and a survey, prior research work, the IT governance literature. |
| **Findings** | Contribution to new theory building and assists practitioners by providing more guidance on how IT governance can be effectively implemented. | Strong support for all the three hypotheses derived from the application of multiple contingencies theory toward the modes of IT governance. | Findings indicate that some board attributes and organisational factors influence board involvement in IT governance, and that a contribution of IT to organisational performance appears to be positively influenced by increased involvement of boards in IT governance. |
| **Similarities** | Similar objective, initial list of IT governance practices based on the findings of the literature search, abductive approach, exploratory research, use of qualitative choice, interviews as data collection tool from multiple organisations; use of Delphi technique and cross-sectional time horizon. | Similar research field, theory testing, use of qualitative choice, deductive approach, positivist philosophy, multiple organisations, and interviews as data collection tool. | Similar research field, theory testing, research paradigm, research method, research approach and interviews as data collection tool. |
| **Differences** | Benchmarking and extreme case research methodologies. | There are differences in terms of not using interpretivisim, inductive approach and in the use of surveys for selecting the organisations. | Difference in methodological choice and use of survey method. |

- **Case study 1:** The first case study (Haes & Grembergen, 2009) explored how organisations implement IT governance. It analysed the relationship between these implementations and business/IT alignment. The research resulted in a finding that business/IT alignment maturity is higher when organisations apply a mix of mature IT governance practices. The focus of this research was on the Belgian financial services sector only.

Similarities between case study 1 and the current research study can be seen in the use of existing theories, models and practices in the ITG domain to derive research questions. Another similarity is the multiple research strategies used to explore the research questions. Similar to case study 1, the present research also aims to identify with some ITG practices that cannot be generalised but that might be applicable to other sectors as well.

- **Case study 2:** The second case study (Sambamurthy & Zmud, 1999) identified three scenarios of multiple, interacting contingencies (reinforcing, conflicting, and dominating) and their impact on IT governance.

Similarities between case study 2 and the present study can be seen in the final result taking the form of a conceptual model with theoretical linkages for understanding an organisation's IT decision-making responsibilities. A significant contribution of this study is the identification of corporate governance, economies of scope and absorptive capacity forces as providing underlying explanations for the effects of specific contingency factors. In a similar way, the researcher expects contribution to the literature through the identification of factors that influence resource allocation.

- **Case study 3:** The third case study (Jewer & McKay, 2012) used strategic choice theory to propose relationships between board attributes and board IT governance. This research contributed to theory and to boards' practice of IT governance by the identification of key antecedents and consequences that may be applicable in selected settings. In addition to the similarities given above, another similarity to the present study is the use of literature and IT governance research as a starting point.

## 4.4 Conclusion

The success factors (T-version) that emerged through the process of researching the related fields using various sources, being theoretical calls for validation via empirical research. The nature of the research questions that inform the present study directed the researcher towards undertaking a qualitative study, while the research philosophy pointed towards a combined interpretive and positivist paradigms. The exploratory research leading to a qualitative philosophy directed the researcher to a case study approach using in-depth interviews for validation and refinement of success factors, and further validation and ranking of success factors through Delphi research. Analysis of three past studies with similar topic provided similarity with the proposed methodology. One of these studies was not only similar to the research topic, but also followed the same philosophy, research paradigm and research design (case study 1).

# CHAPTER 5

# DATA COLLECTION AND ANALYSIS – 1

# 5 CHAPTER 5: DATA COLLECTION AND ANALYSIS – 1

In response to the case study requirement specified in Chapter 4, United Arab Emirates (UAE) was selected as a case study. Twelve IT decision-makers from eleven (two people were from the same organisation) government and private organisations (also referred to as "cases") in Dubai (UAE) were interviewed. Three factors prompted the selection of UAE as the focus of empirical research. Firstly, UAE is ahead of many other countries with regard to its uptake of the latest technologies, and there is a strong growth for public cloud model in the UAE. Secondly, an IS technology audit has been commissioned by the Dubai government since 2000 to provide assurance on IT governance, and encourage the adoption of best practice for ITG within government entities (ISACA, 2009). The ISACA UAE chapter with over 12000 members was a contender for the very large chapter growth award in 2013 (ISACA, 2014b) and has the majority of its members based in Dubai. Thirdly, the location of the researcher and her membership in the UAE ISACA chapter also lent weight to selecting Dubai as the study location.

Detailed interviews were conducted over a period of five months (August to December 2015) in order to validate and refine the success factors (T-version) as shown in table 3.6. The interview questionnaire (Appendix A) was divided into two sections. In section-1, the respondents were asked about the potential factors for roles and responsibilities allocation in a public cloud environment, without showing the derived success factors (T-version). The questions in this section were designed to gather information about the current status of organisations' ITG and cloud computing in the UAE (questions 1–3). This section mainly enquired about the challenges for cloud computing adoption in terms of people's roles and responsibilities (question 4), to elicit the factors for allocating people to cloud-based IT controls (question 5), and to confirm the implications of undergoing this research from the practitioner's perspective (question 6). Therefore, this section delved more into respondents' organisational experience and expertise as well as best practices in allocating roles and responsibilities in allocating IT controls in their cloud environment. Only in section-2 the respondents were shown the success factors (T-version) for evaluation from their perspective. In this respect, the interview questions in this section not only focused on validating the existing factors (question 7–9), but also prompted them to identify missing factors as well as to add relevant additional ones. Questions 10 to 14 focused mainly on obtaining feedback and suggestions for improving the theory.

Qualitative data collection followed the process outlined in chapter 4. The analysis proceeded according to the five steps outlined by LeCompte (2000), namely tidying up, finding items, creating stable sets of items, creating patterns, and assembling structures. The first three steps, which involve active analysis of the data, will be discussed in this chapter. The last two steps, which interpret and synthesise the analysed data, are discussed in chapter 6. The remainder of this chapter is structured as follows: Section 5.1 profiles the 11 cases with organisational as well as personal details of the respondents. Section 5.2 analyses the cases by following the first three tasks of LeCompte's (2000) methods (as per Chapter 4), which are "tidying up," "finding items" and "creating stable sets of items". The last section 5.3 focusses on the validation of the success factors (T-version) by the respondents.

## 5.1 Case profiles

Forty senior IT managers working in 32 organisations in the UAE were contacted through multiple methods. An average of four follow-ups for each potential candidate was made through phone calls, text messages, LinkedIn messages and emails. A total of 12 senior IT decision-makers (Table 5.1) who have related professional certifications such as Certified in the Governance of Enterprise IT (CGEIT), Certified Information Systems Auditor (CISA), Certified Information Security Manager (CISM), Certified in Risk and Information Systems Control (CRISC), ITIL, and/or Certified Information Systems Security Professional (CISSP) as well as organisational experience with cloud migration agreed to participate in the research. Each of these respondents eventually gave their perspective on the research topic from their organisational context and also evaluated the success factors (T-version). Table 5.1 therefore provides the respondent profile as well as the organisational context for the research.

To ensure anonymity, names of all 12 respondents interviewed in the government and private sectors have been replaced with two-letter abbreviations. Since, the researcher selected organisations that have adopted or that are in the process of adopting public cloud technology, the elicited information mostly reflect existing and preferred organisational practices on the researched topic. As of 2016, the UAE government is in the process of devising regulations and standards on the uptake and usage of the cloud. Therefore, this research comes at an opportune time to provide further guidance for organisations. Since private organisations are comparatively more involved in cloud computing ventures (66.7%) than the government sector (33.4%), the selection of respondents aligns with the proportions at the population level.

Table 5.1: Respondent and organisational profiles

| Respondent profile | | | Organisational profile | | |
|---|---|---|---|---|---|
| **#** | **Position** | **Knowledge of ITG** | **Industry** | **Sector** | **Organisation details** |
| R1 | Senior infrastructure manager | More than 13 years' experience in various IT management positions. | Utility services | Govt. | It is a leading public service infrastructure organisation in the UAE with almost 10,000 staff overall and over 3000 in the IT department. Initiated deployment of IaaS cloud model. |
| R2 | Chief IT restructuring officer | In a very senior IT management position. More than 30 years' IT management experience in IT industries.. MBA with certification in CGEIT. | Technology | Govt. | It is a leading Dubai based ICT service provider in the UAE. It is a subsidiary of an organisation with more than 50,000 employees. There are more than 90 people working in the ICT provider branch. |
| R3 | Head of IT | More than 20 years' IT management experience in IT industries. An engineer with certification in CISSP and PMP. | Investment | Private | Total number of employees exceeds 700. Currently 26 employees in the IT department and has a target of 65 by the end of the year. Hybrid cloud model adopted. |
| R4 | Vice president information technology | More than 16 years' experience in the IT industry. Chartered accountant and global CIO. | Real estate | Private | Company with a centralised IT department for all of its subsidiaries. Number of employees exceeds 400 with 10 (plus outsourced staff) in the IT department. Public cloud model adopted. |
| R5 | Chief information security officer | More than 15 years' experience in the IT industry. Holds 39 qualifications, including CGEIT, CISSP and CFE. | Banking | Private | Bank with nearly 800 employees, including 60 in the IT department. Public cloud model adopted. |
| R6 | Consulting engineer | More than 18 years' experience in the IT industry. Master's degree in engineering. Holds qualifications including CCIE, CISSP and VCP. | Technology | Private | Global leader in IT with revenue of US$ 47.1142 billion and an office in UAE. Number of employee's exceeding 70,000 with over 200 in the UAE office. This organisation is a cloud enabler with its own cloud. |
| R7 | Group CIO | More than 11 years' experience in senior IT management. Holds an honorary doctorate and two master's degrees. | Retail | Private | Number of employees close to 10,000 and the organisation has adopted the public cloud. |
| R8 | Head systems and storage | More than 15 years' experience in IT management. Holds a BE and MBA (IT) and has qualifications in ITIL, MCP, CCNA, CAN, VCP, and PMP. | Banking | Private | Number of employees equals 2500 with 90 in the IT department. Cloud models adopted are private, public and hybrid |
| R9 | Head of IT | More than 17 years' experience in IT management. Holds an MBA (finance) and has qualifications in PMP, CISA, and CGEIT. | Real estate | Private | One of the largest real estate developers in UAE, operating internationally, having a revenue of more than $3 billion. Numbers of employees exceed 10,000 with over 200 in the IT department. Cloud models adopted include private, public and hybrid. |
| R10 | Senior manager (Information security and IT) | More than 30 years' experience in IT management. Holds an M.Tech and has qualifications in Oracle DBA (7, 8, 9i, 10i), IBM AIX Administrator (4.x), HPUX Administrator (7,8), CISSP, PMP, ABCP, CISM, CGEIT and CRISC. | Manufacturing | Govt. | It is a leading global producer with number of employees exceeding 7,000 having over 160 in the IT department. Their cloud adoption is at a very early stage. |
| R11 | Manager information security and risk | More than 11 years' experience in IT management. An engineer with qualifications in ISO 27001 implementer, ISO 27001 auditor, and ISO 27000 auditor. | Technology | Govt. | It is a leading Dubai based ICT service provider in UAE. It is the subsidiary of an organisation with more than 50,000 employees. There are more than 90 people working in the ICT provider branch. |
| R12 | VP information technology and services | More than 22 years' experience in IT management. Holds an MSc and MBA and has qualifications in ITIL, CISCO, PMP, and CCSIP. | Banking | Private | One of the largest bank in UAE by assets. Number of employees in the IT department exceeds 200. Cloud model adopted is confidential. |

**Case 1: R1**

This interview was conducted with a senior IT infrastructure manager of a leading public service infrastructure in the UAE with approximately 10,000 employees. This organisation has already started the cloud journey by developing their private cloud with infrastructure as a service model. They have completed phase one of virtualising their servers, to be followed by virtualisation of their storage and network. The project will be completed by the automation of their private cloud. They are also in the process of evaluating public cloud services such as Microsoft Azure and Google applications. Their public cloud initiatives of migrating application layers such as emails and databases are at the evaluation phase.

**Case 2: R2 & R11 (two respondents from the same organisation)**

**R2 -** This interview was conducted with the chief IT restructuring officer of a leading Dubai-based ICT service provider. The organisation is a subsidiary of a government organisation with more than 90 people working in the ICT provider branch, which provides IT services to 26 organisations. It has adopted COBIT, ITIL governance frameworks and ISO 27001 for security.

While having its own private cloud, currently, its public cloud initiatives (1%) are minimal, consisting of three websites hosted on a public cloud. Its other public cloud projects are on hold due to Dubai governance rules and regulations, according to which no government or semi-government entities are allowed to host their data outside the UAE. It is currently waiting for the Dubai Electronic Security Centre (DESC) to release a set of standard controls for movement to cloud computing. DESC is a standard body for information security regulation (ISR) that dictates the IS security regulations for all government and semi-government entities.

**R11 -** The respondent is an information security and risk manager with 11 years' experience in the IT industry and six years of experience in her current organisation.

**Case 3: R3**

This interview was conducted with a senior and experienced head of IT at a private company with over 700 employees. Currently, this organisation has an IT department of 26 people, with a growth target of 65 within a year. It has moved approximately 40–45% of its resources

to a hybrid cloud model. The organisation uses IaaS to host websites and file servers. Most of its applications that are on the cloud include HR (recruitment and on-boarding applications), Customer Relationship Management CRM (oracle product), Eloqua (marketing), Social Relationship Management (SRM), Office 365 (email) and Yardi (retail leasing and sales). While it is currently using ITIL as their ITG framework, it is implementing Archer (GRC framework from RSA) and is considering implementing COBIT.

**Case 4: R4**

The respondent is the vice president of the IT department and has worked in the industry for more than 16 years. This organisation is one of the leading private real estate companies with a centralised IT department for all of its subsidiaries. The organisation has already moved around 20% of its resources to the public cloud, with plans to reach an adoption level of 40% within a year. Its public cloud initiatives include Office 365, Microsoft Exchange, Yammar (corporate social media), SharePoint, OneDrive and Oracle ERP.

**Case 5: R5**

The respondent is a senior IT security manager with more than 15 years' experience in the IT industry. This organisation is in the retail banking sector and has more than 800 employees in various branches. It uses COBIT governance framework and has adopted the public cloud model. Its public cloud initiatives include a corporate enterprise portal as well as and industry and investor relations migrated to the public cloud.

**Case 6: R6**

For case 6, the interview was conducted with a consulting engineer with relevant qualifications and more than 18 years' experience in the IT sector. This organisation is a global leader in IT, with annual revenue of USD 47.142 billion with a substantial presence in the UAE. With over 70,000 employees globally, approximately 200 personnel work in its UAE office. The ITG frameworks deployed include ITIL and TOGAF. This organisation is 100% cloud based and also operating its private cloud.

**Case 7: R7**

The respondent is an IT professional working as Chief Information Officer (CIO) for the entire group and has been in the industry for more than 11 years. This organisation is a large retail enterprise with over 3,500 employees. The ITG practices of this organisation are based

on agile and scrum methodologies. They have deployed Enterprise Resources Planning (ERP), COBIT, and ITIL, which have been customised to their organisational needs. Therefore, the respondent calls it the organisation's "Project Management Office, PMO". Apart from using hybrid and private cloud models, the organisation has moved around 22–33% of its customer-centric resources to the public cloud, with plans to increase the migration to 45–55% in the next three years.

**Case 8: R8**

The respondent is the head of systems and storage at a regional private bank with approximately 2,500 employees and 90 employees in the IT department. This organisation has adopted all three cloud models, namely private, public and hybrid. It has implemented ITIL and COBIT governance frameworks. With around 10% of the resources moved to the cloud, it plans to further move it's testing and development environments to the public cloud, thereby targeting 40% migration by 2017. Its public cloud movement includes IaaS and AZURE (a messaging system).

**Case 9: R9**

The respondent is the head of IT at a leading real estate development organisation in the UAE, operating internationally with annual revenue of more than $ 3 billion. It has around 10,000 employees, with around 200 of them working in the IT department. It uses a mix of COBIT and ISO 27000 governance frameworks. While adopting private, public and hybrid cloud models as an organisational strategy, as per its policy, any new initiative will be on the cloud. With around 15% of its resources currently on the cloud, it plans to increase this to 30–40%. Its cloud-based initiatives include SAP Success Factors talent management, Office 365, sales and marketing and adoption of IaaS.

**Case 10: R10**

The respondent is an experienced senior manager in information security at a leading public manufacturing organisation with approximately 7,000 employees, of which 160 are in the IT department. This organisation's ITG model is aligned with ITIL. Like other public organisations, its cloud adoption is at a very early stage. However, there is definitive thinking about the need to adopt cloud services to leverage its benefits. Its current cloud initiatives include job evaluation, email services, simple file storage services, dynamic name resolution services (for external IPs) and plans to move its internet (web) proxy controls to the cloud.

**Case 11: R12**

The respondent is the Vice President (VP) of IT and services and has worked in the IT industry for around 22 years. This organisation is a private bank with group assets of nearly USD 40 billion, a market capitalization of $ 7.0 billion and a workforce of more than 8000 employees within the group. It also has a strong presence across all the Emirates with growing international operations in Asia, Middle East and Africa. The respondent did not reveal a lot of information about the cloud adoption level and the ITG frameworks used within the organisation for reasons of confidentiality. He did not allow the interview to be recorded for the same reason. However, his experienced insights into the topic were noted down and were very useful for this research.

## 5.2 Phase-1: Emerged success factors

Prior to discussing the theoretical success factors (T-version) with the respondents, they were asked about factors that impact people's roles and responsibilities allocation to IT controls that have been migrated to the public cloud environment. Even though the interviewer conducted the interview with a tentative schedule of the topics to be covered, care was taken to ensure that at this stage, the themes/factors (these terms will be used interchangeably) were derived from the transcripts rather than from preconceived topics. The actual wording of the questions were framed at the time of the interview according to the situation, but based on the interview guidelines (section 4.1.6). Care was taken to elicit as broad an answer as possible, while still keeping the respondents to the topic. This was to ensure that the respondents did not limit their responses to the researcher's questions but gave their organisations' perspective on the topic. The three analysis stages in this phase include tidying up, finding items and creating stable sets of items.

### 5.2.1 Stage 1: Tidying up

This is the first of the five steps in the data analysis. Table 5.2 assists in an internal audit of the chapter whereby the plans of analysis outlined in Chapter 4 (section 4.1.7) are checked for conformance and variations. Therefore, the first column taken from table 4.3 outlines the planned steps, while the second column in table 5.2 outlines the actual steps taken.

Table 5.2: Stage 1 of the analysis and actions taken

| Strategies (actions planned – detailed in table 4.3) | Actual steps taken |
|---|---|
| 1. The interviews to be recorded using digital recorders, and subsequently transcribed. Keeping two copies of the interviews and their transcription ensures duplication. One copy to be kept in the researcher's computer and a backup hard drive to store the second copy. | For the interviews, researcher used the recording function on her iPhone. The digital files were transferred to the researcher's computer and the files in the iPhone were deleted. A copy of the transcription is saved in cloud storage and another copy is saved in the researcher's hard drive. |
| 2. Dates and time of each interview to be kept in the separate file. Transcript creation date follows the operating systems default properties format. | All of the interviews were saved in a file labelled "Interviews," with a particular folder designated for each interview and filed by date. |
| 3. Contextual data to be filed in folders according to the organisation. | The limited contextual data that was obtained was saved in the respective folders of the main "interviews" folder. |
| 4. Hard copies such as the consent form and any other relevant materials to be stored separately in the researcher's safe. The interviews to have meta-data with details like date, time, location, organisational context, format, and media type, including subsequent transcript validation sessions. This to be put in the same folder, along with any other relevant materials like field notes, if any. | All of these actions were completed. |
| 5. The names of the files to include the interviewer's initials and the organisational code. To maintain confidentiality, the names of the interviewee to be saved as initials. | Proper name format was followed. Two letters were used for each respondent (RN)' where R represents a respondent and N is a number from 1 to 12); each case was named as CASE X (where X is a number from 1 to 11). |
| 6. An index to be created. | Done using a folder called "Interviews," which includes a table of contents. |
| 7. The researcher to have a list of pre-determined topics to cover during the interviews. Following this format, ensure correlation with the data collected. | Completed. |
| 8. Transcribed interview data to be compared with the list of topics to be covered, to identify any missing data. | This was done—some missing data was noticed. |
| 9. If any topics are found to be missing, arrangements to be made to collect the missing data (through a repeat visit or telephone). | • For Case 7 (R7), information was missing. A second interview was conducted 12 days later to complete the data.<br>• For Case 2: R11, the information was not sufficient and satisfactory. Another interview was conducted with a more senior employee from the same company (R2) to get more details.<br>• For Case 10 (R10), the interview did not produce sufficient data, and another interview with the same respondent was conducted (via telephone). |

### 5.2.2 Stage 2: Finding items

This stage involves finding themes that emerged over the course of the interview. Table 5.3 illustrates the initial plan (Table 4.4) and the action taken at this stage regarding stage 2 (finding items).

Table 5.3: The second step in the analysis and steps taken

| Strategies (actions planned – detailed in table 4.4) | Actual Steps Taken |
|---|---|
| Identifying and grouping of repeated ideas as nodes or sub nodes. | Themes were created based on the concepts discussed by the respondent. Using NVIVO's functionality, helped in identifying the frequency of the themes. |
| The researcher to take note of pre-determined themes that did not make into the interview. | Themes identified through the literature review were examined. |
| The researcher to strive to identify themes, which have not been emphasised in the theoretical list, but identified by respondents as significant. | NVIVO's functionality to show percentages to identify the emphasis on themes by the respondents was used. |

The respondent's responses were recorded (with permission) and transcribed verbatim using the freeware software "O-Transcribe." Once the interviews were transcribed, they were played back several times to ensure that they accurately convey the respondents' responses and to fill in minor gaps. The final transcripts were loaded into NVIVO 10 software, and after reading through the final transcripts again several times, familiar and non-familiar (to success factors (T-version)) themes emerged. This process was repeated a few times to make sure that the coded text accurately represented the themes. Thereafter, a review was conducted by an experienced qualitative academic. He checked the themes for a randomly selected interview to ensure the correctness of the coding. Each node/theme represents a success factor. Thirty-six themes that emerged from these 11 organisations are listed in table 5.4.

Table 5.4: Themes emerged from the interviews (overlapped)

| # | Success factors | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | R10 | R11 | R12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **Technical competencies** | √ | | | | | | | | | | | |
| 2 | **Service based allocation** | √ | | | √ | | | | | | √ | | |
| 3 | **Policies** | √ | | | | √ | | √ | | √ | | | |
| 4 | **Department reshape** | √ | | | | | | | | | | | |
| 5 | **Legal** | √ | | √ | | | | √ | | √ | √ | | |
| 6 | **Quality management** | √ | √ | | | | | | | | √ | | |
| 7 | **Distributed IT workforce** | √ | | | | | | | | | | | |
| 8 | **Security** | | √ | √ | | √ | | √ | | √ | √ | √ | √ |
| 9 | **Compliance** | | √ | | | | | | | | √ | | |
| 10 | **Data privacy** | | √ | | | | | | | | | | |
| 11 | **Processes** | | √ | | | | | | | | | | |
| 12 | **Strategy** | | √ | | | | | √ | | √ | | | |
| 13 | **Risk management** | | √ | | | | | | | | √ | | |
| 14 | **Training** | | √ | √ | | | √ | √ | √ | √ | | | √ |
| 15 | **Managing time zones** | | √ | | | | | | | | | | |
| 16 | **Financials implications** | | √ | | | | | | | | √ | | |
| 17 | **Performance management** | | √ | | | √ | | | | | | | |
| 18 | **Coordinate roles** | | | √ | | | | | | | | | |
| 19 | **Aptitude and ability to take on challenges** | | | √ | | | | | √ | | | | |
| 20 | **Management abilities** | | | √ | | √ | | | | √ | √ | | |
| 21 | **Vendor management** | | | √ | | √ | | | | √ | | | |
| 22 | **Knowledge of infrastructure** | | | √ | | √ | | | | | | | |
| 23 | **Change management** | | | | √ | | | √ | | | | | |
| 24 | **Managing SLAs** | | | | | √ | | | | | | | |
| 25 | **Supply chain management** | | | | | √ | | | | | | | |
| 26 | **Relationship management** | | | | | √ | | | | | | | |
| 27 | **People's resistance** | | | | | | √ | | | | | | |
| 28 | **Organisational size** | | | | | | √ | | | | | | |
| 29 | **Knowledge management** | | | | | | | √ | | | | | |
| 30 | **Adaptation** | | | | | | | | √ | | | | |
| 31 | **Domain knowledge** | | | | | | | | | √ | | | |
| 32 | **Contract management** | | | | | | | | | | √ | | |

Among the themes that emerged from the interview, the ones that appeared more frequently include 'security', 'training' and 'legal'. While most of the themes identified through the literature review, like 'security', 'compliance', 'strategy', were also emphasised by the respondents, there were new themes that emerged from the respondents: such as 'management skills', 'training', 'financial implications', 'quality management', and 'service based allocation'. There is an overlap in the meaning of some of the emerged themes. For example, while talking about 'relationship management' and 'vendor relationship', respondents were actually talking about the same things. Similarly, respondents talking about 'adaptation' and 'people's resistance' were actually talking about the same issue. At this stage, all 32 emerged themes are written as is. In the next stage of the analysis, all of the 32 emerged themes are carefully examined to find the overlaps and relationships among them and/or with the theoretical success factors, if any.

### 5.2.3 Stage 3: Creating stable sets of items

Stage three has been further subdivided into two distinct sub-phases, namely, mixing/matching and comparing/contrasting themes. Table 5.5 illustrates the initial plan (table 4.6) and the action taken at this stage of analysis.

Table 5.5: Steps in creating stable sets of items

| Strategies (actions planned in table 4.6) | Actual Steps Taken (Chapter 5) |
|---|---|
| Mixing and matching the coded themes to be undertaken only if it is deemed necessary. | Done under the heading of "inter-case analysis of derived themes." |
| Comparing and contrasting between the cases and success factors (T-version) to be undertaken. | Done under the heading of "intra-analysis of themes." |
| Look out for other categories that may emerge from respondents' beliefs. | Done. New theme emerged from the interviews. |
| Involve respondents in the process of creating categories. | Respondents were shown the success factors (T-version) once created. |

#### Inter-case analysis of derived themes

Domain analysis (Leech & Onwuegbuzie, 2011) utilising Spradley's (1979) semantic relationships were used on the 32 themes/factors (Table 5.4) to gain an overall view of the outcome. Interview respondents emphasised the requirement of people's abilities for 'managing relationships', 'managing supply chain' and 'coordinating activities' (roles), for successful cloud deployments. Researchers have linked these three people's capabilities to 'cloud vendor management' (Figure 5.1) by justifying how building positive relationship and coordinating

implementation activities with the cloud vendor (or supplier) are important to maximise the likelihood of successful cloud deployment (Garrison, Kim, & Wakefield, 2012). Other researchers have also emphasised the necessity of people's capability of managing their vendor relationships as essential for generating value from cloud or IT outsourcing (Ross & Westerman, 2004). Therefore, considering the researchers' (secondary) and respondent's (primary) views, this study has looked at forming Spradley's (1979) relationships between 'vendor management' and other three factors ('relationship management', 'supply chain management' and 'coordinate roles') (Figure 5.1).

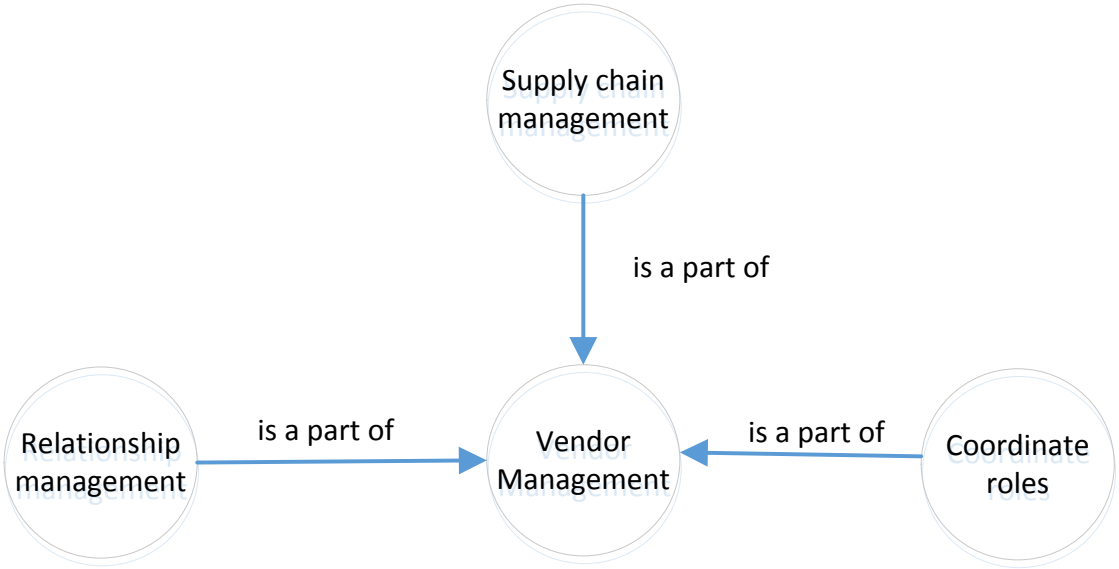



Figure 5.1: Spradley's relationship between 'vendor management' and other factors.

Figure 5.2 explains the relationships between various other emerged themes/factors. Eight respondents talked about the importance for IT staff to ensure "security" in the cloud. One of these respondents also mentioned "data privacy", while discussing security as a factor for role allocations. Using Spradley's (2016) 'Means-end' relationship (where X is a way to do Y) between "security" and "data privacy" factors, it can be seen that maintaining "data privacy" is a way of maintaining "security" (Figure 5.2). Respondents also pinpointed the importance of people in 'managing time zone' differences and 'financial implications' between cloud vendor and users. Researchers consider (and therefore link) people's inabilities to resolve time zone differences (Kliem, 2004) and financial implications (Clemons & Chen, 2011) as risks for any IT outsourced or cloud based delivery services. In a similar way, researchers have linked 'legal', 'policies' and 'regulatory compliance' factors related to cloud computing by emphasising the importance of verification of the cloud provider's compliance with regulation and security policies (Kaufman, 2009; Liu et al., 2011). Three respondents consider the allocation to IT controls to be dependent on the kind of services (or processes) required

therefore linking ‘service-based allocation’ to the ‘processes’ factor. One of these respondent also talked about the importance of the ‘domain knowledge’ or the knowledge of various processes such as finance, human resource and security to meet the business requirements. ‘Quality management’ and ‘SLA management’ are related to performance management as Quality of Service (QoS) provides a guarantee of performance, and Service Level Agreements (SLAs) are an effective means for assuring QoS between service providers and end-users (Xu, 2012). Five respondents identified people’s ability to take challenges, their willingness to change without ‘resistance’, their ‘aptitude’, and their ‘adaptability’ as important factors in deciding their allocation to roles and responsibilities, subsequently suggesting knowledge of ‘change management’ to face these challenges and to reap the benefits of cloud.

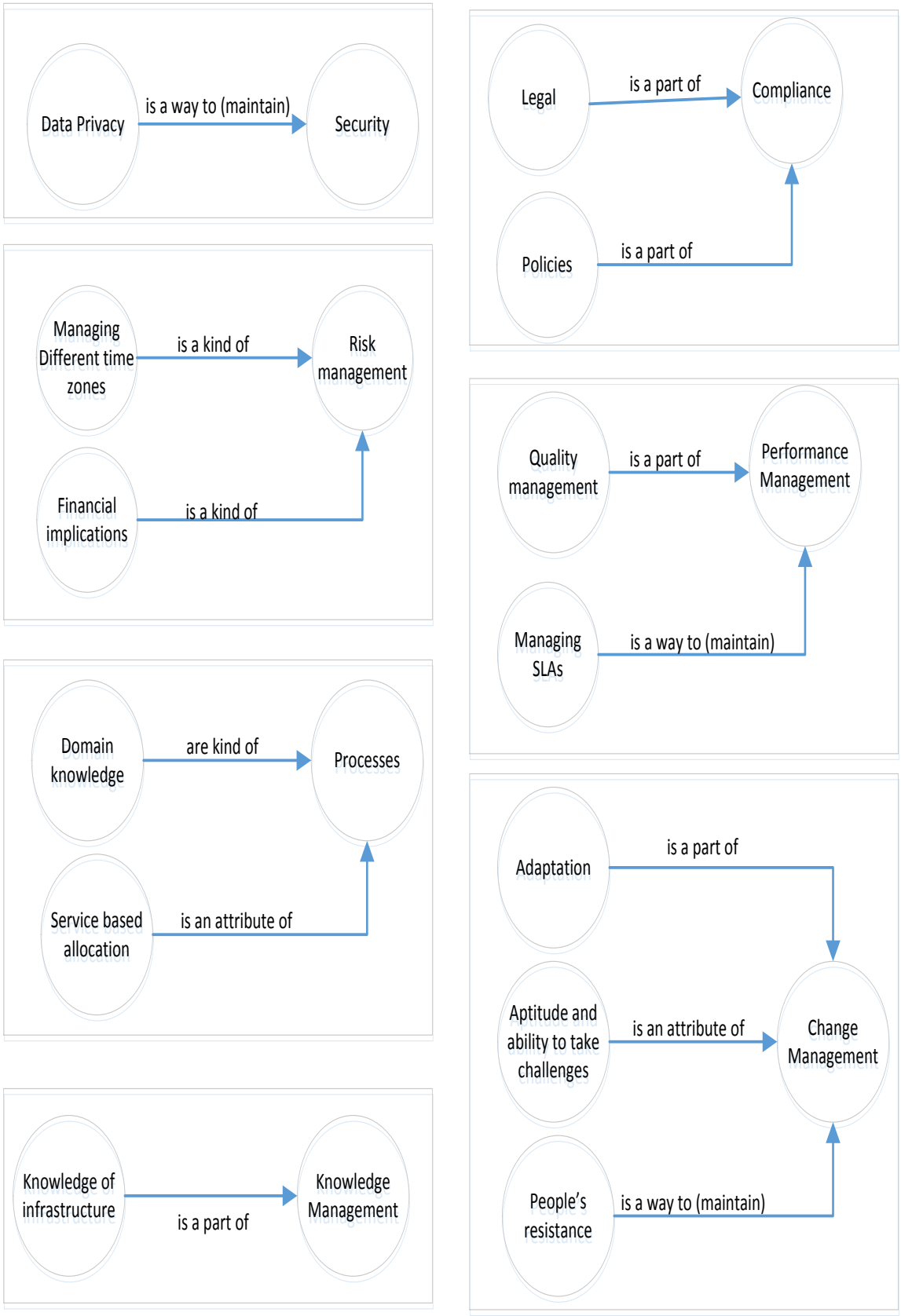



Figure 5.2: Spradley's relationship between factors.

Establishing various types of Spradley's relationships between the factors resulted in a well-defined set of 16 success factors (Table 5.6) that emerged from the interviews.

Table 5.6: Themes emerged during the empirical research.

| No | Success factors | Coverage | Sources | Definitions |
|---|---|---|---|---|
| 1 | Vendor management | 34.12% | R1, R2, R3, R9, R5, R10, R11, R4, R8 | People's roles are changing from technical to management. People need to have skills to manage and maintain a good relationship with the cloud vendors. |
| 2 | Compliance management | 24.9% | R1, R2, R3, R9, R10, R7,R5 | Understanding the UAE's laws and regulations for hosting data is critical in governmental as well as in private organisations. People with knowledge of forming and adhering to stringent cloud policies are necessary. |
| 3 | Strategy | 24.8% | R2, R9, R7 | An organisation's strategy determines data protection mechanisms, business segmentation and cloud-based products that it will use. This in turn defines the skill sets that are needed. |
| 4 | Security management | 21.4% | R2, R3, R5, R7, R9, R10, R12, R11 | IT staff must be able to evaluate cloud vendors, have knowledge of security technologies for data confidentiality, integrity, privacy and authenticity. |
| 5 | Training | 21.3% | R2, R3, R9, R6, R7, R8, R12 | Technical as well as managerial training is required for IT staff in order to align with the new technology and new framework of work. Motivating staff also helps to overcome challenges. |
| 6 | Contract management | 16.6% | R10 | People allocated to clouds need to look at developing and managing contracts very carefully. |
| 7 | Knowledge management | 11.41% | R3, R7 | People need to have knowledge of all of the infrastructure and services provided by the cloud solutions. |
| 8 | Distributed IT workforce | 5.78% | R1 | Structural changes will take place to distribute the IT workforce and to handle the new way of doing business. |
| 9 | Organisational size | 5.72% | R6 | Allocation of people will depend upon the number of people in the organisation who run the IT. |
| 10 | Department reshape | 3.90% | R1 | Department will be restructured to handle the new way of doing business. |
| 11 | Risk management | 3.3% | R2, R10 | People need to understand the impact of moving to the cloud on their organisation. Competency to evaluate cloud decisions, based on financial implications and time zone differences, is required. |
| 12 | Processes | 3.1% | R2, R9, R1, R4, R10 | People allocation will be based on the nature of the cloud services and their domain knowledge. |
| 13 | Change management | 2.23% | R3, R4, R7, R8, R6, R5 | People who are ready to change and adopt the new technology are needed. Allocation is based on aptitude, ability to take on challenges, and readiness to adopt the new technology, without resistance. |
| 14 | Performance management | 1.95% | R5, R2, R1, R10 | Performance management is extremely important to get quality services from the cloud suppliers. Performance can be monitored through SLAs. |
| 15 | Management abilities | 1.29% | R3, R5, R9, R10 | People need to have management abilities. |
| 16 | Technical competencies | 0.7% | R1 | Allocation is based on the technical areas covered. |

While the second column in table 5.6 names the emerged factors, the third column indicates the emphasis laid by respondents during the interviews (by using word count). The fourth column shows the sources that identified the given factors and the last column provides the definitions of these success factors, based on the summary of the interviewee's responses. Constant comparison analysis feature of NVIVO (Leech & Onwuegbuzie, 2011) was performed to generate the word count in terms of percentage coverage, which shows the number of characters as a percentage of the total source. Counting words is particularly useful if the researcher can assume that the frequency of the words, categories, or themes provides a good indication of significance (Leech & Onwuegbuzie, 2007) of the derived themes. Figure 5.3 gives an overview of the relative importance of the emerged themes.

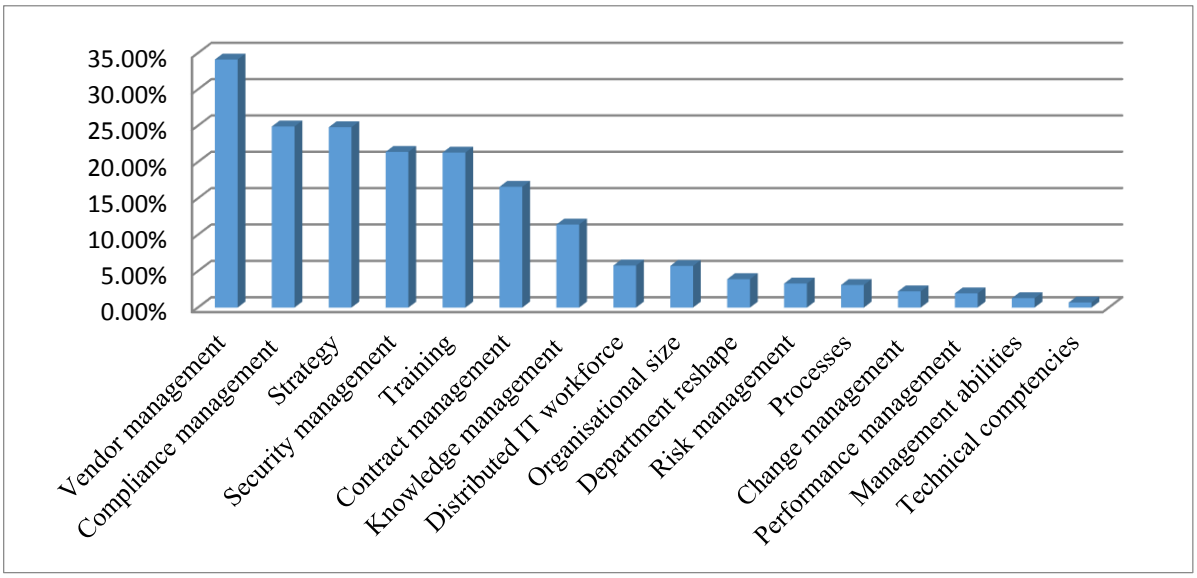



Figure 5.3: Coverage of the emerged themes.

'Vendor management' is the most talked about emerged theme, followed by 'compliance management', 'strategy' and 'security management'. 'Training', specifically identified through interviews, was found to be an important allocation factor discussed by seven interview respondents. Only one respondent cited 'technical competency' as a theme by stating that it is only relevant while the organisation is still in the journey of migrating to the cloud. Other new factors that emerged include 'distributed IT workforce', 'department reshape', 'change management', 'organisational size' and 'management abilities'.

Even though the percentage of coverage provides an overall view of the extent of coverage of the factors, being a qualitative study, the conclusion of final success factors, based on this result is subjective. It was challenging to separate the themes into different silos, as the themes overlapped considerably, and when answering a question, the response could directly refer to one or two (themes) and indirectly to several themes. While the percentage of coverage of

data only takes into account direct mention of discussion of a particular theme, there are numerous indirect and implied references that have been excluded from the themes to maintain rigour in data generation.

**Intra-analysis of themes**

As mentioned in chapter three, sixteen factors have been identified through the literature review (success factors-T-version). Therefore, comparison was undertaken between factors emerged during interviews (Table 5.6) with those in the success factors (T-version) (Table 3.6). Of the 16 factors, it was observed that themes 1, 5, 8, 9, 10, 13 and 15 (the shaded portion in Table 5.6) emerged during the interviews, while the remaining themes in table 5.6 correlate with the factors already identified in the success factors (T-version). Further analysis of these emerged themes revealed that all of the themes except 'change management' were directly embedded in the induced themes. Further analysis of the transcript from a contextual perspective revealed the link between the emerged themes and the success factors (T-version) (Figure 5.4). In this regard, the researcher categorised the 'department reshape', 'distributed IT workforce' and 'organisational size' under 'structures'; 'training' under 'rewards'; and 'management abilities' under the 'CSP management' factor; of the success factors (T-version). Apart from the deduced 16 themes correlating with the success factor (T-version), a new theme ('change management') emerged from the interviews. Since 'change management' which discuss employees' ability to handle the change did not relate to any theme in the success factors (T-version), it was added to the list. However, it was noticed that three deduced themes (from the success factors (T-version))—'relational mechanisms', 'negotiation skills', and 'conflict management' were not explicitly stated in this induced list.

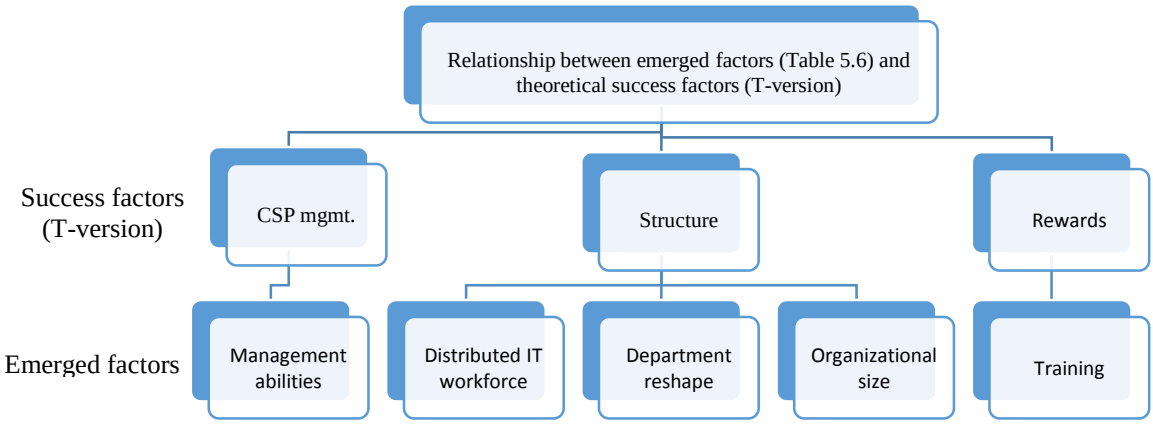



Figure 5.4: Grouping the emerged factors under the theoretical success factors (T-version).

## 5.3 Phase-2: Success factor (T-version) validation

During the second phase of the interview, respondents were asked to validate the success factors (T-version). Since, researchers have already identified 16 factors (in Table 3.6), constant comparison analysis (Glaser & Strauss, 2009) was undertaken deductively to code responses into the pre-determined (16) factors. Results show that all respondents were in agreement (providing justifications too) with the factors given in the success factors (T-version). Leech and Onwuegbuzie (2007) found word count useful if the researcher can assume that frequency of words, categories or themes provides a good indication of meaningfulness. In this regard, word count was used to find and evaluate the emphasis of each factor by the respondents. The constant comparison analysis feature of NVIVO was used to generate the word count in terms of 'percentage coverage' (Table 5.7) which shows the number of characters as a percentage of the total source. This word count depicts the positive emphasis given by respondents for the identified factors (Leech & Onwuegbuzie, 2011). Negative values display the disagreement of the respondent on inclusion of a particular factor (displayed in terms of percentages, using NVIVO). Since the content of factors overlap with each other, the combined 'percentage' of words for the particular theme (shown in the second last column) aggregates to 349.7.5%. This figure has been reduced to 100% and re-calculated to reveal the 'true percentage' in the last column aggregating to 100%. Table 5.7 summarises the validation results of the success factors (T-version), in the order of their mentions by the respondents. Figure 5.5 provides a graphical representation of the summary of the validation results of the success factors (T-version).

Table 5.7: Success factors (T-version) validation- percentage coverage

| Success factors | Percentage emphasis by interview respondents | | | | | | | | | | | | Percentage coverage | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **R1** | **R4** | **R3** | **R2** | **R8** | **R5** | **R10** | **R12** | **R11** | **R6** | **R7** | **R9** | **349.7%** | **100%** |
| **Structure** | 7.10 | 8.02 | 8.41 | 8.90 | 5.82 | 13.39 | 2.17 | 4.63 | 0.97 | 0.48 | 0.41 | 3.88 | **64.18** | ***18.4*** |
| **Compliance management** | 1.61 | 15.71 | 1.65 | 6.13 | 4.82 | 3.95 | 1.32 | 0.34 | 0.37 | 2.07 | 0.41 | 0.50 | **38.88** | ***11.1*** |
| **Security management** | 0.79 | 0.71 | 0.39 | 2.15 | 5.96 | 4.52 | 5.07 | 2.59 | 0.25 | 3.07 | 0.41 | 4.20 | **30.11** | ***8.6*** |
| **Strategy** | 2.01 | 2.68 | 0.37 | 0.42 | 1.36 | 0.35 | 1.96 | 4.51 | 0.30 | 6.66 | 0.41 | 5.56 | **26.59** | ***7.6*** |
| **CSP management** | ND | 3.23 | 1.63 | 2.31 | 2.91 | 2.76 | 1.52 | 1.55 | 0.07 | 3.49 | 0.41 | 5.24 | **25.11** | ***7.2*** |
| **Processes** | 0.74 | 0.94 | 6.38 | 2.67 | 2.74 | 3.62 | 1.17 | 1.91 | 0.10 | 0.22 | 4.52 | (2.05) | **22.97** | ***6.6*** |
| **People** | ND | 1.49 | 8.58 | 2.87 | 4.03 | 1.22 | 1.23 | 0.07 | 0.33 | 1.18 | 0.41 | ND | **21.42** | ***6.2*** |
| **Relational mechanisms** | 3.35 | 1.64 | 2.93 | 3.82 | 4.42 | 1.34 | 0.49 | 0.35 | 0.08 | 1.45 | 0.41 | 0.59 | **20.87** | ***6.0*** |
| **Rewards** | ND | 1.60 | 0.37 | 3.28 | 4.08 | 2.15 | 0.34 | 2.38 | 0.26 | 2.96 | 0.41 | 2.39 | **20.22** | ***5.8*** |
| **Performance management** | 8.52 | 2.11 | 0.07 | 4.53 | 0.10 | 0.42 | 0.09 | 0.26 | 0.90 | 0.13 | 2.80 | ND | **19.93** | ***5.7*** |
| **Risk management** | 0.79 | 4.80 | 0.37 | 0.12 | 6.99 | 0.37 | 0.08 | 3.36 | 0.22 | 1.57 | 0.41 | ND | **19.09** | ***5.5*** |
| **Negotiation skills** | ND | 10.66 | 0.83 | 0.10 | 0.41 | 1.25 | 0.61 | 0.80 | 0.14 | 0.12 | 0.32 | 0.10 | **15.34** | ***4.4*** |
| **Contract management** | 0.67 | 1.58 | 0.43 | 1.48 | 0.18 | 0.13 | 1.26 | 0.57 | 0.32 | 1.92 | 0.41 | ND | **8.96** | ***2.6*** |
| **Knowledge management** | 1.89 | 0.43 | 0.53 | 0.23 | 1.33 | 0.29 | 0.73 | 0.87 | 0.02 | 1.44 | 0.41 | ND | **8.17** | ***2.3*** |
| **Conflict management** | 1.82 | 0.41 | 0.95 | 0.33 | ND | 0.20 | 0.75 | 0.75 | 0.15 | 0.1 | 0.1 | ND | **5.55** | ***1.6*** |
| **Technical competencies** | (1.13) | (1.32) | 5.04 | (1.08) | (1.12) | (1.92) | 1.0 | 0.6 | 0.18 | 0.82 | 1.98 | (0.81) | **2.31** | ***0.7*** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ( ) | Negative emphasis | ND | Not Discussed | Bold numbers | Total percentage coverage | Bold and italics numbers | Coverage scaled to 100% |

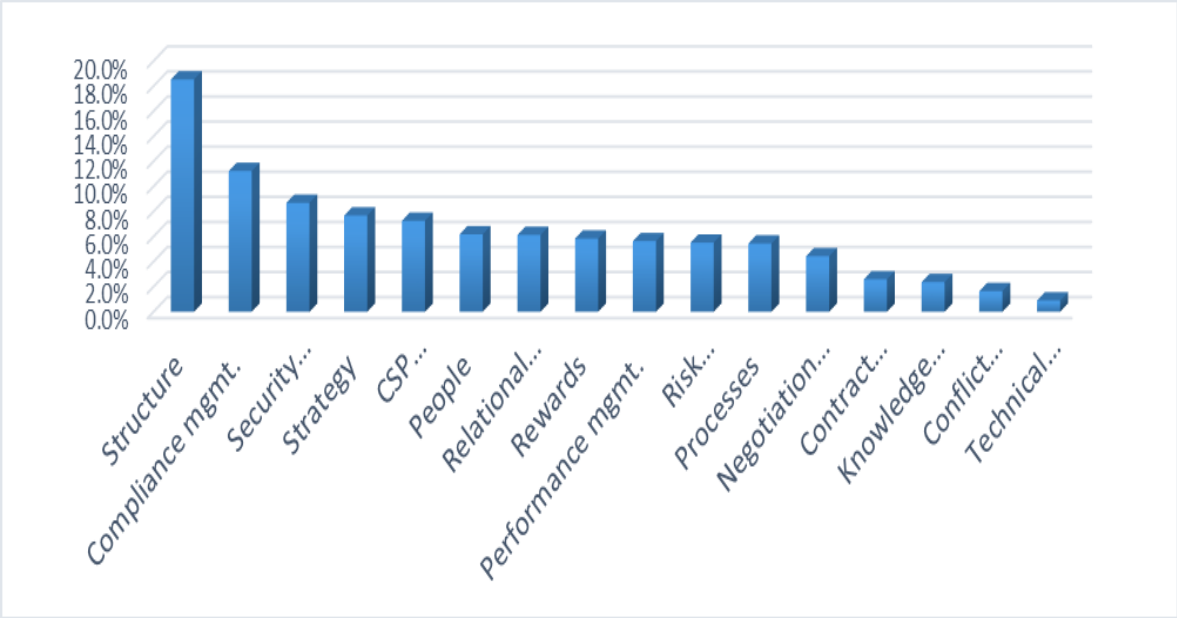



Figure 5.5: Success factor (T-version) validation- themes coverage

It was evident from table 5.7 that respondents have particularly put emphasis on the 'structure' and 'compliance management' success factors. 'Structure' impacts upon role allocation by helping in identifying people that can be allocated to IT controls in the cloud (as stated by R3), by distributing staff to different departments (R1) and by re-allocating their workload to different kinds of jobs (R4). 'Compliance' was also found to be a relevant factor especially with reference to the UAE context as UAE government has enforced data compliance restrictions on government organisations regarding storage of data outside the country.

Moderate emphasis (<10% and >5%) has been placed on 'security management', 'strategy', 'cloud service provider (CSP) management', 'people', 'relational mechanisms', 'rewards', 'performance management', 'risk management' and 'processes'. In contrast, relatively low emphasis (<5%) has been placed on 'negotiation skills', 'contract management', 'knowledge management', 'conflict management' and especially on 'technical competencies'. Lowest emphasis was placed on 'technical competencies'. Six respondents (R1, R2, R4, R9, R5, R8) said that since cloud computing reduces the requirement for the number of IT professionals, technical competencies are not required in such an environment.

### 5.3.1 Analysing interviewees' responses

This sub-section analyses each of the success factor (T-version):

**Factor: Strategy -** This factor received a very positive response with a coverage of 26.59%. While all respondents were in agreement with the inclusion of the 'strategy' as a factor, R6 emphasised this factor the most, while R2, R11 and R11 all considered this as very important (Figure 5.6). According the respondents' feedback, 'strategy' plays a significant role in roles and responsibilities allocation because it defines the cloud-based products adopted by the organisation, the mode of hiring people, creating a balance between differentiation/competitiveness and cost, and leads to tasks being performed.

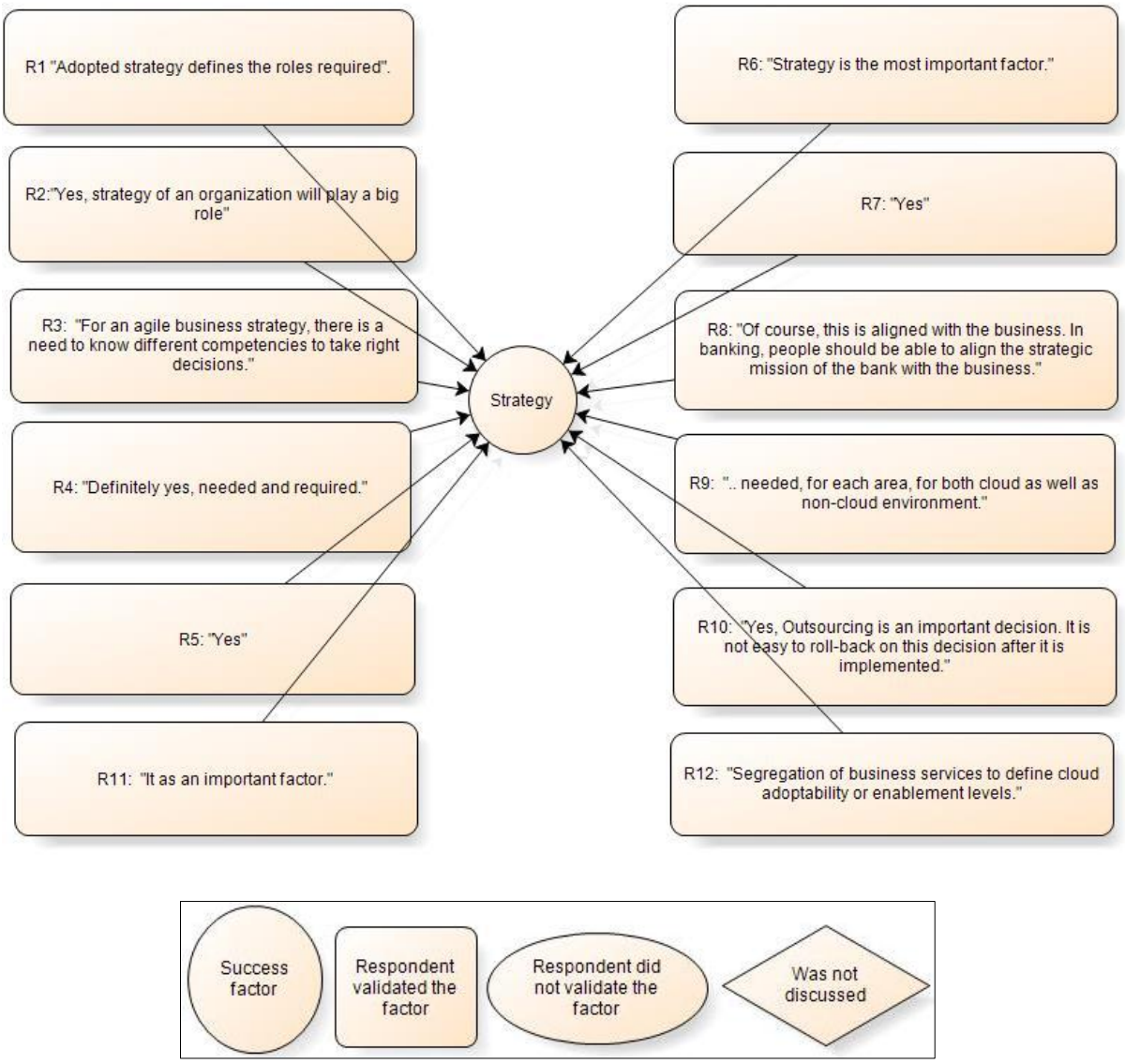



Figure 5.6: Validating 'strategy' factor

**Factor: Structure -** As can be seen in figure 5.7, all respondents were in favour of having this factor. R2 pointed out that cloud computing will change the types of jobs people are required to do, which will also impact on its allocations. R3 also voiced a similar opinion by stating (personal communication, September 03, 2015) that *"*As you move more and more things to the cloud, over a period of time the roles of the people who are managing IT will change*"*.

According to R3, 'structures' help in identifying people that can be allocated to IT controls in the cloud. R5 added by saying that people's specialisations such as 'shortlisting the vendors' will help in allocation and in deciding the type of cloud to select. R9 and R12 believe that this factor is applicable to both cloud and non-cloud environments. Six respondents (R1, R2, R4, R9, R5, R8) said that cloud computing will reduce the number of IT professionals required. Furthermore, migrating IT resources to the cloud will result in staff as well as organisational restructuring, (R1) in turn leading to restructured job specifications (R4). While everyone agrees that distribution of power has a considerable influence on the overall outcome of the delivery, R10 further added that the question of centralisation or de-centralisation is very organisation specific.

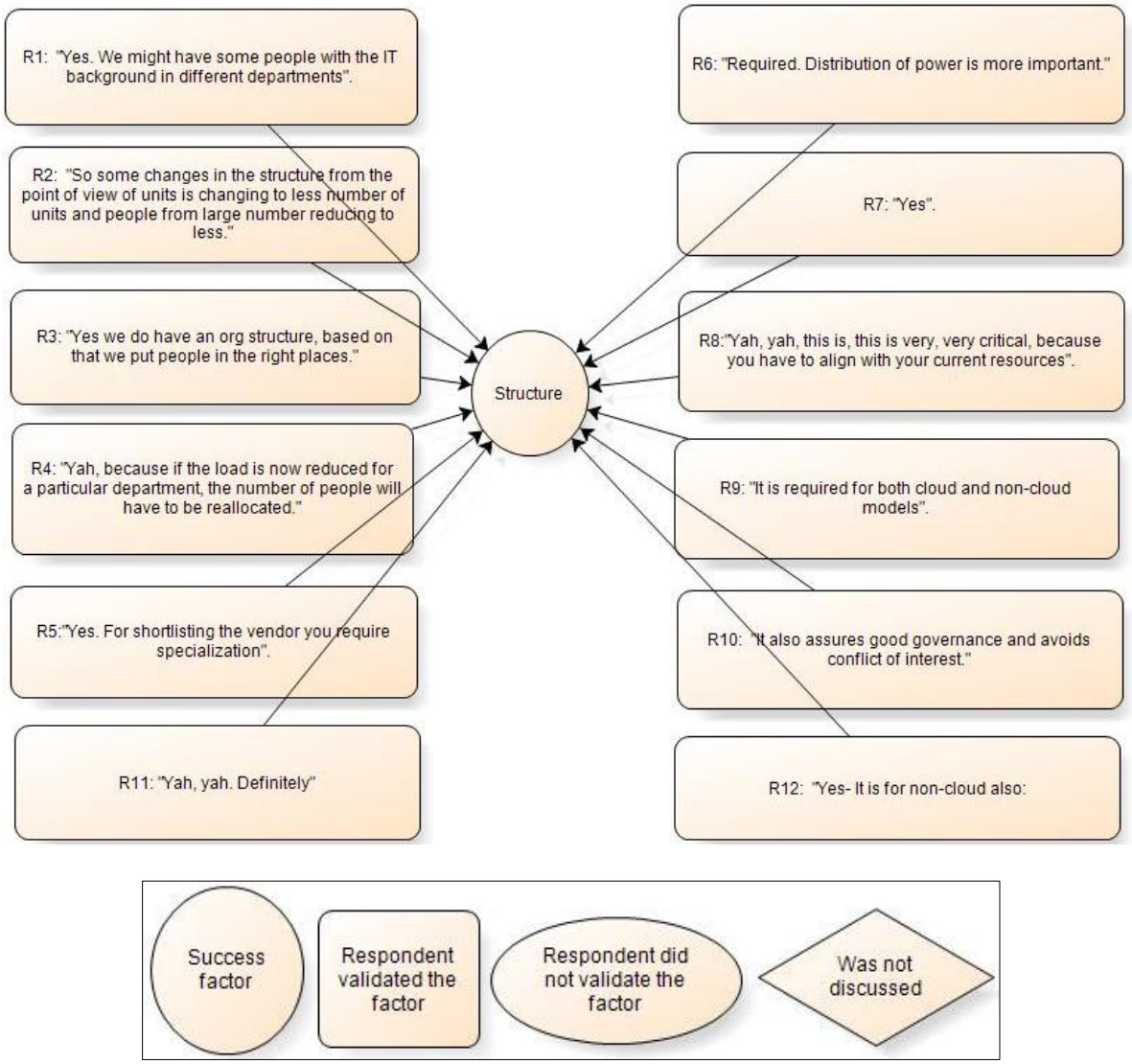



Figure 5.7: Validating 'structure' factor

**Factor: Processes –** 'Processes' is considered to be a significant factor by eleven respondents (Figure 5.8), especially when an organisation moves its IT resources to the cloud. R5 justified this by saying that internally it is easier to get processes changed, but to change a process that is on the cloud requires a formal request and making changes in SLAs. According to R2, since processes are outsourced to the cloud providers, organisations need to invest in fewer people but depend on people with skills for handling different set of processes. When moving onto the cloud, new processes are formed or the current ones undergo changes (R9, R6), by becoming simpler (R9). However, R9 believes that processes will not have an impact on the allocation of roles and responsibilities.

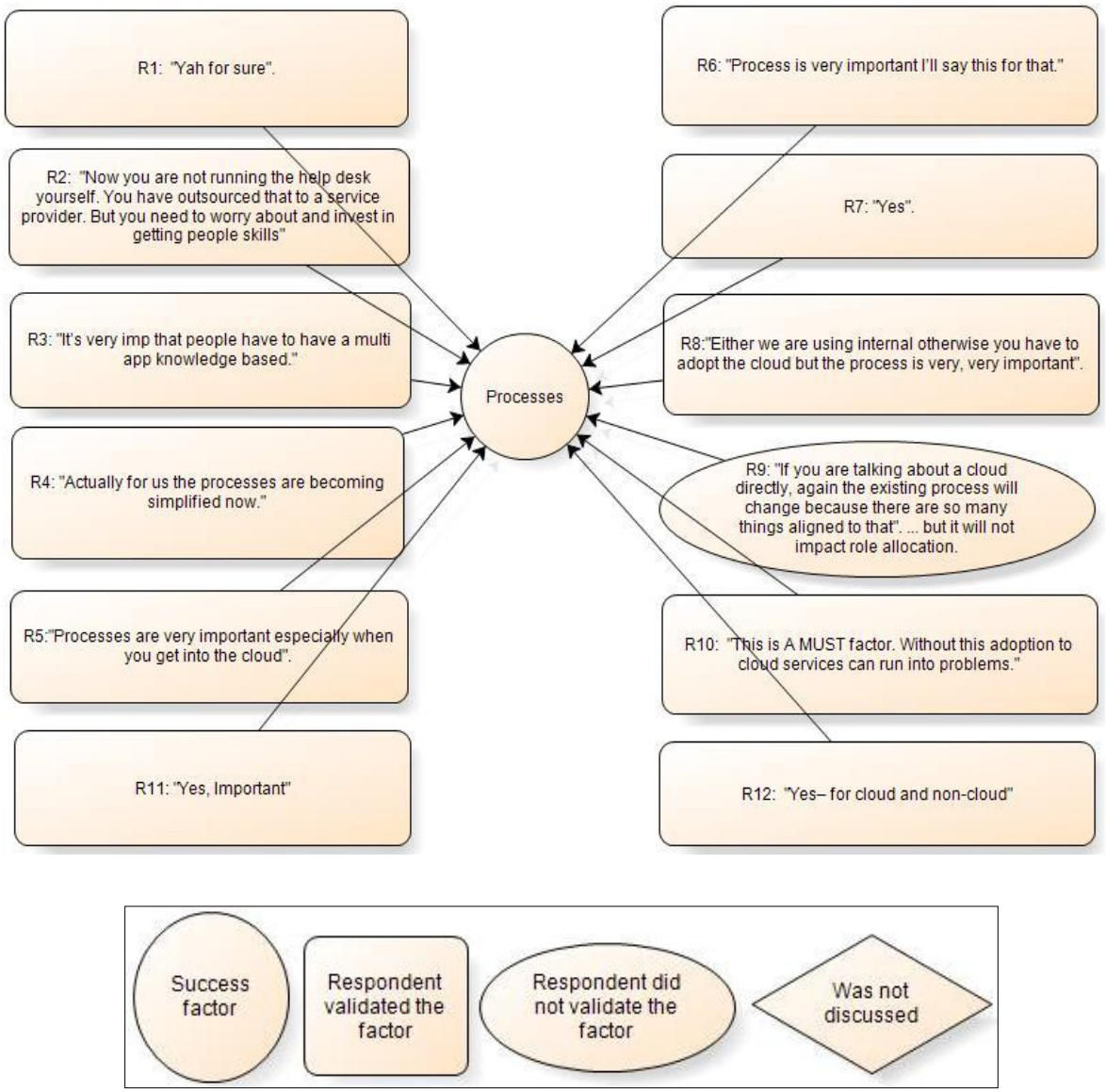



Figure 5.8: Validating 'processes' factor

**Factor: People -** As can be seen in figure 5.9, 'people' is a factor validated by ten respondents. Migration of IT resources to cloud results in reduced personnel requirements. Also, skill and capability requirements change (R4, R2). As stated by R2 (personal communication, November 23, 2015):

> When you have an email system on premise you would need to have a system administrator. You will need to have windows administrator, you would need to have Microsoft exchange administrator, right? But when you take this to a cloud, these roles will diminish.

What is required is to either train existing staff or to replace them with people having required skills and capabilities (R2, R8). Due to the new technology, it is also important to have job rotation, so as to have a backup staff with a particular skills (R8). Moreover, IT staff assigned to cloud resources need to have the right kind of skills and to be up-to-date with the cloud

technology because they are the ones answerable to the organisation rather than the cloud providers. Therefore, having people with the right skills is vital for successful cloud ventures (R5). From a strategic perspective, the practised core values and culture of the organisation determine employees mind-set to take strategic decisions (especially in generic role allocation) and know the balance between tactical versus strategic decisions (R10).

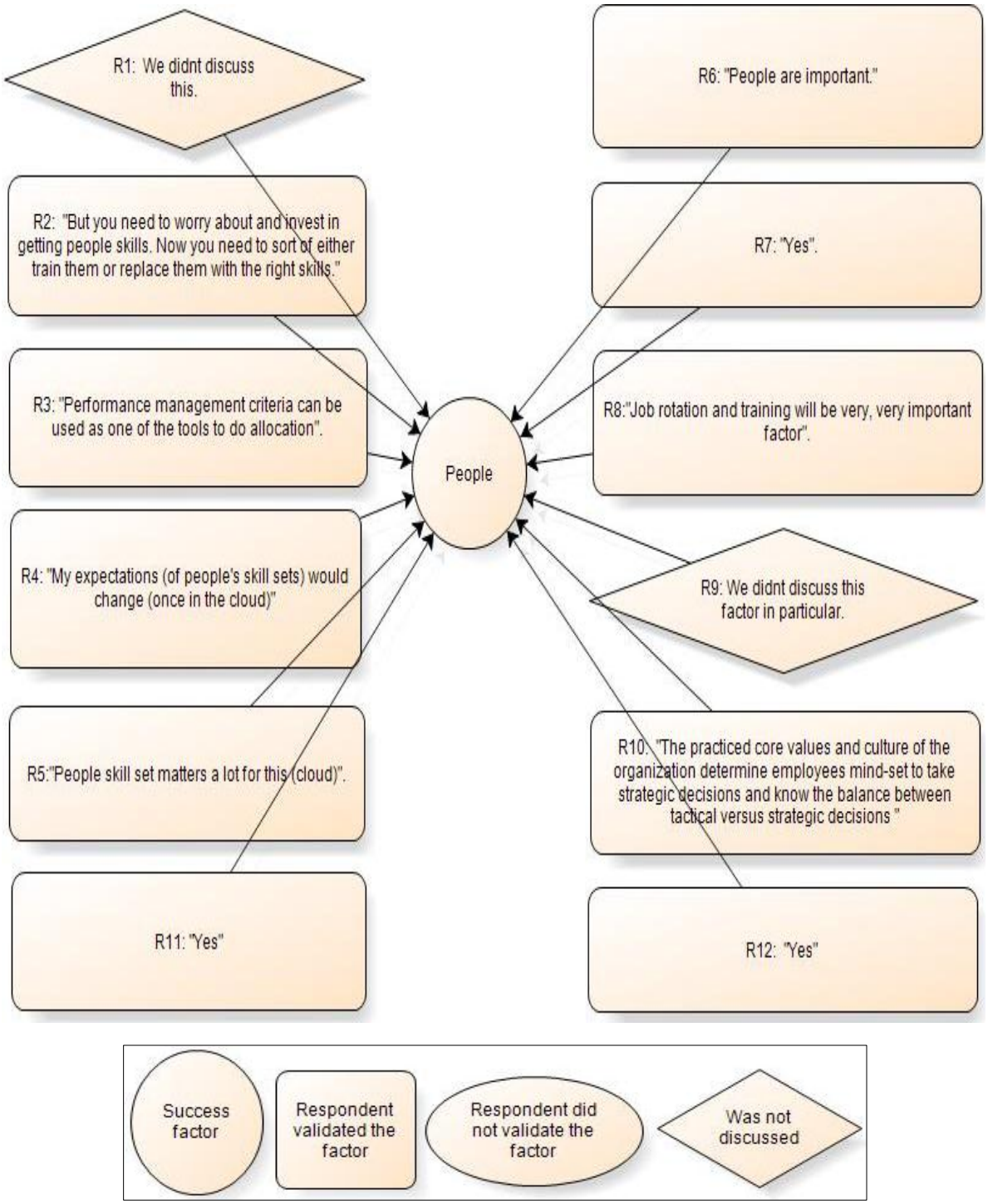



Figure 5.9: Validating ‘people’ factor

**Factor: Rewards -** All respondents, except R1, with whom it was not discussed, approved 'rewards' to be a factor in role allocation, with R5 and R6 considering it to be vital (Figure 5.10). Among other motivational factors, training staff for the cloud related processes has also been identified as a reward (R8). They find it rewarding and motivating to learn new challenging technologies, they are satisfied that the organisation is investing in them and it also gives them an opportunity for growth (R2) and a challenge in their work (R4). While as a suggestion for improvement, R5 and R12 feels that it ('rewards') should be a part of people factor; R6 thinks that it should be a part of 'strategy'; however R9 feels that this factor is similar to 'relational mechanisms' (job rotation).

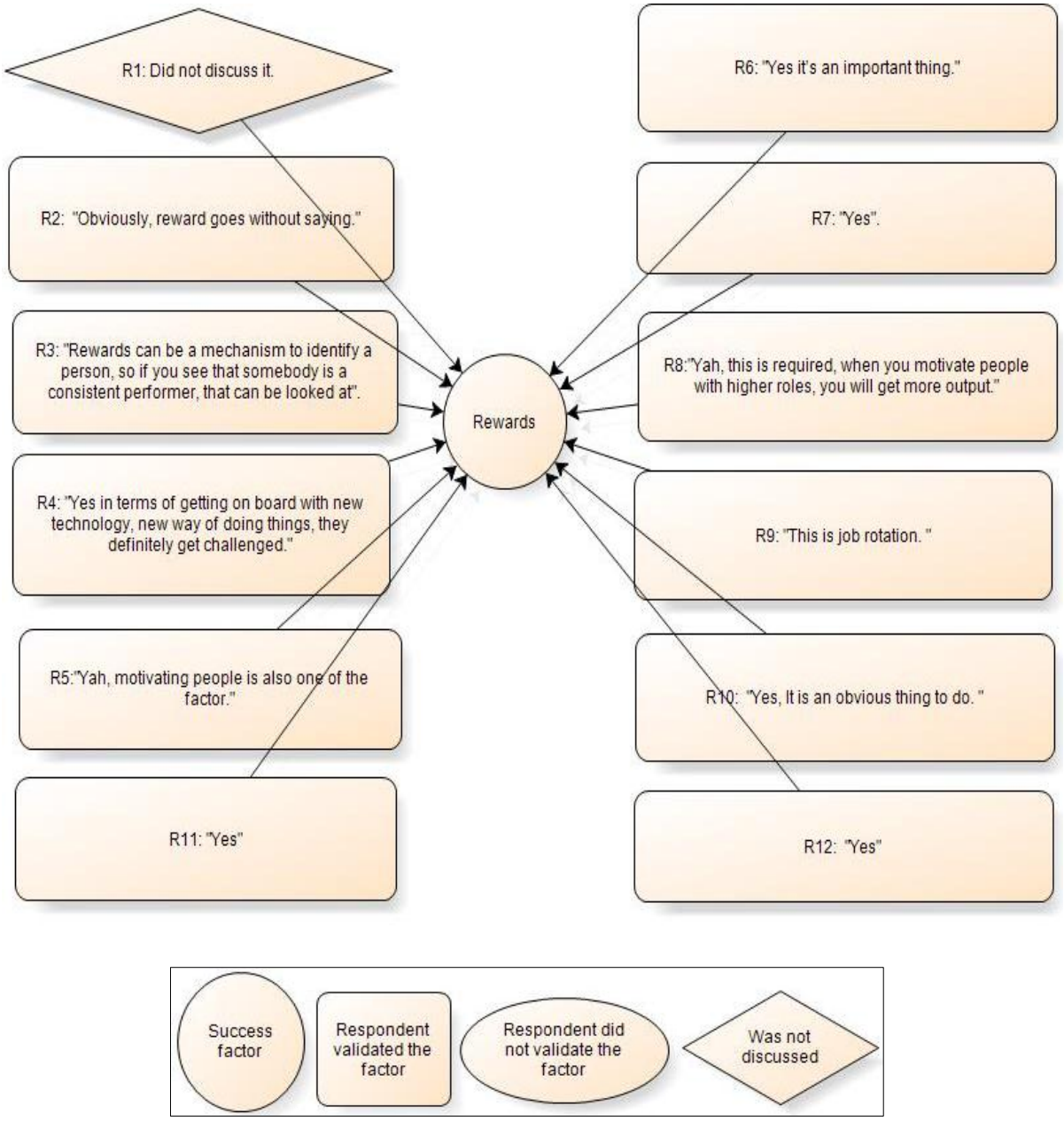



Figure 5.10: Validating 'rewards' factor

**Factor: Relational mechanisms –** 'Relational mechanisms' was validated by all respondents and identified as one of the main factor by three respondents (Figure 5.11). IT staff being more knowledgeable and experienced in implementing systems across multiple departments and organisations (R3) forms the core IT department (R1) that controls the cloud implementation and provides suggestions for modifications based on best practices from various other industries (R3). At the same time, domain experts from other departments, that are IT savvy, will be picked up and allocated to IT controls too (R2, R3). Since these people know the business processes, the cloud becomes easier to implement (R3). People are also allocated to IT controls on the basis of job rotation, so as to share best practices from highly qualified people or to give others an opportunity to grow (R9).

While HI feels that 'relational mechanisms' factor depends on the type of cloud services adopted by the organisation, R6 argues that relational mechanisms are subject to the experience of a person in the organisation and R10 believes that it to be influenced by the size and complexity of the organisation.

All interviewees supported the inclusion of this factor in the success factor (T-version) list. 'Relational mechanisms' are believed to be useful for the easier implementation of cloud by domain experts, for teamwork and collaboration among staff within the IT department, for job rotation to give people to share best practices or to give others an opportunity to grow.

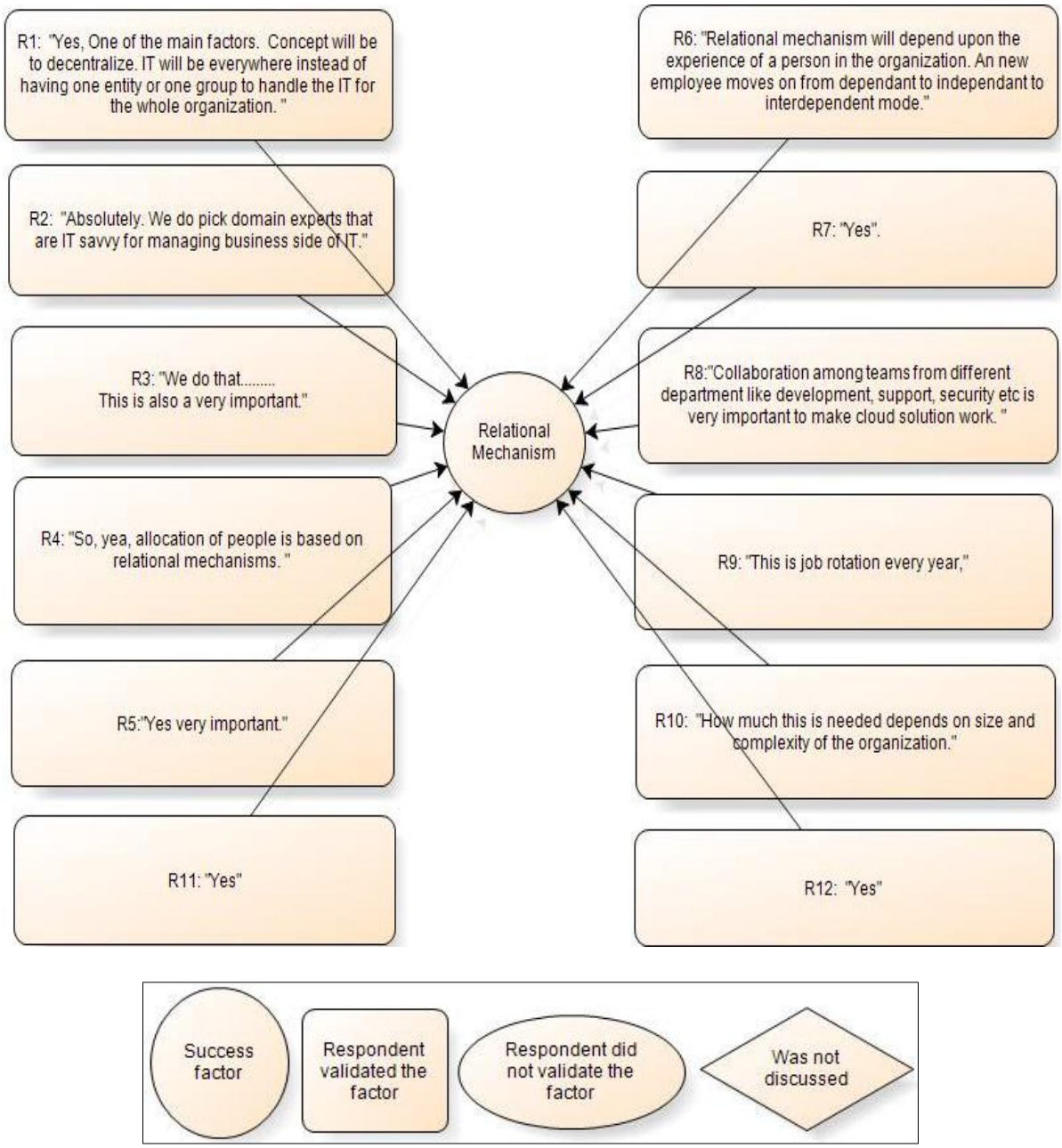



Figure 5.11: Validating 'relational mechanisms' factor

**Factor: Risk management – '**Risk management' is considered to be relevant by R5, R6 and R10 (Figure 5.12). In this regard, R3 feels that the knowledge of risk, compliance and SLA management is important for people allocated to cloud related tasks. Some of the risks identified include service provider site or link going down and legal implications of moving into cloud (R5). While R7 points out that organisations have project management office (PMO) specifically for this job, R8 believes that risk is managed at the organisation level by the "IT governance, Risk and Compliance (ITGRC)" department and R10 recommends organisations to seek appropriate specific CSP subject matter experts from legal and contract management function to identify risks.

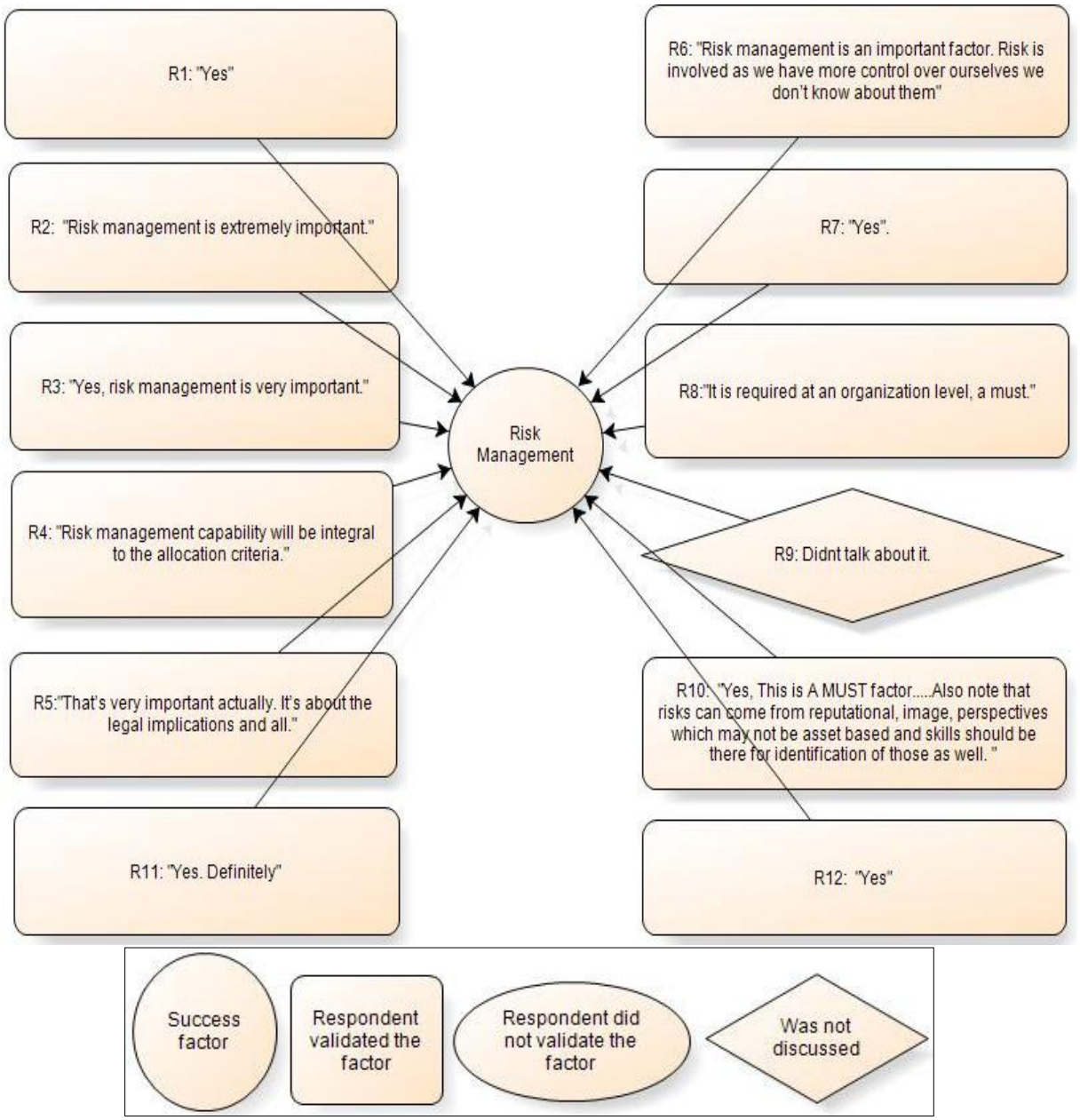



Figure 5.12: Validating 'risk management' factor

**Factor: Compliance management -** While all were in agreement with having this factor on the list, R3, R2, R1, R4, R6 specifically mentioned its requirement (Figure 5.13). Compliance is not necessarily a part of the IT department. Mostly in bigger organisations, compliance often is a third party entity reporting to the legal department (R4). It is also required to have a good understanding of government policy and the evolvement of technology as a whole that can have an effect on the CSP and thereby the content in the cloud (R10). In this regard, the UAE government has introduced data compliance restrictions, for example requiring data to be stored only within the country (R2). Organisations need to obtain assurance from cloud providers that they are not going to share customer data or information with somebody else. They also require assurance on their ethical practices and compliance with the laws of the

country (R2). They also need to be aware of how the evolvement of technology as a whole can have an effect on the CSP and thereby the content in the cloud (R4). The number of personnel allocated to handling compliance management depends upon the size of the organisation (R4). In large organisations, there are separate departments that handle compliance requirements (R5), while in the small organisations, small teams of staff audit compliance. Irrespective of the size of the team, knowledge of compliance and risk management is very important (R4, R5). Moreover, it all also depends on the model used, for example private or public, SaaS, PaaS, or IaaS (R4).

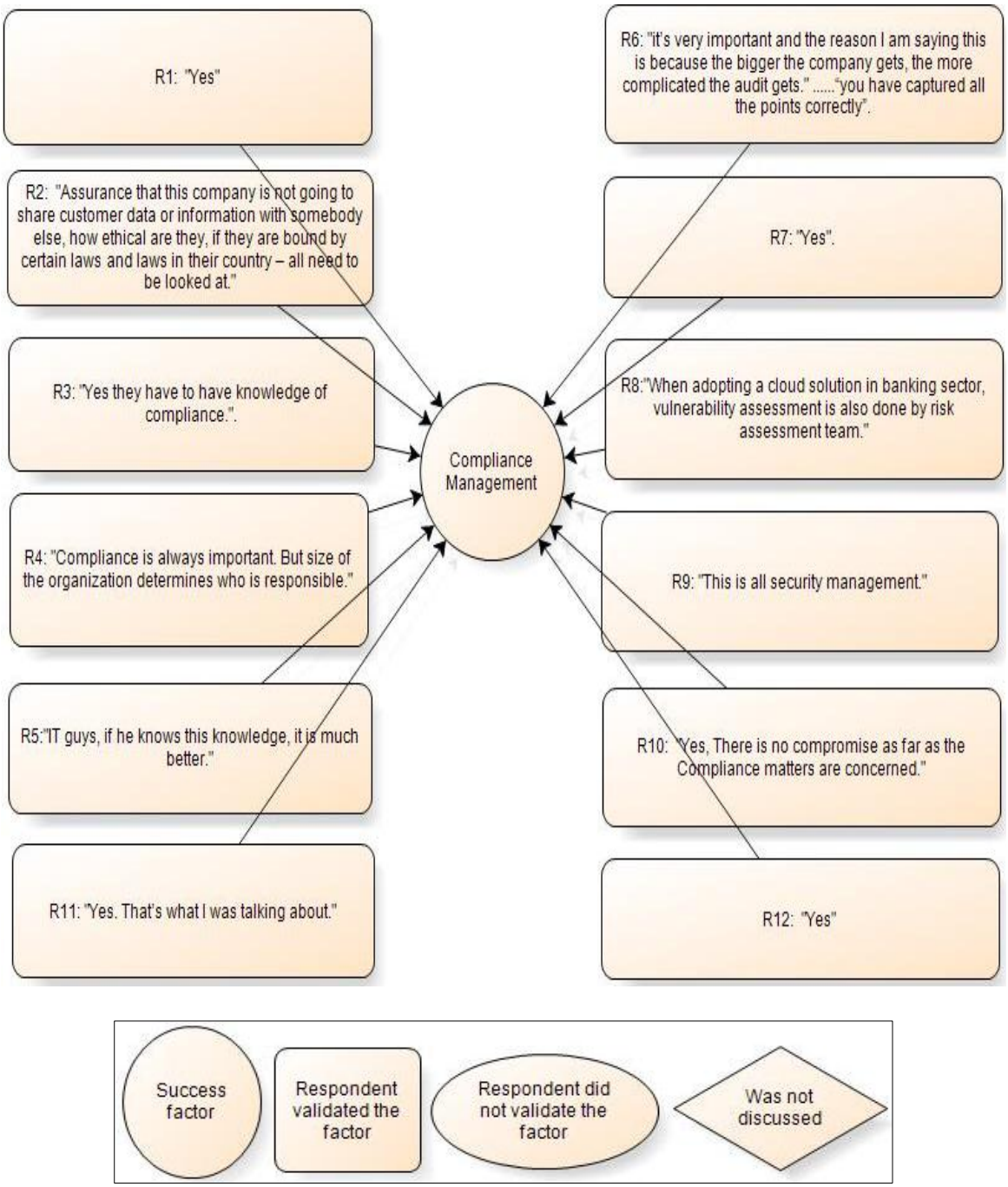



Figure 5.13: Validating 'compliance management' factor

**Factor: Security management** – 'Security management' is considered to be a very important factor (R5, R6, R3) and it goes hand-in-hand with compliance (R6). R6 feels that security depends upon on the kind of cloud model adopted.

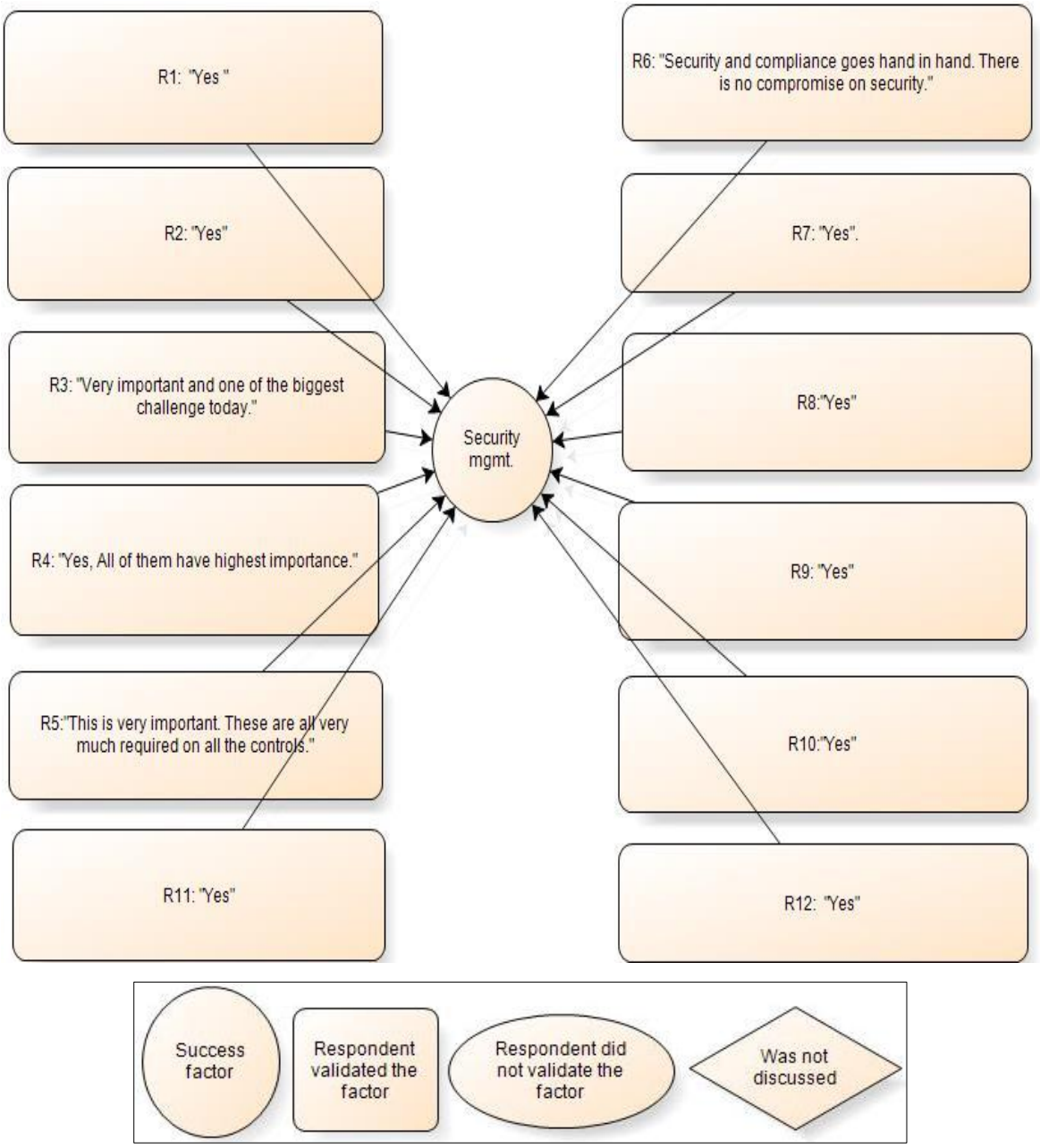



Figure 5.14: Validating 'security management' factor

**Factor: CSP Management** - Three participants (R12, R5, R3) are of the view that 'CSP management' should be considered to be part of vendor management (Figure 5.15). Two participants believe that CSP should be part of security, risk and compliance management (R5, R4). Organisations have to evaluate, select and deal with more than one cloud vendor, therefore making it vital to have vendor management skill (R4). CSP evaluation is very important

to mitigate risk (R4). Vendor management skills are needed to ensure that the service provider is sharing its strategic road map that they have for the business, otherwise customers will have no idea about the financial health of the provider. There should be a contracting team, or a legal team that is able to look at legal contracts very carefully and a team that can look at the service level agreements and monitoring of the service level agreements (R2). It is important for people to be able to know the competency level and strengths of different cloud providers in terms of security and data confidentiality for example. (R8). As a precautionary measure, some organisations in UAE are only selecting reputed cloud vendors like Microsoft or Oracle (R4).

According to HI, security management, regulation and compliance are important when shortlisting a vendor. By default, it not expected to have in-house technical experts or even for the middle management staff within IT to have CSP management ability. Depending on the scale of the cloud model in question, organisations may seek consultancy assistance to evaluate CSPs (R10).

Evaluating a cloud provider is dependent on multiple dimensions, including support, distribution channels, experience (R6) and data centre locations (R9). Therefore, it is important that people are able to evaluate clouds based on all these factors as well (R6). R9 believes that this skill is more important to lean organisation structures, which depend heavily on vendor solutions (R9). It was clear that respondents preferred to call 'CSP management' factor as 'vendor evaluation and management'.

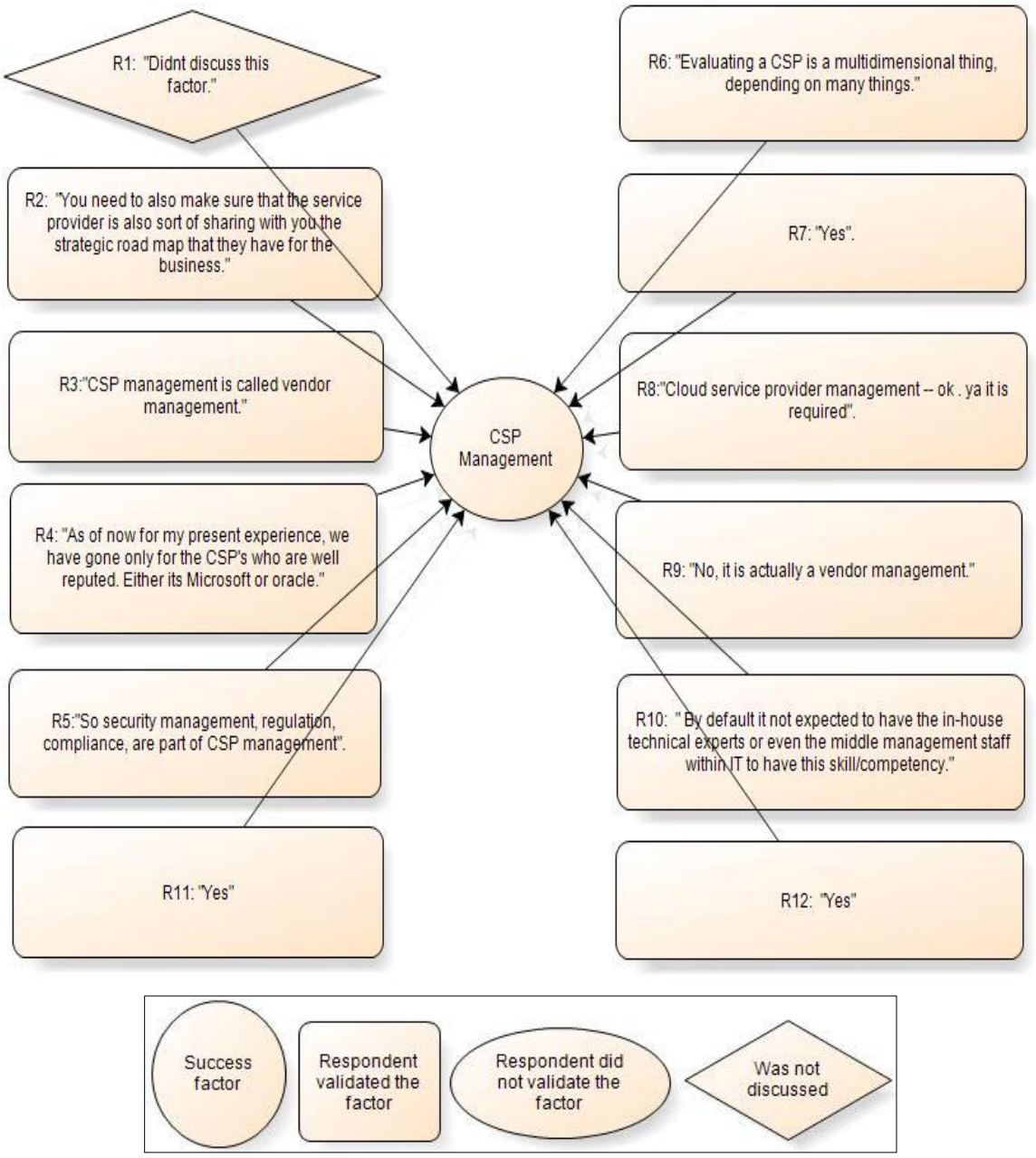



Figure 5.15: Validating 'CSP management' factor

**Factor: Contract Management – '**Contract management' factor is considered an essential factor by all, except R9, with whom it was not discussed, and mandatory by R10, R8, R5 (Figure 5.16), for ensuring secure and optimal availability of the services. R2 feels that contract development only needs to be done once', whereas it needs to be monitored and its performance needs to be measured in the form of Service Level Agreements (SLAs). R3 clarified that writing SLAs and contracts is the most important part of contract development and management. R6 prefers to involve IT rather than procurement staff while writing contracts, because procurement staff are not aware of the actual tasks to be done and therefore it can be very challenging for the IT staff with regard to implementation or performance monitoring.

R10 believes that contract development is a joint responsibility for legal and contract teams. Legal/purchasing departments in organisations also need to possess necessary the skillsets for this. Other possible clauses may for example include exit clauses, switching process to another CSP, Business Continuity Management (BCM) needs, SLA for updates, licensing and metering costs and the right to audit. IT would consider access rights, data ownerships and SLAs from the risk management perspective (R4). Therefore, it becomes part of risk and compliance (R4).

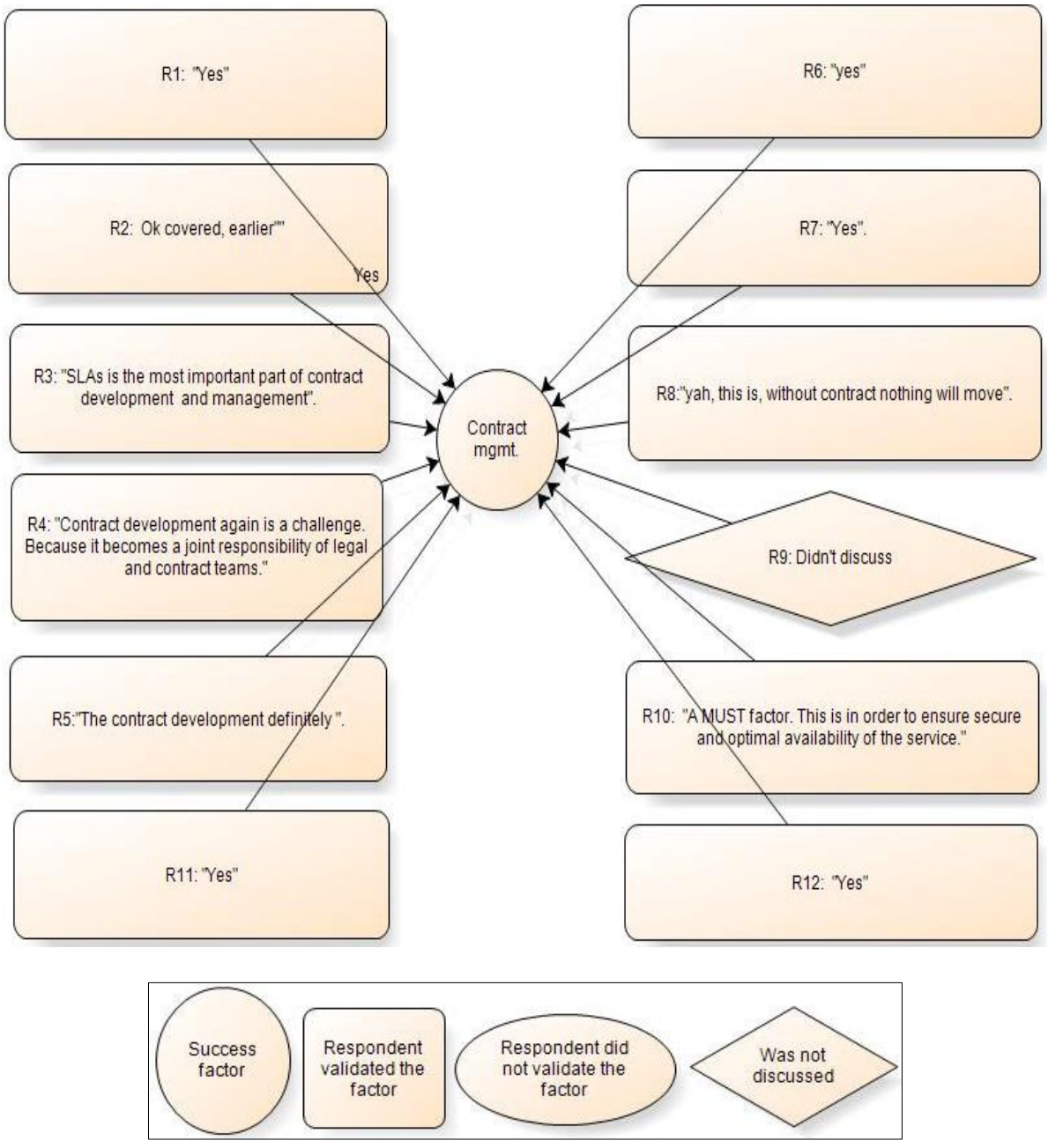



Figure 5.16: Validating 'contracts management' factor

**Factor: Technical competencies -** While six respondents (R3, R10, R12, R11, R6 and R7) find it appropriate to include 'technical competencies' as a factor, the remainder of the respondents disagreed with its inclusion (Figure 5.17). While R5 feels that this skill is not required, R2 and R4 narrated that skill requirements are shifting from administration to business skills. R4 articulated that cloud computing is changing people's roles from technology to administration by stating (personal communication, October 06, 2015):

> The roles definitely changes, they become more administrative. They just login into the admin console and you know, and assign permission, upgrade uses and things like that. They get away from a lot of other tedious work of doing patching for the servers, taking backups.

While R3 justified its inclusion for the purpose of integration, R4 refuted this by adding that integration has not been an issue because of the availability of vendor's white papers and the facility of vendors deploying the solutions. R9 also argued that even a person with business skills or domain knowledge could facilitate the integration part. He further added that cloud vendors do not even like to give customers access to their technical aspects.

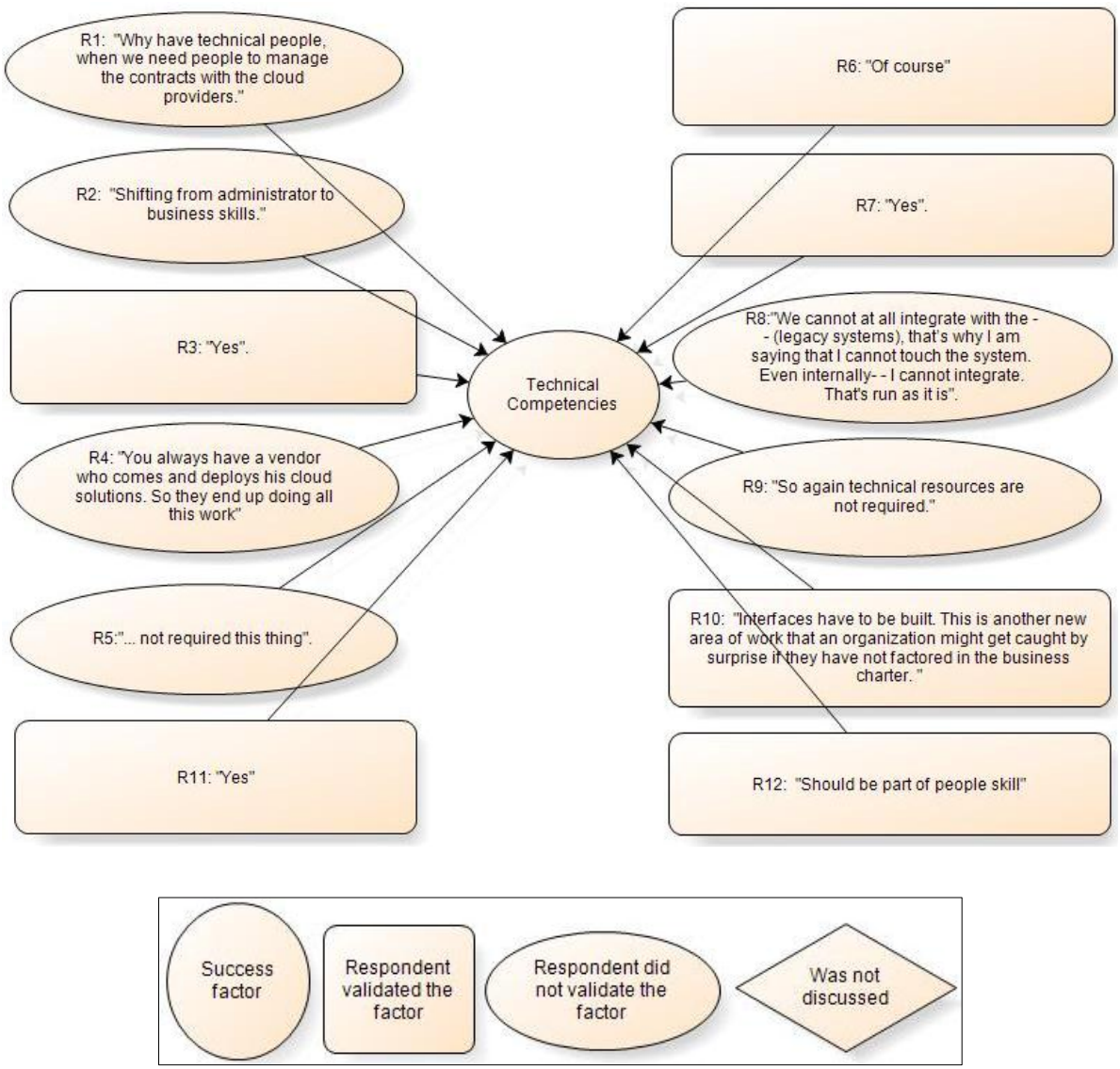



Figure 5.17: Validating 'technical competencies' factor

**Factor: Negotiation skill –** R5, R3, R12 and R6 stated that 'negotiation skill' is needed to negotiate on money, contracts and SLA agreements with cloud vendors (Figure 5.18). R4 differs in opinion by saying that (personal communication, October 06, 2015), "in terms of contract you really can't negotiate much. Cloud vendors come up with their own contracts leaving no room for negotiation". According to R4, negotiation can be made in terms of financial aspects only. Furthermore, R4 gave suggestions on improving negotiation power by having market awareness on the best time of the year to negotiate, the resources used by the peers in industry and discounts they receive. While R10 stated (personal communication, August 23, 2015) that "this skill [negotiation skills] is a must to safeguard the interests of the organisation and its shareholders", R8 describes this skill as an inborn talent.

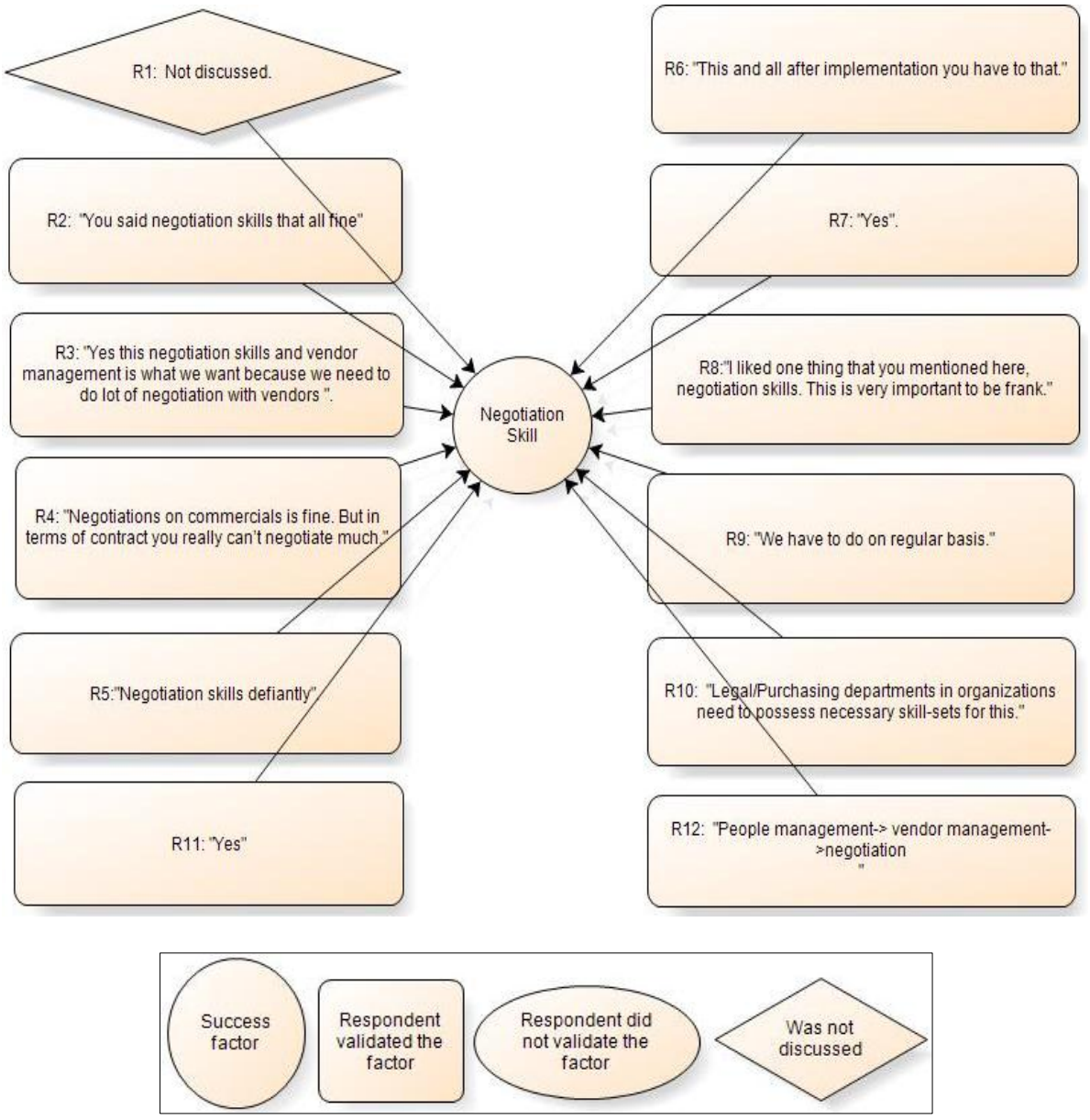



Figure 5.18: Validating 'negotiation skills' factor

**Factor: Performance management –** R1 anticipates a person with 'performance management' competency as someone in a cloud environment who can understand the business and work on providing quality service provisioning. According to R1, there is an increased need for personnel capable of handling service provisioning quality.

While R3 favours the presence of this factor, R5, R4, R2 and R6 consider this a very important factor (Figure 5.19). R8 considers 'contract' and 'performance management' as the same. According to R8, quality level requirements are to be drafted in the form of SLAs. Cloud providers not meeting the required performance levels are penalised with fines, which also needs to be written in SLAs. However, R4 reported that it is very challenging to track cloud service SLAs. According to R2, organisations need to have capability to have continuous

monitoring of SLAs when it comes to performance. Contracts need to be measured against the performance and to ensure quality of service from suppliers. R10 added that organisations need to scale up or fine-tune their current available skills to have this capability. R2 finds quality, service level agreement, legal aspects about privacy of data and privacy of information extremely important. Overall, he ranked quality of a service, as well as quality management, as extremely important.

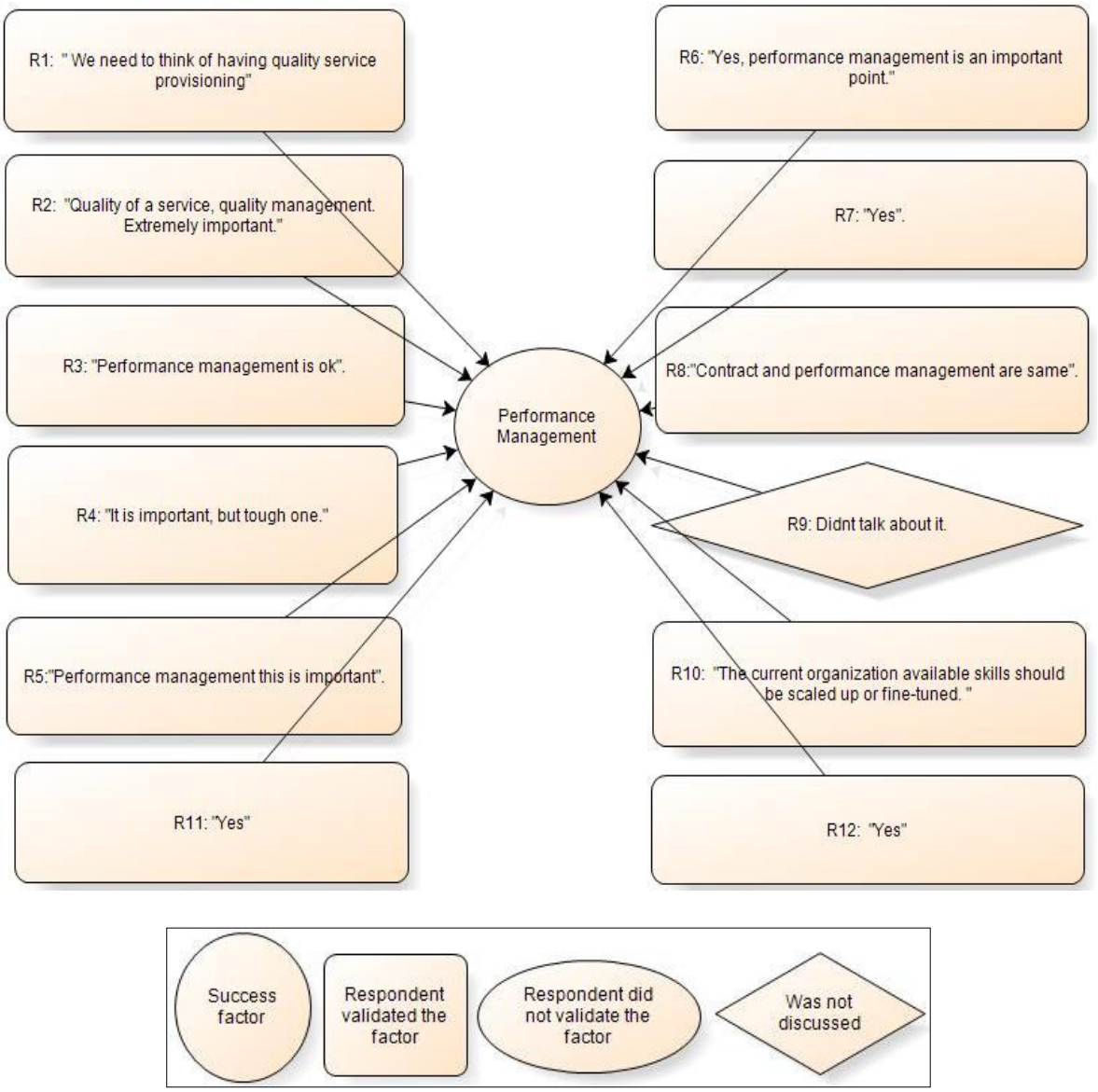



Figure 5.19: Validating 'performance management' factor

**Factor: Conflict management -** All respondents accepted the inclusion of 'conflict management' in the list (Figure 5.20). However, while R1 relates it to customer management, R3 and R12, relates this to 'vendor management', R10 to 'contract management' and R5 to 'supply chain management'.

According to R3 (personal communication, September 03, 2015), "Firstly, people need to have skills to evaluate cloud vendor, thereafter negotiate the contract/SLA, and then be able to manage any sort of conflict with them". R10 added "due to termination of the contract. If the CSP goes bust, or if the CSP does not perform, then it is not easy to switch between CSPs". R6 did not consider this factor as very important and therefore suggests reducing its weight.

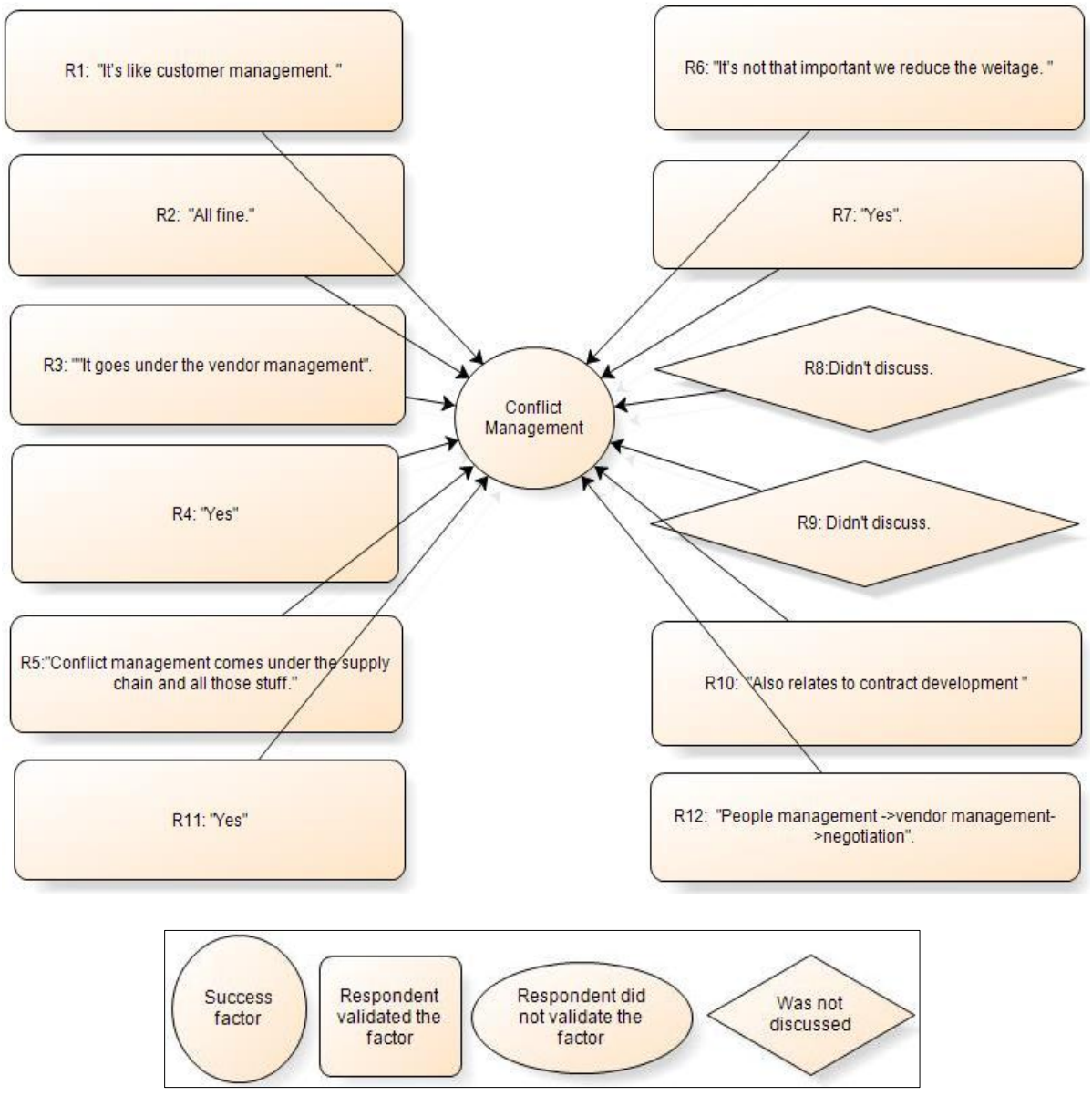



Figure 5.20: Validating 'conflict management' factor

**Factor: Knowledge management -** Respondents consider 'knowledge management' as important (R6) or a required factor (R1, R5, R7, R11, R12, R8, R2, and R4) (Figure 5.21). However, R3 considers it to be part of 'vendor management'. While sharing of knowledge

between the cloud user and vendor is encouraged, knowledge management is considered essential especially for cloud users (R6). Knowledge management competencies allows the cloud user to have better understanding of the market conditions and thereby puts them in a stronger position to negotiate on terms and conditions (R4).

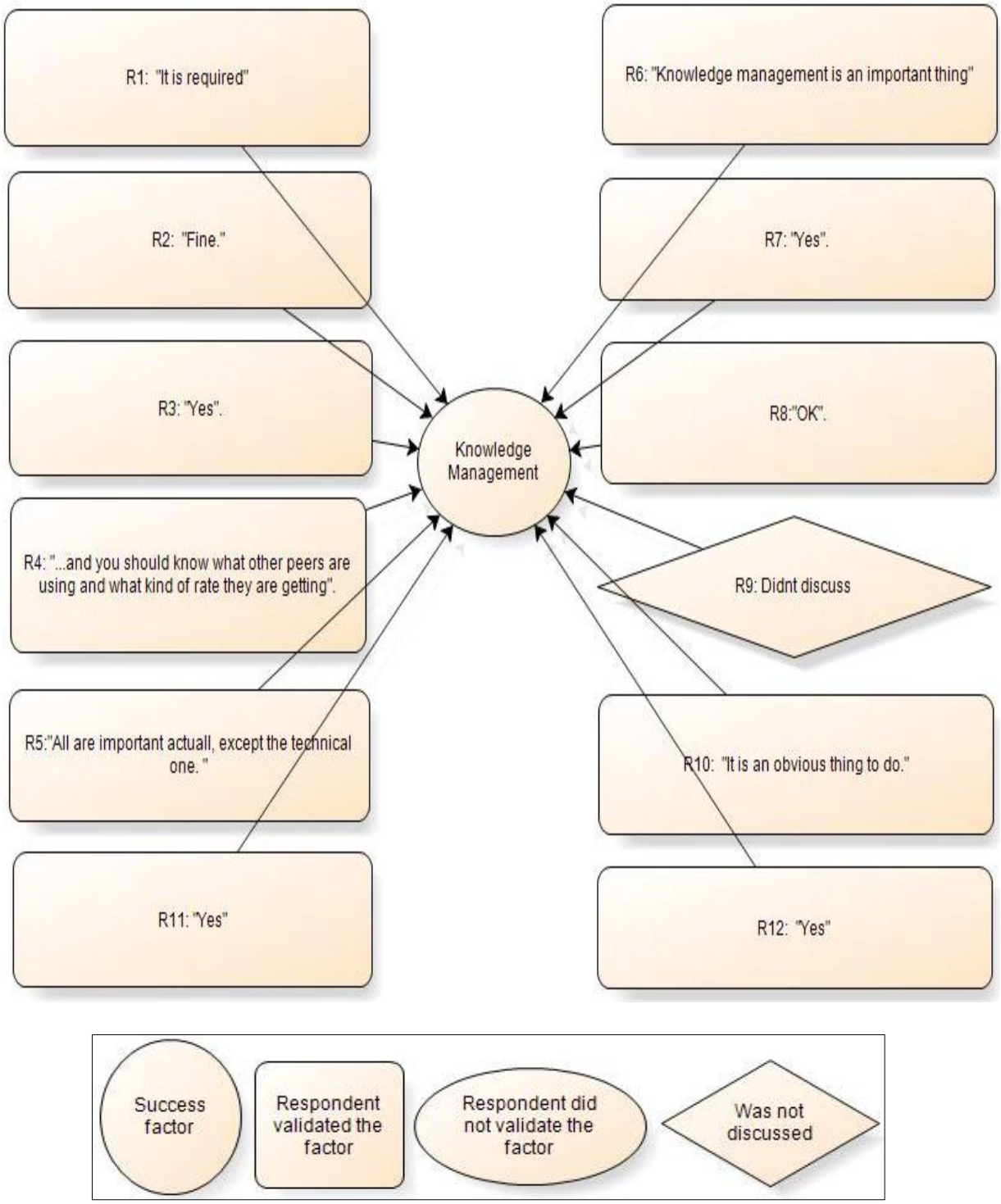



Figure 5.21: Validating 'knowledge management' factor

## 5.4 Conclusion

Analysis of respondents' data in phases one and two (Table 5.8) revealed that they not only support the validity of the success factors (T-version), but also the success factors extracted from their own organisational context align with those of the success factors (T-version). However, phase-1 results did not support 'relational mechanisms', 'negotiation skills' and 'conflict management' themes, instead added an extra theme called 'change management' to the list. Phase-2 results do not put much emphasis on 'technical competencies' as a factor for the role allocation. Therefore, it was observed that all emerged themes (Table 5.6), except 'change management', are embedded directly or indirectly in the induced themes of success factors (T-version) (Table 3.6). However, since 'change management' (table 5.6 discussing about people's abilities to handle the change) does not relate to the predetermined themes in the success factors (T-version), it was added to the updated list as an additional factor. Based on the respondents' feedback, 'CSP management' was renamed as 'vendor management'.

Table 5.8: Comparing success factors (T-version) with the phase - 1 & 2 results.

| Success factors (T-version). | Strategy | Structure | Processes | Relational mechanisms | Risk management | Compliance management | Security management | Vendor management (CSP management) | Contract management | Technical competencies | Negotiation skills | Performance management | Conflict management | Knowledge management | Rewards | X |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Phase-1** | ✓ | ✓ | ✓ | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | x | ✓ | x | ✓ | ✓ | Change management |
| **Phase-2** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |

The results of both phase 1 and 2 found substantial validation of the success factors (T-version ), which supports the factors derived from theory, with and addition of one more factor ('change management'). These results also helped in redefining factors making them more relevant to the cloud environment. Table 5.9 presents validated success factors termed as success factors (V-version).

Table 5.9: Validated success factors (V-version).

| Success factors | Definitions |
|---|---|
| **1. Strategy** | Defines whether to build capabilities (like skills, processes, technologies, human abilities) internally or exploit external capabilities. It defines the tasks to be performed. |
| **2. Structure** | Determines the location of decision-making power and authority by setting out the reporting relationships, power distribution, and communication channels |
| **3. Processes** | When moving to the cloud, processes undergo changes requiring people to have different skills for handling different set of processes, crossing the organisational boundaries. |
| **4. People** | Fundamental set of competencies, skills and mind-sets required from employees at all levels. |
| **5. Rewards** | People are rewarded by allocated them to cloud related tasks, as it gives them an opportunity for growth, motivation, recognition and challenge of learning new technology. |
| **6. Relational mechanisms** | Role and responsibilities allocation will be made to build interpersonal and collaborative relationships among units and organisations. |
| **7. Risk management** | Competencies/skills to identify and manage all potential critical, legal and compliance related risks associated with clouds. |
| **8. Compliance management** | Competencies to ensure compliance to internal as well as external policies, regulations and accountability mechanisms, when operating in the cloud. |
| **9. Security management** | Competencies to evaluate cloud vendors to ensure deployment of security mechanisms related to information assurance, data privacy, data confidentiality, ownership and technology related issues. |
| **10. Vendor evaluation & management** | Competencies and skills to evaluate and manage cloud vendors |
| **11. Contract management** | Skills to develop and manage contracts for effective SLAs, pricing, access rights, data ownership, risk management and for ensuring the availability of data and reports. |
| **12. Technical competencies** | Competencies to coordinate with the cloud provider and integrate cloud services with the existing systems. |
| **13. Negotiation skills** | Skills to negotiate the contact terms to ensure the firm's rights and obligations for both parties. |
| **14. Performance management** | Competencies required for setting quality levels, monitoring the CSP against the SLAs and rating the CSP performance. |
| **15. Conflict management** | Skills to assess and avoid negative impact of establishing new business ties or terminating the existing business with a CSP. |
| **16. Knowledge management** | Skills to share knowledge between cloud user and vendor, both ways, to build trust which will result in improved commitment and therefore better results |
| **17. Change management** | Allocation is based on people's aptitude, ability to take up challenges and readiness to adopt the new technology |

# CHAPTER 6

# DATA COLLECTION AND ANALYSIS – 2

# 6 CHAPTER 6: DATA COLLECTION AND ANALYSIS – 2

Chapter 5 focused on exploring, and validating the success factors (T-version) by undertaking an intra- and inter-case analysis of the collected data. This examination resulted in validated success factors (V-version) which are also cloud relevant. This chapter went a step further to uncover the various implied statements by following the domain analysis in the last two steps (creating patterns and assembling structures) of the proposed analytical framework.

Clear and unambiguous definitions of the roles and the responsibilities of the involved parties are a crucial prerequisite for an effective ITG framework. It is the role of the Board and Executive management to communicate these roles and responsibilities and to make sure that they are clearly understood throughout the whole organisation (ITGI, 2001). Success factor validation was conducted among IT practitioners at the decision making and executive levels. However, "IT Governance effectiveness is only partially dependent on the CIO and other IT executives, and should be viewed as a shared responsibility and enterprise-wide commitment towards sustaining and maximising IT business value" (Peterson, 2004, p. 42). Therefore, the Delphi technique was used not only to further validate the success factors through people working at operational levels (within IT and business management), but also to rank them, thereby making them more relevant to the public cloud environment.

This chapter is broadly divided into two sections. Section 6.1 analyses and interprets the interview data by creating patterns of related themes followed by assembling of the structures, resulting in validated and refined success factors (VR-version). In section 6.2, the success factors (VR-version) are subjected to a Delphi technique, thereby resulting in final validated, refined and ranked success factors (VRR-version), for the allocation of roles and responsibilities of IT controls that have been migrated to the public cloud.

## 6.1. Analysis and interpretations

The first three steps of analysis, conducted in chapter 5, supported the success factors (T-version). However, there was a need to focus on a case-by-case analysis to uncover various implied patterns among the success factors, leading the researcher to the last two stages (stage 4 and 5) of the analysis.

### 6.1.1. Stage 4: Creating patterns

Stage 4 of the analysis mainly involves creating patterns by grouping factors/themes that seem to be related to each other in a meaningful way (LeCompte, 2000). Table 6.1 illustrates the planned strategies and the actual steps taken.

Table 6.1: Steps in stage 4: Creating patterns (audit of analysis plan: stage 4)

| Strategies (actions planned – detailed in table 4.6) | Actual Steps Taken |
|---|---|
| All of the categories that relate to one other and that lead to a similar explanation will be joined together to create a pattern.<br><br>Undertake identification of patterns formed with categories that link with the same construct.<br><br>Inclusion of patterns that the researcher has derived from the literature review. | These three aspects are covered in section 6.1 |

The researcher observed that the validated success factors (V-version) (Table 5.9) were not mutually exclusive but that they were overlapping and inclusive, as the interview respondents implicitly and explicitly stated. Therefore, to find the relationship between the factors, the researcher conducted domain analysis (Spradley, 2016) by choosing a domain (success factor) first and then searching the data using the semantic relationship to find attributes of the domain (or success factor). Based on the respondents' opinion and domain analysis, the researcher identified the relationships between the success factors, thereby resulting in the creation of patterns (Figure 6.1).

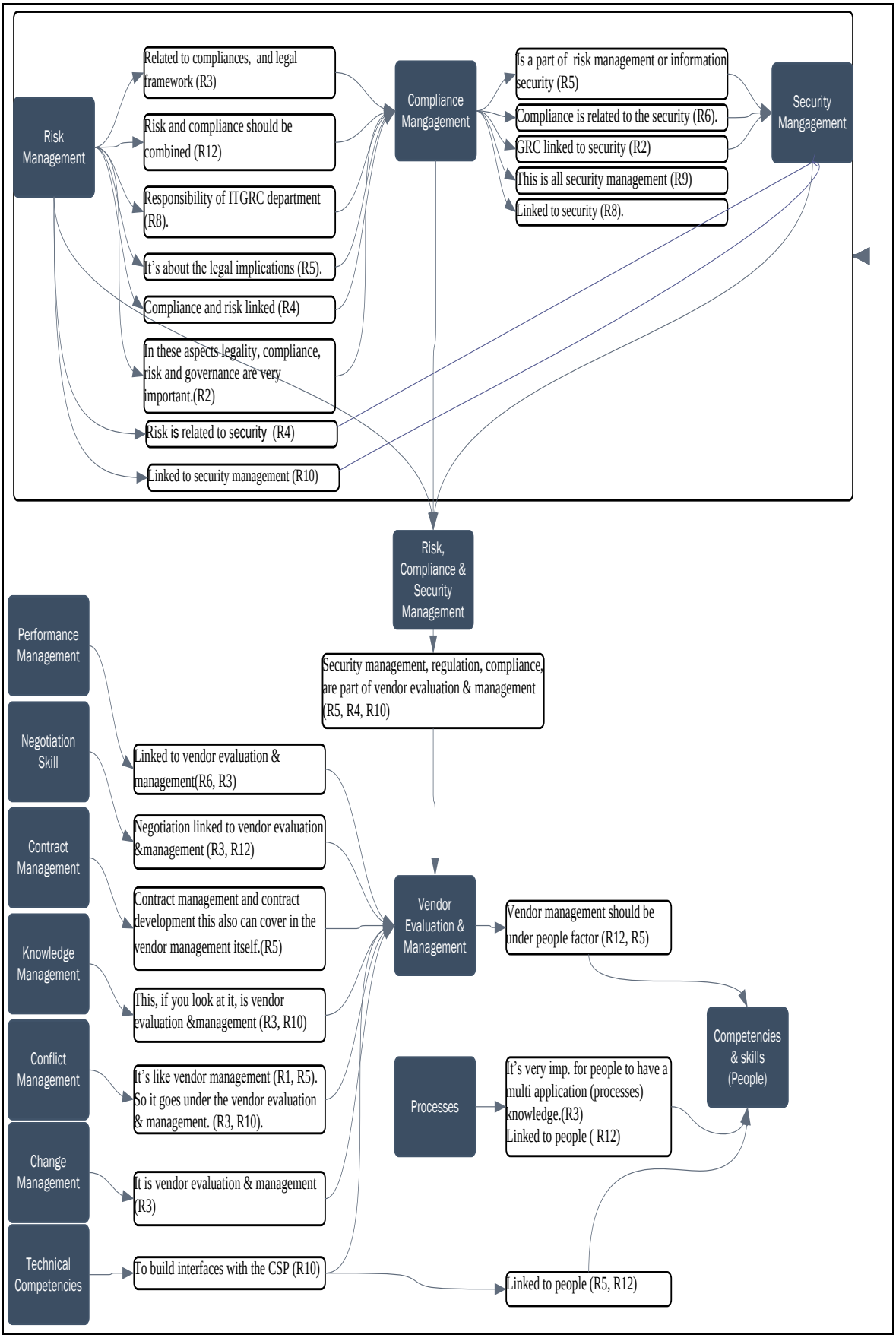



Figure 6.1: Creating patterns of factors.

As shown in figure 6.1, the researcher identified the relationships between 'vendor evaluation & management' and other success factors. Reading through the transcripts in detail revealed that 'performance management', 'negotiation skills', 'contract management', 'knowledge management', 'conflict management', 'change management' and 'technical competencies' are all linked to 'vendor evaluation & management', which in turn were defined as people's skills and competencies and therefore were placed under the 'people' factor. Similarly, when the respondents discussed 'risk management', they considered it to be a component of 'compliance management'. In the same manner, 'compliance management' was linked to 'security management'. Based on their responses, these three factors were aggregated under 'risk, compliance, and security management'. Further analysis of the transcripts led the researcher to aggregate them under 'vendor evaluation & management'. The respondents associated 'processes' with domain competencies therefore aggregating it under the 'competencies and skills (people') factor. The respondents deemed 'structure', 'strategy', 'rewards', and 'relational mechanisms' exclusive of 'competencies and skills (people)' as separate factors. Meaningful aggregation of success factors (identified in stage 4) under respective themes helped in the assembling of structures.

### 6.1.2. Stage 5: Assembling structures

Groups of patterns (identified in stage 4) were assembled to form structures in order to build an overall picture of the success factors. Therefore, the major refinement of the success factors (V-version) was the aggregation of the 17 factors into five key success factors and 10 sub-factors. Total weight of each success and sub-success factor was calculated by adding the weight (emphasis in terms of word count) placed by interview respondents during interview discussions (phase-1: emerging) as well as during validation (phase-2) of the success factors (T-version). Total weight was then scaled to 100% (Appendix A: Figure A1.0). The resulting table (Table 6.2) contains a corresponding set of 15 validated and refined success factors termed as validated and refined success factors (VR-version) that aids in managerial decisions to allocate roles and responsibilities for IT controls in a public cloud-based environment. While supporting the theoretical success factors, the empirical results further enabled the researcher to fine-tune them to make them more relevant to the cloud environment. High emphasis was laid by respondents on the significant risks, compliance, and security aspects of the cloud. In this regard, the interview respondent R2 (personal communication, November 23, 2015) mentioned "I think you need to highlight the compliance aspects, especially for

government organisation. For them compliance to the laws of the country is extremely critical without which it's very difficult to take your stuff onto cloud." Furthermore, he added:

> Another very important element is how you protect customer's information. You need to give more weightage to the privacy and confidentiality of information in this respect… So quality, service level agreement, legality aspects with regards to privacy of data and privacy of information, is extremely important.

The interview respondent R8 emphasised the security, compliance, and risk management in a cloud perspective by stating that: "security management, compliance management and IT risk assessment, are the main factors to achieve." Figure 6.2 shows the percentage coverage of these success factors. As can be seen, people's competencies and skills have the highest impact in the context of the allocation of roles and responsibilities. The highest competency and skill required is being able to manage risks, compliance, and security. While 'skills' mentioned in the table refer to general skills, 'competencies' are role specific skills possessed by people (Rudd & Loyd, 2007).

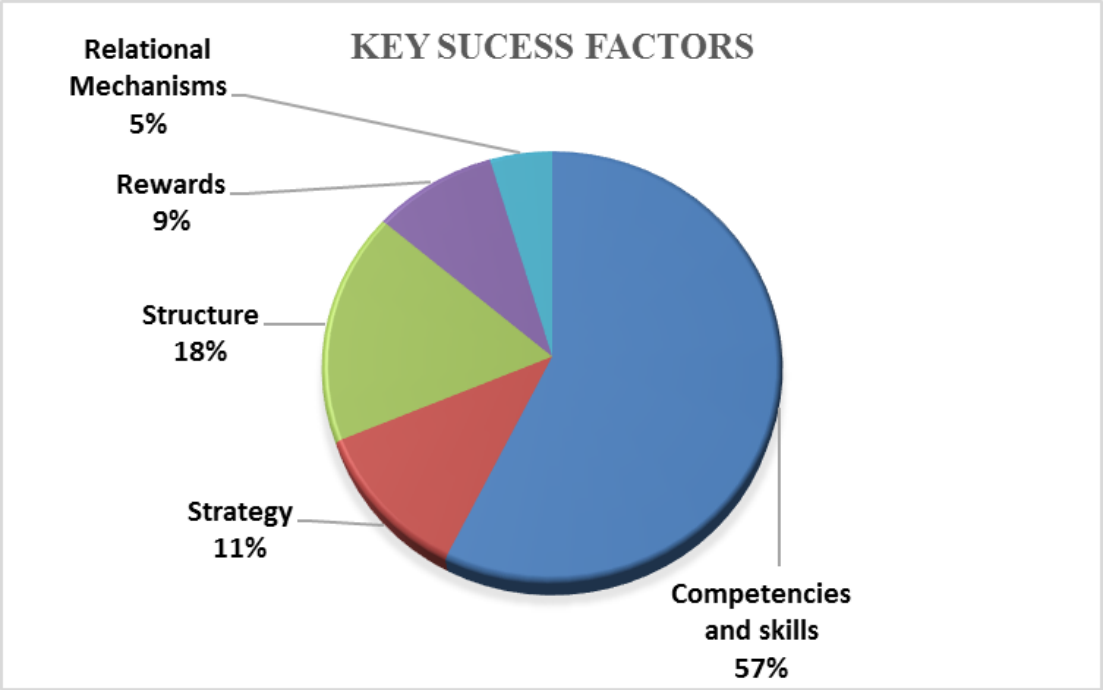



Figure 6.2: Coverage of the validated and refined success factors (VR-version).

Table 6.2: Validated and refined success factors (VR- version)

| Success factors | | | Definitions |
|---|---|---|---|
| **1. Competencies and skills (People) (57%)** | **1.1. Vendor evaluation and management (90%)*** | **1.1.1 Risks, compliance, & security management (59%)**** | Competencies to identify and manage all potential critical, legal, and compliance-related risks associated with the cloud.<br>Competencies to ensure compliance with internal as well as external policies, regulations, and accountability mechanisms when operating in the cloud.<br>Competencies to evaluate cloud vendors to ensure deployment of security mechanisms related to information assurance, data privacy, data confidentiality, ownership, and technology-related issues. |
| | | **1.1.2 Contract management (11%)**** | Skills to develop and manage contracts for effective SLAs, pricing, access rights, data ownership, risk management, and to ensure the availability of data and reports. |
| | | **1.1.3 Performance management (9%)**** | Competencies required for setting quality levels, monitoring the vendor against the SLAs, and rating their performance. |
| | | **1.1.4 Knowledge management (9%)**** | Skills to share knowledge between cloud users and vendors in both directions, building trust that will result in improved commitment and better overall results. |
| | | **1.1.5 Negotiation skills (7%)**** | Skills to negotiate the contract terms to ensure the rights and obligations for both parties. |
| | | **1.1.6 Conflict management (2%)**** | Skills to assess and avoid any negative impact from establishing new business ties or terminating existing business with a cloud provider. |
| | | **1.1.7 Change management (2%)**** | Ability to handle challenges, and readiness to adopt the new technology. |
| | | **1.1.8 Technical competencies (1%)**** | Competencies to coordinate with the cloud vendor to implement/ integrate the cloud services with the existing systems. |
| | **1.2 Processes (10%)*** | | Competencies to handle different sets of processes that cross departmental and organisational boundaries. |
| **2. Structures (18%)** | | | Roles and responsibilities allocation is based on the location of decision-making power and authority that establishes the reporting relationships, power distribution, and communication channels. |
| **3. Strategy (11%)** | | | IT strategy which is in alignment with business objectives will define whether to build capabilities (such as skills, processes, technologies, and/or people abilities) internally or to exploit external capabilities. It defines the tasks to be performed. |
| **4. Rewards (9%)** | | | People are rewarded by being trained or allocated to cloud-related tasks so as to give them the opportunity for growth, motivation, recognition, and the challenge of learning new technologies. |
| **5. Relational mechanisms (5%)** | | | Roles and responsibilities allocation depends on building interpersonal and collaborative relationships among units and organisations. |

* Weights relative to 'competencies & skills' ** Weights relative to 'vendor evaluation and mgmt.'

The success factors T-version (Table 3.6) was derived from cloud computing, organisational theory and ITG theories, therefore, making it more of a generic theory. This set of success factors was found useful by all respondents, for example, one respondent (R8) specifically stated that: "I am happy that whatever points you have put theoretically, are all applicable". However, empirical intervention helped in improving these success factors by changing them from generic to cloud specific. Changes were made in terms of updating the definitions of the factors; adding one extra success factor ('change management') and grouping some of the related success factors. Changes were made based on LeCompte's analysis stages and based on the suggestions of the respondents. As stated by R2: "There are too many factors here, I think you can cluster them"; as well as by R3 according to whom: "So this can be reduced, the factors I mean".

Therefore, sixteen factors in T-version were combined into five key and ten sub success factors in the validated and refined VR-version. Analysis of interview transcripts resulted in the updating of the definitions to make them more cloud specific and arranging these factors in the order of their importance, within a cloud perspective.

## 6.2. Delphi technique

Governance and management of IT within an organisation is found at three levels (Figure 6.3): at strategic level involving the board members, at management level involving C-suite layer, and finally at the operational level involving IT and business management (Haes & Grembergen, 2008). This implies that people at all these levels need to understand their individual roles and responsibilities within the framework and need to be involved in the IT governance and management processes. The success factors (T-version) were validated by 12 IT decision makers working at executive management levels within government and private organisations. In order to involve people from the operational (IT and business management) levels as well, this set was further validated by 44 IT practitioners working at IT operational levels, using Delphi rounds. This requirement was also raised by the interview respondent (R10), according to whom "these factors need to be circulated to at least 60+ subject matter experts coming from different streams of IT and different streams of industries. Then it will be more enhanced and practical".

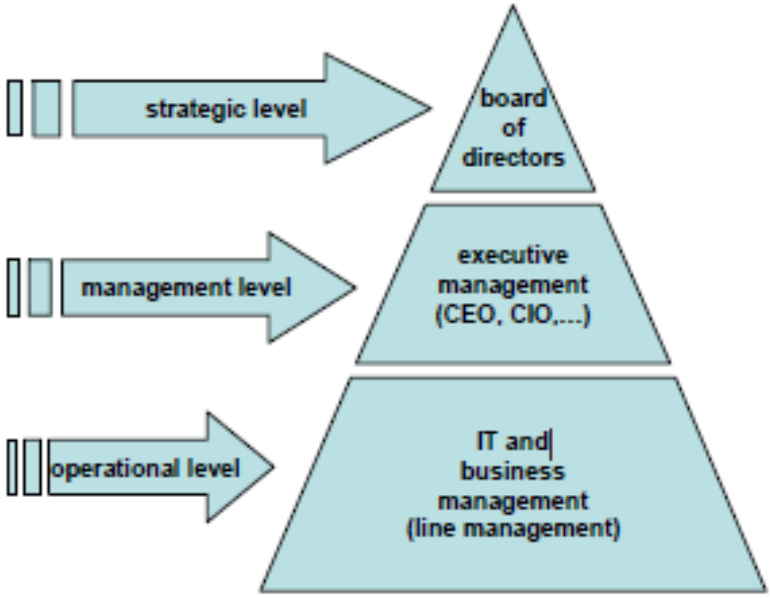



Figure 6.3: Three layers of ITG responsibility

Furthermore, Delphi technique was also used to rank the success factors in the order of their importance from a public cloud perspective. The plan for Delphi (in chapter 4, section 4.1.6) was to involve IT operational personnel of a large retail company as Delphi participants. However, it proved difficult to arrange for all relevant personnel of one company to be available at the same time for this purpose. Having a large group of staff as members of the ISACA UAE chapter, and the researcher being a member of the ISACA chapter, led to an alternative process of selecting ISACA members (called panellists hereafter) for conducting the Delphi rounds. Delphi rounds were organized and sponsored by ISACA UAE Chapter in December 2015, as part of their monthly CPE (Continuing Professional Education) session routine (Figure 6.4). Two Delphi rounds were conducted on the same day in around 2 hours 10 minutes, among panellists with varied ITG background and experiences.

ISACA is an international association that focuses on ITG, with the UAE Chapter having the largest number of members in the Middle East. Involving members of this association as panellists met the requirement of creating a 'panel of informed individuals' (McKenna, 1994) who have the knowledge, perceptions or interest (Goodman, 1987) in various roles of ITG. These panellists comprised of varying profiles (1 CIO, 10 IT auditors, 4 IT consultants, 25 IT management, 4 undeclared) with eleven of them working in government and twenty in private UAE organisations (the balance did not declare their organisation). The panellists were informed about the purpose and duration of the CPE sessions fifteen days in advance through the ISACA website and emails.


Figure 6.4: Snapshot of the Delphi event conducted through ISACA CPE sessions.

A few days prior to the Delphi event, questionnaire 1 (Appendix B) was prepared; four volunteers were identified and trained to provide assistance during the Delphi rounds; excel sheet templates were kept ready; and, finally, a fast printer with sufficient paper was made available. Following other researchers' work (Keil, Tiwana, & Bush, 2002)(Duffield, 1993), this Delphi research provided pre-existing information (a list of success factors (VR version)) to panellists, for re-validation and rankings. To address the threat of inadequate clarification of success factors (Cook, Campbell, & Day, 1979), the definition of each success factor was provided in the questionnaire and was further explained through a presentation.

### 6.2.1. Delphi Rounds

As mentioned in the chapter 4 (section 4.1.6), the researcher planned to continue rounds of discussions until consensus among panellists was achieved. Kendall's W coefficient concordance (W) (Schmidt, 1997) was used to measure the degree of consensus between the panellists. Satisfyingly, consensus among the panellists was achieved within two rounds. Even though "ten to fifteen people may be adequate for a focused Delphi, where participants do not vary a great deal" (Taylor-Powell, 2002, as cited in Haes & Grembergen, 2008, p. 446), the current study involved fifty-two ISACA members. The members were asked to participate in success factors validation and ranking, based on their organisational knowledge or experience of working on public cloud based projects. Accordingly, out of fifty-two members who attended the CPE session, only forty-four members participated in round 1 & 2 (12 % drop off rate) of the re-validation and ranking efforts.

- **Round-1: success factor re-validation**

The focus of the first round was on the re-validation of the success factors (VR-version). Success factors were explained through a fifteen minutes presentation, followed by the distribution of the questionnaire-1 (Appendix B). Questionnaire 1 was divided into two steps with step 1 of this questionnaire designed to collect panellists details like email address (for those who wanted to receive the results), professional designation, name and size of their organisation. In order to provide for anonymity, the provision of personal or organisational information by the panellists was optional. Depicting three levels of the set, step 2 of the questionnaire listed the success factors divided into three sections. Taking the professional experiences of panellists' day-to-day practices into account, in round 1 the panellists were asked to validate the initial list of factors, thereby giving them the opportunity to make recommendations to add, change, or delete factors. Towards the end of the round 1, the four assistants collected the questionnaires and subsequently processed the questionnaire data into three pre-prepared excel sheets.

Round 1 was followed by a twenty minutes presentation by the next speaker. While the subsequent presentation was going on, the collected data was analysed and changes were incorporated into the list of success factors by the team (researcher and the four assistants). Subsequently, the team modified the success factors and printed copies of questionnaire–2 (Appendix B).

- **Round-2: success factor ranking**

Round 2 started by showing the modified success factors to the panellists through a presentation, thereby enabling them to see the anonymous collected opinion of the group. Questionnaire 2 was distributed among the panellists and they were asked to rank the factors in terms of their importance, using a Likert scale, as well as by assigning weight to each factor. Questionnaire 2 was divided into three sections. The first section contained five key success factors ('competencies, skills & mind-set'; 'structure'; 'strategy'; 'rewards'; and 'relational mechanisms'). For each of the five main success factors, the panellists were asked to rank them according to their importance, on a scale of 5 (1 being most important, 5 being least important). Instructions were given not to create a tie between two factors by repeating a rank. The second section consisted of the three sub-factors of the 'competencies, skills and mind-set' factor namely 'vendor evaluation & management', 'processes' and 'mind-set'. For section 2 of this questionnaire, panellists were asked to rank each sub-factor on a scale of 3 (1 being most important and 3 being least important). The third and last section listed the seven sub-factors of the 'vendor evaluation & management' factor ('risks, compliance & security'; 'contract management'; 'performance management'; 'knowledge management'; 'negotiation skills'; 'conflict management'; and 'technical competencies'). Similar to the previous two sections, panellists were asked to rank the success factors on a scale of 7 (1 being most important and 7 being least important). Apart from assigning rank, panellists were asked to assign weights to each success factor. Towards the end of the round-2, while the panellists dispersed for a break, the assistants and the researcher (the team) entered the data in the pre-prepared excel sheets. This was then analysed and new rankings were calculated for each key success factor and sub-success factor based on the statistical average of the panellists' and the empirical estimates of ratings. Round 2 results were printed (Appendix B).

After the end of the twenty minute break, only thirty-eight panellists returned to the Delphi room while the others left the hall. The anonymous results of the second round were shared with the thirty-eight panellist through the subsequent presentation and printed forms. This was done to provide feedback regarding the final rankings to the panellists thereby complying with Goodman's (1987) guidelines to keep the panellists informed about the current status of their collective opinion. After two weeks, results were also emailed to those who had provided their email addresses.

- **Results of the Delphi technique**

In conducting the Delphi study, the researcher followed four key necessary features of 'Delphi' namely: anonymity, iteration, controlled feedback, and the statistical aggregation of group response as laid out by Rowe and Wright (1999). Anonymity was ensured by showing the group responses to the panellists without revealing their identity. Additionally, to respect their anonymity, panellists were advised not to write their names on the questionnaires. The Delphi focus group followed two iterative rounds (Figure 6.5). In these rounds, success factors were updated followed by calculation of the statistical aggregation to find their final rankings. Controlled feedback was given to the panellists. The controlled feedback process, consisting of a well organised summary of the prior iteration, was distributed to the panellists towards the end of each round. Controlled feedback allowed them an opportunity to get clarity on the information developed in the previous iteration, to become more problem-solving oriented, to offer their opinions more insightfully, and to minimise the effects of noise (Hsu & Sandford, 2007). Delphi rounds and the resulting changes are detailed in table 6.3 and shown in figure 6.5.

Table 6.3: Details of two Delphi rounds

| Time span | Delphi rounds | No of people attended | No of responses received | Result of the Delphi round |
|---|---|---|---|---|
| 11:00 - 11:30 | Round 1 | 52 | 44 | Success factors explained through presentation<br>Success factors validation using questionnaire-1 |
| 11:40 - 12:00 | Presentation by another speaker | 52 | N/A | Data analysis |
| 12:10 - 12:40 | Round 2 | 52 | 44 | Success factor ranking using questionnaire-2 |
| 12: 40 - 1:00 | Break | | | Data analysis |
| 1:00 – 1:10 | Results of round 2 shared | 38 | 38 | Results were shared through presentation and printed sheets.<br>Panelists' consensus on success factor rankings achieved. |

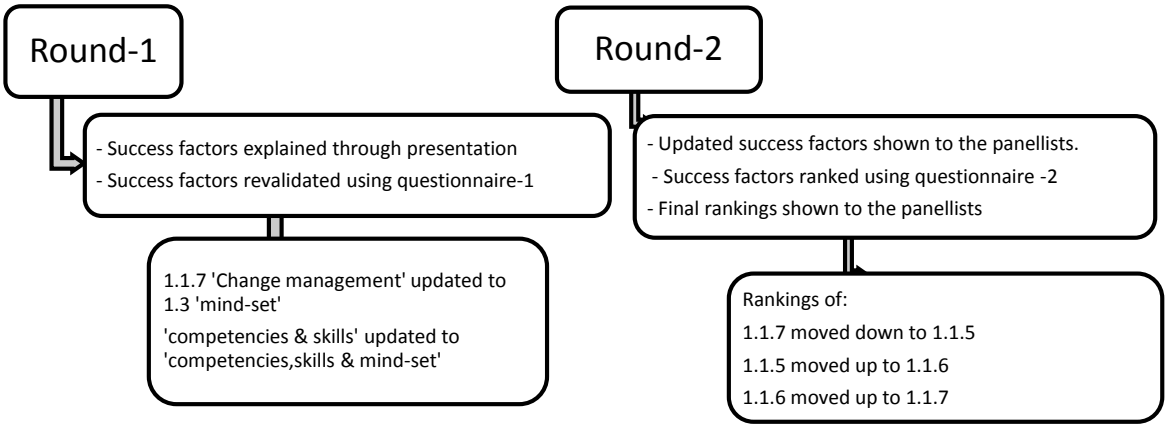



Figure 6.5: The Delphi rounds and the resulting changes

- **Round - 1 results**

During the first round, qualitative feedback was captured from the panellists via questionnaire-1. The panellists agreed with all the validated and refined success factors (VR-version) and considered them to be necessary and appropriate. However, six Delphi panellists suggested review of the title of 'change management' sub-factor. They also made a suggestion by stating: "change management is not restricted to vendor management alone. Change management should be at organisational level". The panellists' suggestions correlated to the response from six interview respondents (Chapter 5, Table 5.6), who consider the abilities of people to accept and adapt to the changed work environment as an important factor, at the organisational level. These comments are also in conformance to Galbraith's (2011) views which emphasizes the importance of skills and mind-set of people to execute the strategic directions of the organisation (Chapter 3, Table 3.1). Therefore, taking into account the Delphi panellists', researcher's and interview respondents' feedback, 'change management*'* was renamed as 'mind-set' (Figure 6.6) and moved out from 'vendor evaluation & management' to the higher level of main constructs. Subsequently, the 'competencies and skills' key success factor was changed to 'competencies, skills and mind-set'.

| Success factor | Definition |
|---|---|
| **1.1.7 Change management** | — Ability to handle challenges and readiness to adopt the new technology. |

updated to

| Success factor | Definition |
|---|---|
| **1.3 Mind-set** | — Ability to handle challenges and readiness to adopt the new technology. |

Figure 6.6: Changes suggested by Delphi panellists

Furthermore, one panellist recommended merging and giving predominance to the factors 'structure' & 'relational mechanisms'. He justified his statement by adding that the "success of any project depends a lot on business involvement". Since this recommendation was not expressed by any other panellist it was not considered strong enough to make changes to the set.

- **Round -2 results**

In round 2 the panelists were asked to rank the success factors by assigning them a number on the Likert scale and by assigning the appropriate weights (in terms of percentage) to them. The purpose of using the Likert scale ranking was to measure the degree of consensus between the panellists and therefore leverage Kendall's W coefficient concordance (W) (Schmidt, 1997). Using Schmidt's (1997) interpretation of Kendall's W coefficient, the level of consensus of 0.79 in the first section and 0.84 in the second section and 0.89 in third section indicated a strong agreement between the panellists on the success factors (VR-version) rankings. Therefore, Kendall's W coefficient results provided a good degree of consensus among panellists, giving confidence in the results and providing reason not to go for a third round.

Using the assigned weights and applying statistical aggregation, new ratings and rankings were calculated (Table 6.4) for each factor. In table 6.4 ('Final results' section), column 1 shows the average ranking given to each factor by the Delphi panellists, and column 2 shows the average percentage weights given by the Delphi panellists. Column 3 shows the average weights given by interview respondents, and column 4 shows the average ratings of column 2 and 3. Consequently, based on column 4 ratings, new ranks were developed as can be seen in column 5. As an example, for the 'competencies, skills & mind-sets' key success factor, the average percentage assigned by Delphi respondents is 48.4%, while the average percentage assigned by the interview respondents is 57%. The average of these two (48.5 and 57) resulted in 52.7%. Based on this result, 'competencies, skills & mind-sets' retained its first rank (in terms of importance) in the success factors (VR-version).

Table 6.4: Delphi ratings and final rankings

| Delphi Round 2 Results | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Allocating accountability and responsibility of IT controls in a cloud environment | | | | | | | | |
| STEP 1 Feedback on ranks | | | Final Results | | | | | |
| | | | Col. 1 Delphi average ranking | Col. 2 Delphi average weight (%) | Col. 3 Research weight (%) | Col. 4 New rating (%) | Col. 5 New rank |
| SECTION 1- Five Key Factors | 1 | Competencies, skills & mind-set (People) | 1 | 48.4 | 57 | 52.7 | 1 |
| | 2 | Structure | 2.8 | 17.9 | 18 | 17.95 | 2 |
| | 3 | Strategy | 2.5 | 18.4 | 11 | 14.7 | 3 |
| | 4 | Rewards | 4 | 8.4 | 9 | 8.7 | 4 |
| | 5 | Relational Mechanisms | 4.7 | 6.9 | 5 | 5.95 | 5 |
| SECTION 2 - Three sub-factors of the '*Competencies, skills and mind-set (People)*' factor | 1.1 | Vendor evaluation & management | 1 | 53.8 | 90 | 71.9 | 1 |
| | 1.2 | Processes | 2.2 | 37.5 | 10 | 23.75 | 2 |
| | 1.3 | Mind-set | 2.8 | 8.6 | 2 | 5.30 | 3 |
| SECTION 3 - Seven sub-factors of the '*Vendor evaluation & management*' factor | 1.1.1 | Risks, compliance & security | 1.1 | 48 | 59 | 53.5 | 1 |
| | 1.1.2 | Contract management | 2.8 | 12 | 11 | 11.5 | 2 |
| | 1.1.3 | Performance management | 4.2 | 9 | 9 | 9 | 3 |
| | 1.1.4 | Knowledge management | 5.5 | 7 | 9 | 8 | 4 |
| | 1.1.5 | Negotiation skills | 6.3 | 6 | 7 | 6.5 | 6 |
| | 1.1.6 | Conflict management | 7 | 5 | 2 | 3.5 | 7 |
| | 1.1.7 | Technical competencies | 3.7 | 13 | 1 | 7 | 5 |
| STEP 2 Feedback | | Instruction: Provide valuable feedback/comment/ suggestions | | | | | |

Table 6.4 indicates absolutely no change in the ranks of the five key success factors: 'competencies, skills & mind-set'; 'structures'; 'strategy'; 'rewards' and 'relational mechanisms' of the success factors (VR-version), although the weights (or ratings) of four of them (1, 3, 4 and 5) did change slightly. Similarly, there is no change in the rankings of 1.1, 1.2 and 1.3 sub-factors. Seven sub-factors of 'vendor evaluation & management' did undergo some minor changes in their ranks. The rank of 'technical competencies' went up from 7$^{th}$ to 5$^{th}$ rank; 'negotiation skills' shifted to the 6$^{th}$ rank, and 'conflict management' slipped to 6$^{th}$ from 7$^{th}$ rank. Therefore, the final validated, refined and ranked success factors termed as success factors (VRR-version) is shown as table 6.5.

Table 6.5: Validated, refined and ranked success factors (VRR-version)

| Success factors | | | Definitions |
|---|---|---|---|
| **1. Competencies, skills & mind-set (People) (52.7%)** | **1.1. Vendor evaluation and management (71.9%)*** | **1.1.1 Risks, compliance, and security management (53.7%)**** | Competencies to identify and manage all potential critical, legal, and compliance-related risks associated with the cloud.<br><br>Competencies to ensure compliance with internal as well as external policies, regulations, and accountability mechanisms when operating in the cloud.<br><br>Competencies to evaluate cloud vendors to ensure deployment of security mechanisms related to information assurance, data privacy, data confidentiality, ownership, and technology-related issues. |
| | | **1.1.2 Contract management (12%)**** | Skills to develop and manage contracts for effective SLAs, pricing, access rights, data ownership, risk management, and to ensure the availability of data and reports. |
| | | **1.1.3 Performance management (9.5%)**** | Competencies required for setting quality levels, monitoring the vendor against the SLAs, and rating their performance. |
| | | **1.1.4 Knowledge management (7.8%)**** | Skills to share knowledge between cloud users and vendors in both directions, building trust that will result in improved commitment and better overall results. |
| | | **1.1.5 Technical competencies (7%)**** | Competencies to coordinate with the cloud vendor to implement/integrate the cloud services with the existing systems. |
| | | **1.1.6 Negotiation skills (6.5%)**** | Skills to negotiate the contract terms to ensure the rights and obligations for both parties. |
| | | **1.1.7 Conflict management (3.5%)**** | Skills to assess and avoid any negative impact from establishing new business ties or terminating existing business with a cloud provider. |
| | **1.2. Processes (23.8%)*** | | Competencies to handle different sets of processes that cross departmental and organisational boundaries. |
| | **1.3. Mind-set (4.3%)*** | | Ability to handle challenges, and readiness to adopt the new technology. |
| **2. Structures (18%)** | | | Roles and responsibilities allocation is based on the location of decision-making power and authority that establishes the reporting relationships, power distribution, and communication channels. |
| **3. Strategy (14.7%)** | | | IT strategy which is in alignment with business objectives will define whether to build capabilities (like skills, processes, technologies, people abilities) internally or to exploit external capabilities. It defines the tasks to be performed. |
| **4. Rewards (8.7%)** | | | People are rewarded by being trained or allocated to cloud-related tasks, so as to give them opportunity for growth, motivation, recognition, and the challenge of learning new technologies. |
| **5. Relational mechanisms (6%)** | | | Roles and responsibilities allocation depends on building interpersonal and collaborative relationships among units and organisations. |

* Weights relative to 'competencies, skills & mind-set' ** Weights relative to 'vendor evaluation and mgmt.'

An important finding here is that the Delphi panellists placed a higher emphasis on the technical competency requirements than the interview respondents. This finding was also reflected in their comments, as one of the panellists stated that "reasonable in-house technical knowledge is a must" and another one believes that "people's competencies and skills has more impact (on roles and responsibilities allocation)". Another panellist commented that reliance on technical competencies depends on the size of the organisation. According to him, as smaller organisations have less technical skills, they rely heavily on cloud vendors' advice. It was re-iterated by a panellist who stated that "technical skills are not adequate with small companies, therefore too much reliance is on vendors. …whereas in large organisations in house technical skills are strong and mature". Therefore, it is clear that in a cloud environment, where IT controls are migrated and managed by the cloud provider, technical competencies are still required. However, their requirement is reduced in smaller organisations which mostly rely on the cloud provider for this capability.

## 6.3. Conclusion

The exploration of the literature related to the cloud computing, organisational behavior and ITG, provided an initial list of success factors for the allocation of roles and responsibilities that organisations can leverage to the public cloud environment. In-depth interviews helped in validating as well as in refining the success factors. Subsequently, to further validate and rank the success factors, two Delphi rounds were conducted with 44 experts, working at various IT operational levels. This exercise resulted not only in adding a new success factor but also in redefining and ranking these success factors according to their importance in a public cloud environment, at all ITG levels, thereby changing these success factors from generic to public cloud specific.

# CHAPTER 7

# FINDINGS AND CRITICAL EVALUATION

# 7 CHAPTER 7: FINDINGS AND CRITICAL EVALUATION

This chapter aims to answer the research question ('What are the key success factors in the allocation of staff to the roles and responsibilities for the control of cloud based IT resources?'*)* stated in chapter one. This was investigated in subsequent chapters with the primary aim of gaining a greater understanding of the success factors for the allocation of roles and responsibilities of IT controls that have been, or are planned to be, migrated to the public cloud. This chapter therefore presents a summary of the study findings and critical evaluation, while linking the findings to the existing literature provided in previous chapters. The research question was further divided into four sub-research questions:

1. What is the impact of cloud computing on the roles and responsibilities of people in charge of IT controls?

2. What are the current mechanisms inherent in IT governance frameworks for allocating people to roles and responsibilities of IT controls in non-cloud as well as in cloud environments?

3. What are the success factors inherent in determining the allocation of staff to roles and responsibilities for the control of cloud based IT resources specific to the UAE public cloud environment?

4. What is the perceived ranking of these success factors in terms of their importance?

The sub-research questions led the researcher to review existing literature on cloud computing, organisational theories (roles and responsibilities) and ITG (IT controls), leading to the development of fifteen success factors for the allocation of people's roles and responsibilities for IT controls in a cloud environment. These success factors (T-version) (Table 3.6) were subsequently validated and refined through a case study (chapter 5 and 6), renamed as success factors (VR-version), and ranked in terms of their importance through Delphi research from a public cloud perspective (success factors (VRR-version)). This chapter therefore answers all the four sub-research questions that were raised in chapter 1. Accordingly, the emphasis of section 7.1 to 7.4 of this chapter is on the corroboration of the findings with the research questions, section 7.5 explains a use case scenario for the application of the proposed success factors, followed by comparing the proposed tool to another related tool in section 7.6,and finally followed by the conclusion of the chapter in section 7.7.

## 7.1 Sub-research question 1

**What is the impact of cloud computing on the roles and responsibilities of people in charge of IT controls?**

Response to sub-research question1 and objective # 1 (identify the impact of cloud computing on the roles and responsibilities of people in charge of IT controls) affirms that both researchers and IT decision makers (interview respondents) assert that migration to cloud computing requires changes in the roles and responsibilities of staff. Emphasis is laid on the business, management, security, risk & compliance capabilities, requiring updated ITG mechanisms for handling the new roles and responsibilities of staff. While the number of required staff in cloud user organisations will diminish overall, there will be some new cloud based roles introduced. In such a situation, organisations will face challenges from staff resistance. Training has been proposed to help overcome this resistance.

The decision of management to adopt cloud computing leads to the need to select the IT resources to be migrated to the cloud. This migration of IT resources leads to the shift in the controls and results in a corresponding restructuring of people's roles and responsibilities, in cloud user organisations. Migration to the cloud is changing IT departments from being technical solution providers to being business integrators and many tasks that staff would normally undertake are outsourced to the cloud provider(s). It not only requires to redefine the roles of staff, but it is also essential to identify the skill gaps that should be filled in order to successfully utilise cloud services (EMC, 2014). Using an influence diagram, Figure 7.1 structures the discussion related to sub-research question 1, and provides a clear, graphical picture of the results.

**Sub-RQ1: What is the impact of cloud computing on the roles and responsibilities of people in charge of IT controls?**

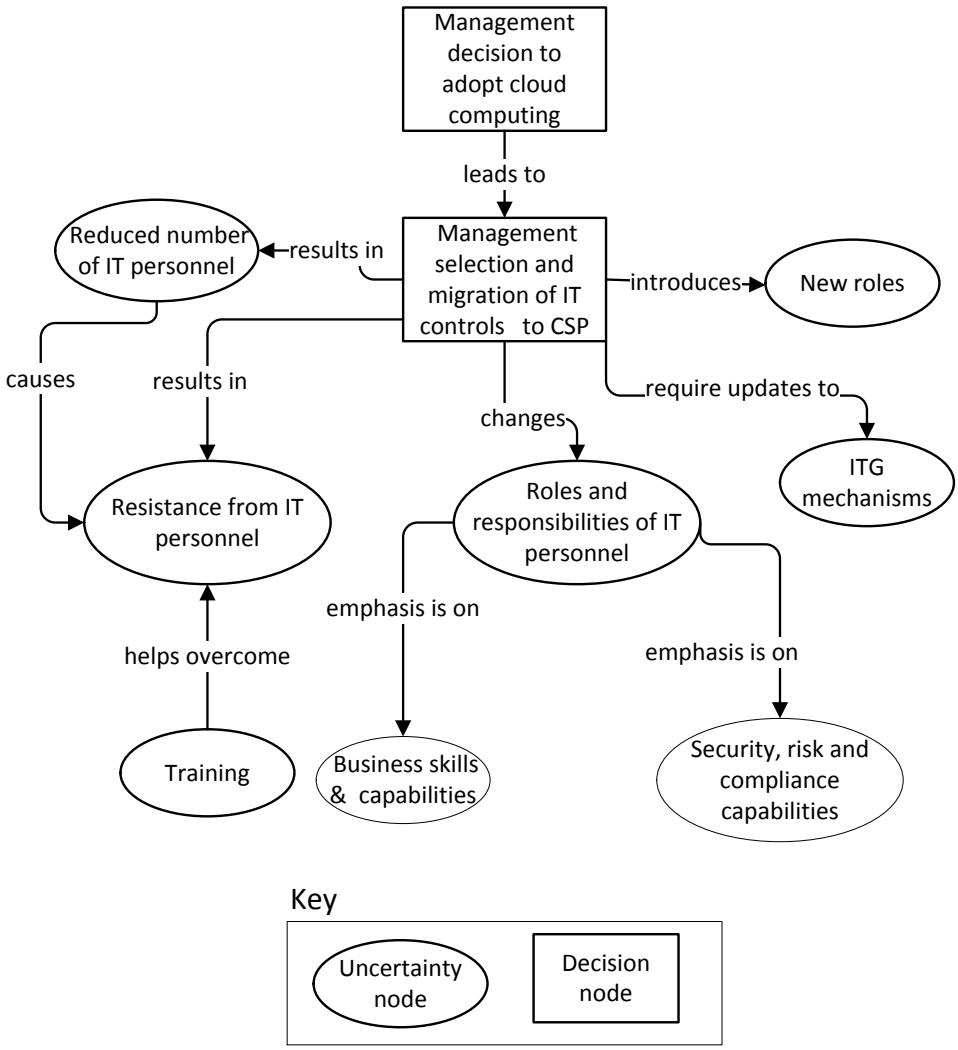



Figure 7.1: Discussion and results related to research question #1

Transformation to the cloud-based model defines new roles such as those of service administration, service management, service governance, and policy formulation. These roles must understand organisation's needs as against industry trends to drive an effective product strategy; ensure that the cloud provider delivers cost-competitive needed services; serve as a key interface between the provider and the organisation's staff; and maintain day-to-day contact with the provider to ensure that the organisation's needs are met.

The roles and responsibilities of staff undergo changes, and researchers recommend that organisations staff their cloud initiatives with people who have the appropriate cloud related competencies and skills. It is suggested by researchers that IT management focuses on the

development of non-technical skills and capabilities of their IT staff. Identified business skills and capabilities include vendor management, contract management, outsourcing, and the ability to identify cloud-suitable workloads.

In an effort to obtain IT decision makers' points of view on the topic, 12 IT decision makers from different organisations were selected for the empirical research. Focus was on large private and/or government organisations in the UAE that have migrated, or are in the process of migrating, to the public cloud. A qualitative methodology using semi-structured interviews was used for capturing the points of view of the respondents. The selection of the UAE as the location of the study was based on a number of factors: the advanced state of IT governance implementation in the UAE; the state of readiness for the uptake of cloud technology by different sectors of the economy, with 95% of enterprises having already implemented or planning to implement a cloud computing model (Desk, 2015); strong growth of the public cloud model (Dartnell, 2015); and the fact that the Information Systems Audit and Control Association (ISACA) UAE chapter is the largest and oldest chapter in the Middle East, indicating the depth of knowledge and experience of the respondents. The researcher selected only organisations that have adopted cloud technology. Selected respondents were interviewed face-to-face and the interviews recorded. For analysis purposes, the audio files were transcribed verbatim using 'O-Transcribe' and loaded into the qualitative data analysis software NVIVO 10. For analysing and interpreting the qualitative data, the researcher decided to follow the five step guideline given by LeCompte (2000), namely, 'tidying up', 'findings items', 'creating stable sets of items', 'creating patterns' and 'assembling structures'.

Interviews did not directly address the topic of the impact of cloud computing on people's roles and responsibilities. However, a question on the challenges faced by organisations in respect of people's roles and responsibilities while in a public cloud environment provided adequate insight into the topic. According to all the interview respondents, cloud computing technology has a significant impact on staff's roles and responsibilities. Similar to the literature review results, the majority of respondents (ten) are of the view that cloud computing technology is moving the role of IT personal away from technology to a more business-centric role. The IT decision makers (interviewees) stressed the need for staff to be equipped with business capabilities and knowledge in order to handle the cloud aspects. They identified the required business skills and competencies as vendor management, knowledge of processes, contract management, knowledge management, change management, and performance management. The respondents also identified the need for people with knowledge of governance in order to ensure proper monitoring of IT controls. They pointed out that because technical

elements are commoditised, there is not much need for this skill, however, skills will be needed to monitor and manage risk, compliance, and security.

Five interview respondents asserted that fewer staff would be required in cloud based user organisations. For half of the respondents (six), the biggest challenge organisations face while adopting cloud technology is resistance from staff. People fear change because they feel that work is going out of their hands; they also find it difficult and time-consuming to understand new business models. In order to overcome this resistance, several respondents (seven) suggested that training should be provided to staff at all organisational levels including senior management level. Training topics suggested by them include operating in the cloud, dealing with cloud vendors, operating onshore and offshore teams, and connecting to the cloud. The researchers point out that, while IT controls are moved to the cloud provider, accountability, responsibility and assurance of regulatory compliance still lies with the organisation. Therefore there is a requirement that updated governance mechanisms be put in place.

## 7.2 Sub-research question 2

**What are the current mechanisms inherent in IT governance frameworks for allocating people to roles and responsibilities of IT controls in non-cloud as well as cloud environments?**

In response to sub-research question # 2 and to meet objective # 2 (Identify the popular ITG frameworks. Evaluate the existing mechanisms used by them to allocate people to roles and responsibilities of IT controls in non-cloud and cloud environments), a detailed exploration of the academic & practitioner literature and an empirical study was conducted. This study revealed that information systems domain and ITG frameworks lack mechanisms to provide factors/criteria for the allocation of staff to the roles and responsibilities of IT controls in a cloud environment.

This question was explored through literature review as well as through empirical research. A search in the Association of Information Systems (AIS) database and Google Scholar, spanning the years 2008 to 2014, was conducted to identify relevant success factors for the allocation of roles and responsibilities of IT controls in a cloud environment. These search results indicate that although cloud computing has been examined from several specific business perspectives, there is no research conducted to guide practitioners on the allocation of the roles and responsibilities of IT staff for resources that have been migrated to the cloud. Using an influence diagram, Figure 7.2 structures the research question 2 discussion, and provides a clear, graphical picture of the results. Study of the academic and practitioner's literature identified COBIT and ITIL as the most popular and widely used ITG frameworks by organisations that support the implementation of effective ITG processes. Some researchers also recommend adopting PMBOK as the ITG best practice.

Detailed exploration of each of COBIT, ITIL and PMBOK was conducted to identify the guidelines provided by them on allocation of people's roles and responsibilities. In COBIT, assignment to processes with the documented responsibility levels takes place in the form of RACI charts. Similarly, the roles and responsibilities of various activities in ITIL are also defined by using an RACI chart. Likewise, PMBOK also uses RACI to show the assignment of various roles in completing tasks or deliverables. While role allocation in the form of an RACI chart has been used in all these three popular ITG frameworks; its implementation in COBIT is too generic for practical use; ITIL provides only generic guidelines for employing

RACI in the non-cloud; and, in PMBOK allocation is left up to the decision maker's experience, judgment and authority. This review of the literature led to the researcher's confirmation of the lack of guidance on roles and responsibility allocation success factors for IT controls in a cloud environment.

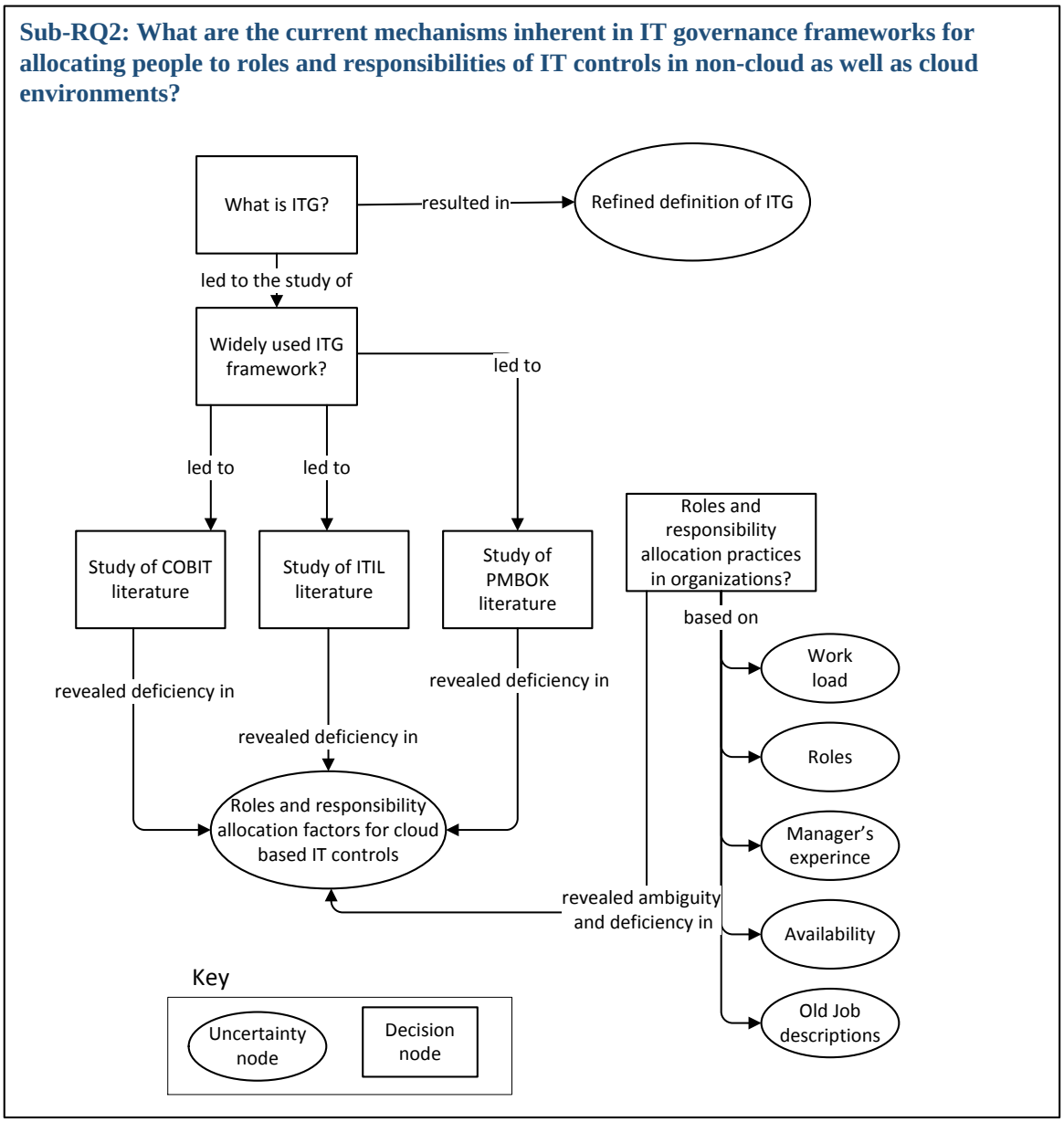



Figure 7.2: Discussion and results related to research question # 2

Empirical exploration also confirmed the research findings about COBIT and ITIL being the most popular ITG frameworks used within organisations. Out of eleven organisations studied in the UAE, nine are using either ITIL or COBIT frameworks or both. Enquiries among IT decision makers (interview respondents) on the roles and responsibility allocation factors resulted in ambiguous and varying responses. While one organisation performs this allocation based on the "technical areas", others do it on the basis of "job descriptions", "based on the

load", "role based", or "based on the availability". In one of the studied organisations, allocation is based on IT management's experience and knowledge, yet in another organisation they simply shift the duties of the existing people from non-cloud IT controls to the cloud-based IT controls. Some respondents (three) avoided a direct response to this question due to the ambiguity of the mechanism. Therefore, organisations perform this allocation either based on the roles, on the work-load, old (non-cloud environment) job descriptions, their availability, experience, or leave the allocation up to the project decision maker's experience and judgment. There is no uniformity or justification provided for this allocation, indicating a potential research area.

## 7.3 Sub-research question 3

**What are the success factors for determining the allocation of staff to roles and responsibilities of IT controls, specific to UAE public cloud environment?**

Response to this question was achieved by meeting objective # 3 (propose the key success factors to allocate staff to roles and responsibilities for the control of IT resources that have been moved, are being moved, or are planned to be moved to the public cloud environment.) and objective # 4 (validate the success factors using in-depth interviews with IT decision-makers working within UAE organisations that have migrated their IT resources to the cloud). In response to objective #3, a set of 16 theoretical success factors (T-version) was derived from cloud computing, organisational theories, and ITG literature. In order to meet objective #4, these theoretical success factors were tested in practice, using UAE as a case study, among 12 IT decision makers from 11 organisations in the UAE. Results show that people's allocation to roles and responsibilities is driven by their competencies and skills, and by the strategy, structure and policies of the organisation. A significant finding among the factors identified is people's competency to manage the risk, compliance and security issues related to the cloud.

To find the answer to this research question, this study used three research lenses based on the three IS domains (explicit in the title), namely, cloud computing, ITG, and organisational theories.

- **Cloud computing**

Cloud computing, considered to be the latest outsourcing trend, inherits the "roles and responsibilities" factors from outsourcing. Additionally, cloud computing possesses character-

istics that enable ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort. Moreover, the public cloud model, in particular, brings in much more dependency on the cloud provider(s), complex chains of responsibility management, and much higher security concerns. These unique characteristics of public cloud computing indicated a requirement for a unique set of capabilities and skills to manage cloud based IT controls effectively.

Therefore, an analysis of the academic and the practitioner literature on IT outsourcing and public cloud computing resulted in the inclusion of eleven success factors having an impact on the allocation of people to roles and responsibilities in a public cloud environment. These eleven success factors are: 'strategy'; 'vendor management'; 'contract management'; 'governance'; 'technical skills'; 'negotiation skills'; 'performance management'; 'knowledge management'; 'security management'; 'risk management'; and 'compliance management'.

It was noted that organisational design also influences the decision-making process and personnel decisions, thus assisting in identifying the success factors that impact the allocation of roles and responsibilities.

- **Organisational theories in role allocation**

Organisational design is about creating roles, processes, and formal reporting relationships in an organisation. Organisational design helps in reshaping and channelling organisational structures and roles to meet the organisation's business strategy. The widely accepted organisational 'Star model' (Galbraith, 1995, 2011) was useful in providing allocation factors for this research. This model proposed five relevant success factors for the role allocation, namely, 'strategy'; 'structure'; 'rewards; 'processes'; and 'people'.

Allocation of roles and responsibilities of IT controls, being an ITG decision making mechanism (Sambamurthy & Zmud, 1999), the researcher also explored the ITG domain for identifying role allocation success factors.

- **IT governance (ITG)**

'Governance', identified as a role allocation factor in ITG literature, is based on three constructs, namely, structures, processes, and relational mechanisms. While ITG structures and processes correlated with those of the organisational Star Model, ITG helped in identifying a new factor, namely, 'relational mechanisms'. All the processes that are geared towards building interpersonal and collaborative relationships between business and IT management are

grouped under the ‘relational mechanisms’ factor.

The theoretical perspectives of cloud computing, organisational design, and ITG contributed to the understanding of how firms may manage their allocation of roles and responsibilities of IT controls. Some of the success factors derived from these three IS domains overlapped with each other. The ‘strategy’ factor, dictating the differentiating factors of an organisation, has been identified both by cloud computing and by organisational theories. A subsequent factor is ‘structures’ defining the shape of the organisation, key roles, power, and authority, has been identified as a factor by organisational as well as by the ITG theories. Another common factor between ITG and the organisational domain is ‘processes’, which defines the workflow between the roles. In addition, ITG literature identifies ‘relational mechanisms’ as a factor that defines the mechanisms of collaboration between units and departments and therefore impacts on the roles and responsibilities allocation. Organisational theory identifies ‘rewards’ as an additional factor, according to which people will be allocated to roles and responsibilities in order to motivate them. Other success factors identified by the cloud computing literature outlined the required skills and competencies of people allocated to the cloud-based controls.

Aggregating (with redundancies removed) all the success factors derived from cloud computing, organisational theories, and ITG literature resulted in a set of 16 success factors (Table 3.6) for the allocation of people to roles and responsibilities of IT controls in a public cloud. This set of success factors was termed T-version, and it met the objective # 3.

The proposed success factors were tested in practice, using a case study approach, among 12 IT decision makers from multiple organisations in the UAE. Prior research shows that this approach has been used for testing the validity of a framework (Das & Dayal, 2016). Due to the nature of the expertise required to verify the success factors, the only respondents interviewed were those at an IT decision-making level within their organisations, having related professional certifications, and/or having experience of working on cloud projects. Empirical intervention not only resulted in a redefinition of the factors, but also in the addition of one extra success factor (‘change management’). It also helped in moving these success factors from generic to cloud specific as well in customising them to better fit the public cloud environment by aggregating them into meaningful themes. This resulted in the table with five key success factors and ten sub-factors (Table 6.2). Using an influence diagram, Figure 7.3 structures the discussion related to research question 3, and provides a clear, graphical picture of the results.

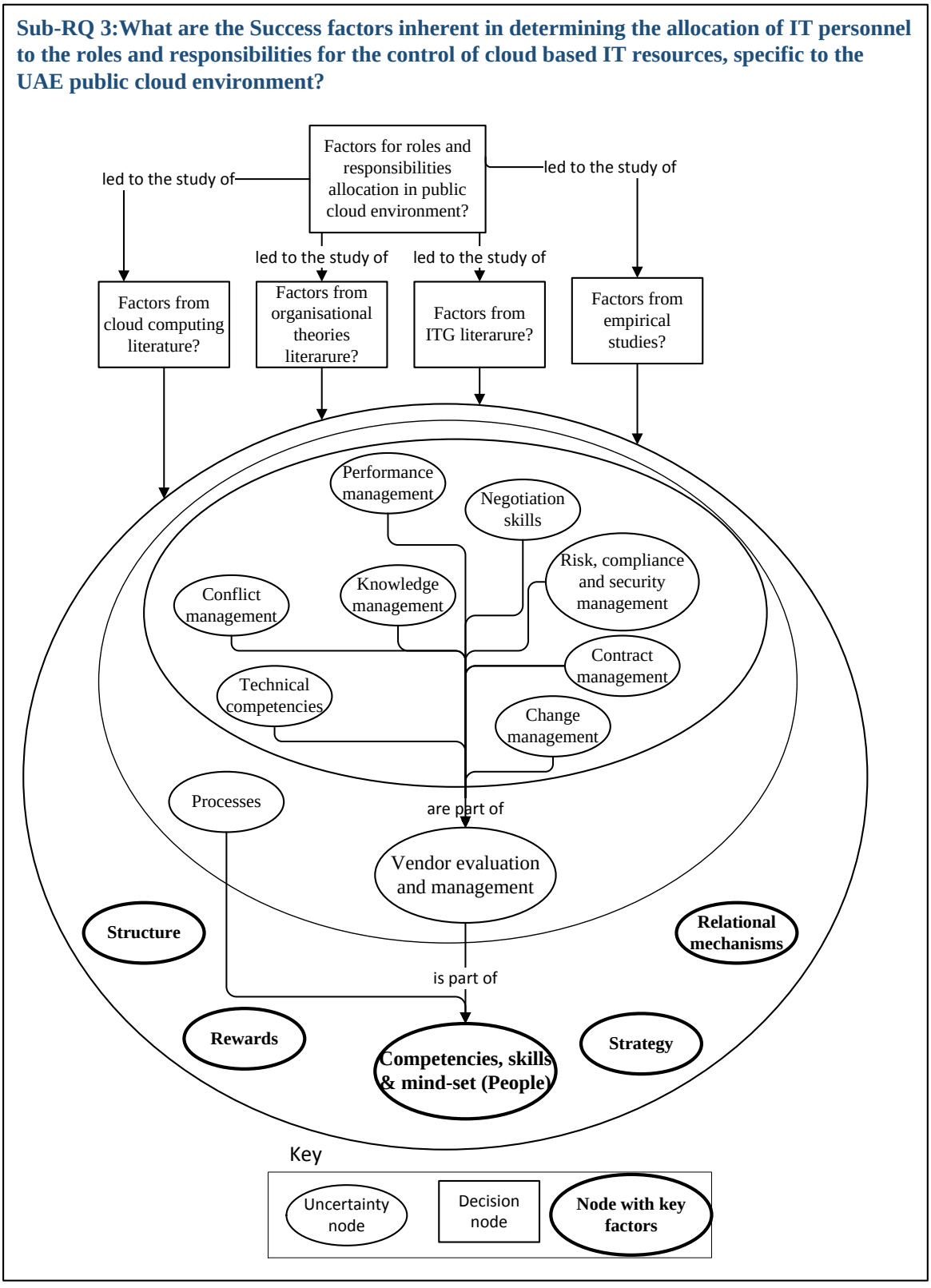



Figure 7.3: Discussion and results related to research question # 3

While researchers have described people's competencies and skills as important for achieving the strategic direction of an organisation (Galbraith, 2011), the empirical study re-established

them as the decisive success factors in role allocation, with the highest coverage (57%). Interpretation of interview respondent's statements revealed that the highest (90%) desired competency and skills of people allocated to IT controls are the ability to evaluate and manage cloud vendors, particularly in terms of risk, compliance and security. Contrary to the literature, which stated that people need profound 'technical competencies' for integrating cloud resources with internal systems (Lacity & Reynolds, 2014), this study indicated that cloud vendors take control of the technical part of the cloud, replacing people's technical competency requirements with business skill requirements. Those who supported the inclusion of technical competencies desired a much-diminished role (1%) for this factor, stating that technical competencies are needed while the organisation is still in the process of migration to the cloud.

The structures within an organisation determine the type and number of job specialties used in performing the work. Task allocation depends upon the number of people in the department at each level of the structure (Galbraith, 2011). Interview respondents also correlated the impact of cloud technology with the size of the IT department. According to five respondents, cloud-computing technology will not only reduce the necessary number of IT professionals in the organisation, but also relocate them to different departments, therefore resulting in reallocation of their roles. Structures also constitute the location and distribution of power (Galbraith, 2011; Peterson, 2004), establishing clear-cut job descriptions and objectives.

The strategy of an organisation also impacts on the role allocation (11% emphasis). Strategy dictates the cloud-based products to be used, the tasks to be performed, and the organisation's personnel hiring policies, to match their competitiveness, differentiation and financial goals. Rewards have an impact on allocation as people are rewarded by being trained, and by being allocated to new and challenging cloud related tasks, thereby giving them recognition, motivation and growth opportunity.

Finally, relational mechanisms, with an emphasis of 5%, are also a factor in role allocations in order to build interpersonal relationships through collaboration, job rotation, and teamwork. The resulting validated success factors will aid in managerial decisions to allocate roles and responsibilities for IT controls in a cloud-based environment.

## 7.4 Sub-research question 4

**What is the perceived ranking of these success factors, in terms of their importance?**

Response to the objective # 5 (re-validate and rank the success factors using Delphi technique with IT practitioner's working within identified organisations), provides the answer to sub-research question #4. Results propose the final validated, refined and ranked set of 15 success factors (VRR-version) for allocating people to the roles and responsibilities of IT controls, in a public cloud based environment. 'Comptetencies, skills and mind-set' ranked first followed by structure', then by 'strategy', then by 'rewards', and finally by 'relational mechanisms'.

This research question was answered through a Delphi technique with 44 experts working at various IT operational (business and IT management) levels, conducted in two rounds. While the focus of the first Delphi round was on re-validating the initial list of success factors, the second round focused on the ranking & rating (by assigning weights of the success factors) by the Delphi panellists. Statistical aggregation was used on the weights provided by interview respondents and by the Delphi panellists to calculate the new ranking for each success factor.

Use of the Delphi technique resulted not only in the change of the sub-factor title from change management to mind-set, but also its move to the organisational level. The panellists' suggestions correlated to the six interview respondents' views (Chapter 5, Table 5.6), who considered the abilities of people to accept and adapt to the changed work environment an important allocation factor at the organisational level. These suggestions were also in conformance to Galbraith (2011) whose views emphasise the importance of skills and mind-set in people to execute the strategic directions of an organisation. Therefore, taking into account the feedback from the Delphi panellists, the academic literature and the interview respondents, 'change management' was renamed as 'mind-set' and moved up from 'vendor evaluation & management' to the higher level of main constructs. Subsequently, the 'competencies and skills' factor was changed to 'competencies, skills and mind-set'. The Delphi process also resulted in the movement of 'technical competencies' rank from $7^{th}$ to $5^{th}$; 'negotiation skills' to the $6^{th}$ rank, and 'conflict management' moved from $6^{th}$ to $7^{th}$ rank (Table 6.5). Using an influence diagram, Figure 7.4 provides a clear, graphical picture of the results of research question 4.

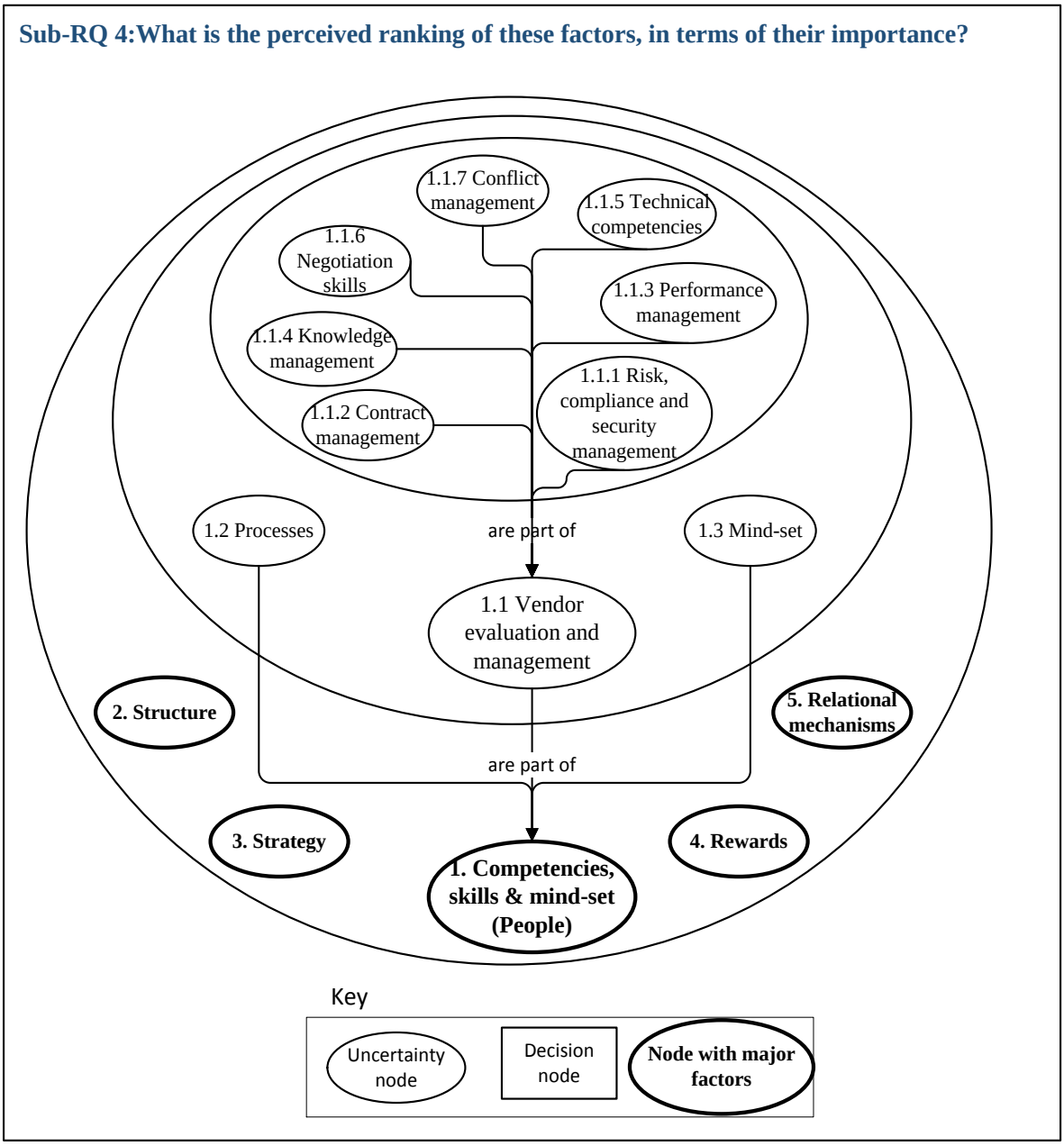



Figure 7.4: Discussion and results related to research question # 4

## 7.5 Application of the success factors (VRR-version)

The success factors obtained from this study can help IT decision makers (in the cloud user organisations) in the selection of appropriate staff for allocation to the cloud based IT controls, based on an organisation's priorities. This can be illustrated using a hypothetical scenario. A weighted decision matrix is a tool used to compare alternatives with respect to multiple criteria of different levels of importance. It helps in evaluating possible alternatives to a course of action (Martin, 2016) and is also used by project managers for selecting the projects[1] based on many criteria. The first step in creating a weighted scoring model is to identify

[1] The researcher is a certified and practicing Project Management Professional (PMP)

criteria (PMBOK, 2013; Schwalbe, 2014). The proposed success factors (VRR-version) can be used as criteria in a weighted decision matrix, for allocating appropriate staff to the IT controls for those resources that have migrated to the cloud.

In this regard, table 7.2 illustrates a hypothetical scenario using a bottom-up approach, for selecting the most suitable person (among person X, Y, and Z) to roles and responsibilities of a particular IT control. In order to use this decision matrix, firstly, weights are allocated to each success factor depending on its importance to the IT control and on organisational priorities. Weights are assigned in percentages; the weights of the factors must total 100 percent. In this scenario, the organisation emphasizes on people's 'competencies, skills and mind-set' (for the selected IT control) by allocating a weight of 80% (cell #D17) to this factor. The other organisational factors, 'structures', 'strategy', 'rewards' and 'relational mechanisms' (relevant to the selected IT control), have been assigned equal weight of 5% (cell # D18, D19, D20 & D21). Out of all the competencies, people with a capability for 'vendor evaluation and management' are preferred, with a weight of 70% (cell # D13), over people with a knowledge of other 'processes' with a weight of 25% (cell # D14), and people with mind-sets to change, with a weight of 5% (cell # D15). Each of the sub-factors of 'vendor evaluation and management' (cell # C5 to C11) are assigned a weight of 50%, 15%, 10%, 7%, 7%, 6%, and 5% (cell # D5 to D11) respectively.

Secondly, in columns E, F and G, numerical scores are assigned to each factor (for example, 0 to 100) for each person. The scores indicate how much each person meets each factor.

Thirdly, after assigning weights for the factors and scores for each person, weighted score is calculated for each person by multiplying the weight for each factor by its score and adding the resulting values. Totals are calculated for 'vendor evaluation and management' (in cell # E12) using a formula (E5*0.5+E6*0.15+E7*0.1+E8*0.07+E9*0.07+E10*0.06+E11*0.05); for 'competencies, skills & mind-set' (in cell E16) using a formula (0.7*E13+0.25*E14+0.05*E15) and total score for Person X is calculated (in cell # E22) using a formula (=0.8*E17+0.05*E18+0.05*E19+0.05*E20+0.05*E21). Similar calculations follow for Person Y and Z.

Table 7.1: Weighted decision matrix for role and responsibilities allocation

| Rows /cols | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 4 | **Success factors** | | | **Allo-cated weight %age** | **Person X %age** | **Person Y %age** | **Person Z %age** |
| 5 | | | 1.1.1 Risks, compliance, and security management | 50 | 100 | 40 | 50 |
| 6 | | | 1.1.2 Contract management | 15 | 5 | 100 | 50 |
| 7 | | | 1.1.3 Performance management | 10 | 5 | 100 | 50 |
| 8 | | | 1.1.4 Knowledge management | 7 | 5 | 100 | 50 |
| 9 | | | 1.1.5 Technical competencies | 7 | 100 | 40 | 20 |
| 10 | | | 1.1.6 Negotiation skills | 6 | 5 | 100 | 50 |
| 11 | | | 1.1.7 Conflict management | 5 | 5 | 100 | 50 |
| 12 | | | **Total of vendor evaluation & management** | **100** | **59** | **66** | **38** |
| 13 | | 1.1.Vendor evaluation & management | | 70 | 41 | 46 | 27 |
| 14 | | 1.2.Processes | | 25 | 50 | 100 | 100 |
| 15 | | 1.3.Mind-set | | 5 | 100 | 10 | 100 |
| 16 | | **Total of competencies, skills & mind-set** | | **100** | **46** | **58** | **49** |
| 17 | **1. Competencies, skills & mind-set (People)** | | | **80** | **37** | **46** | **43** |
| 18 | **2. Structures** | | | **5** | **100** | **100** | **100** |
| 19 | **3. Strategy** | | | **5** | **100** | **100** | **100** |
| 20 | **4. Rewards** | | | **5** | **0** | **0** | **100** |
| 21 | **5. Relational mechanisms** | | | **5** | **0** | **0** | **100** |
| 22 | **Total Score** | | | | **40** | **47** | **54** |

Note that in this example, *Person Z* would be the obvious choice for selection because it has the highest weighted score (54). Based on the weights provided in table 7.2, *Person X* is more of a technical person with very limited business knowledge. On the other hand, *Person Y* is efficient in vendor evaluation and management tasks with limited knowledge of security, risk and compliance management. *Person Z* has average competencies and skills, but similar to *Person Y*, he has domain expertise. In addition, *Person Z* has a mind-set to adopt change and organization wants to reward the person (through trainings) by assigning it to the cloud related (tasks). In this scenario *Person Z* would get preference over other people.

Weights can be easily changed to update the weighted scores for other IT controls. This capability allows to investigate various options for different staffs and different IT controls quickly. This weighted decision matrix can also be used for selecting the right people to be assigned to RACI charts (used in COBIT, ITIL and PMBOK frameworks). Using this chart IT decision makers have a clear picture of the personnel's competencies, skills, mind-set, and their standing in relation to the organizational policies. This will help decision makers to decide whether to assign them as 'responsible', ''accountable', 'consultant' or just to keep them 'informed'. This matrix also helps in identifying training requirements of staff. Organizations can also determine minimum scores or thresholds for specific IT controls in a weighted scoring model. For example, suppose that an organization should not consider a staff if it does not score at least 50 out of 100 on every factor. This type of threshold can be built into the weighted scoring model to reject staff that do not meet these minimum standards.

## 7.6 Comparing proposed success factors with the related tool

ISACA, in alignment with the COBIT 5 framework, developed the cloud computing assurance program as a road map for the completion of specific IT audit and assurance process (ISACA, 2014a). This assurance program contains guidelines focussing on the governance affecting cloud computing; the contractual compliance between the service provider and customer; privacy and regulation issues concerning cloud computing; and other specific cloud computing issues. One of the assurance engagements identified by this guideline is to define, obtain, and assess people, their skills and capabilities, in a cloud environment.

This initiative, identifies three sets of required people's skill as:

- Cloud vendor management skills: an essential skill for all those involved in selecting, negotiating with and managing vendors.
- Understanding of cloud security and compliance components.
- Data integration skills.

Goals related to 'cloud vendor management' skills have been identified as: experience (4+ years); knowledge (of cloud IT costing/value, cloud IT architecture, cloud risk management and a cloud risk management framework); technical skills (basic cloud computing concepts); behavioural skills (communication and negotiation); and number of people with appropriate skill level. ISACA guidelines present three skill sets ('cloud vendor management', 'cloud security and compliance components' and 'data integration skills') but goals have been mentioned for the first skill set (cloud vendor management) only. It does not provide any goals for the other two skill sets.

This guideline was released by ISACA by the end of the 2014 and accessed by the researcher of this study in early 2016 (while revising literature review). Researcher of this study started looking at the research gaps from June 2013 to June 2014, and a model with the proposed factors was sent for journal publication in July 2014 and submitted for interim assessment on April 1st 2015. Therefore, the ISACA assurance program has no role in the development of the proposed success factors. However, a comparison of the final validated, refined and ranked success factors (Table 6.5) with the guidelines given in the ISACA assurance program indicates a degree of similarity (around 35%) across some concepts. Similar to the ISACA assurance guidelines, final success factors determines people's skills and capabilities important for successful cloud ventures. Both documents place stress on cloud vendor management, security & compliance, and data integration skills as important for managing IT controls in the cloud environment. Knowledge of risk management, technical skills, negotiation skills, and the number of people in the organisation, was identified by both. It is worthwhile to note that the IT audit and assurance program tool was developed, reviewed, and acknowledged by a team of 47 global ITG experts. Similarities in the results of this study with the ISACA tool therefore grants credibility and lends weight to the validity of the proposed success factors. It is reassuring that the results of this study are in conformance with the views of global ITG experts.

However, the ISACA guidelines provide a very generic framework and do not look specifically or in their entirety to the allocation of roles and responsibilities. On the other hand, the success factors proposed herein offer a focused insight into the allocation of roles and responsibility, as well as considering the elements from organisational and strategic perspectives. Therefore, the proposed success factors can be considered as an extension of the assurance program guidelines but with a much wider scope. As an extension to the ISACA guidelines, this study has revealed that allocation of roles and responsibilities should not be based on skills and competencies alone. Other factors, like organisational strategies & structures, policies on rewards, and relational mechanisms, also play an important part in the allocation of roles and responsibilities. Results of this research are much more focused and detailed with identification of other non-technical skills like contract, performance, knowledge, and conflict management in addition to people's mind-set, as success factors in allocation of role and responsibilities.

## 7.7 Conclusion

This chapter determines the answer to the main research question by answering four sub-research questions related to success factors for the allocation of roles and responsibilities of IT controls in a public cloud environment. Analysis of the literature revealed a set of 16 success-factors. The validity of these success factors was cross-checked and further analysed using a case study approach with twelve IT decision makers within eleven private and government organisations in the UAE. This empirical intervention resulted in the generation of 17 success factors specific to public cloud environment. Next, using the Delphi technique, IT practitioners at the operational level further validated and ranked these success factors in the order of their importance. This study identified five broad themes that affect people's allocation in an organisation, namely, 'competencies, skills and mind-set'; 'structures'; 'strategy'; 'rewards'; and 'relational mechanisms'. These broad themes are divided into 15 success factors that affect the allocation in the context of a public cloud environment, for an organisation in a developing economy.

# CHAPTER 8

# CONCLUSIONS AND FUTURE WORK

# 8 CHAPTER 8: CONCLUSIONS AND FUTURE WORK

The aim of this unique research was to identify the key success factors in the allocation of staff to the roles and responsibilities for the control of cloud based IT resources. While numerous ITG frameworks, standards, and best practices exists with multiple IT controls, to date there has been no guidance on the 'how' of people's role allocation for IT controls. Theoretical and empirical studies revealed that people's allocation to IT controls in a cloud environment (as well as in a classic data centre environment) has been done on a subjective and ad-hoc basis with little consistency across sectors, regions, or organisational size. This set of ranked success factors is, therefore, an innovative initiative that can be applied to ITG frameworks while ensuring consistency, uniform control, and compliance. Allocation of roles and responsibilities of IT controls is an ITG decision making mechanism and the related literature exploration uncovered ITG as a term with multiple meanings in different contexts. Therefore, drawing from the extant literature and emphasising the predominant role of 'responsibilities of IT control', this study began by formulating a comprehensive definition of ITG as:

> A set of IT controls, with clearly defined and assigned roles and responsibilities, geared towards the right use of technology to meet the strategic goals of the organisation.

Based on the analysis of conceptual components from behavioural, managerial, and information systems literature, success factors for people's allocation to roles and responsibilities within public cloud user organisations were identified. These success factors were empirically evaluated by interviewing IT decision makers and ranked by IT practitioners from various industries in the United Arab Emirates (UAE). This current study is focused on all cloud services (IaaS, PaaS and SaaS) of the public cloud model because IT controls uniformly relate to the transformation of the roles and responsibilities of IT within them.

As a result of studying the literature and empirical studies, this research highlights four findings. Firstly, the literature, as well as the empirical study, showed that while migration to the cloud is causing changes in people's roles, there are no guidelines provided by ITG frameworks or researchers to IT practitioners on the allocation of the roles and responsibilities of staff for IT resources that have been migrated to the public cloud. Within cloud user organisations, this deficiency is leading to the loss of control, staff with inappropriate skills and competencies, inappropriate allocations of personnel, and obsolete job descriptions. Such concerns are, in turn, resulting in a shortage of cloud expertise, ambiguity in the roles and

responsibilities allocation practices, resistance to the acceptance of new technology, and the failure of cloud projects.

Secondly, this research presents a set of 15 success factors that aids in managerial decisions to allocate roles and responsibilities of staff for IT controls in a cloud-based environment. These success factors place emphasis on the 'competencies, skills and mind-set' factor for the allocation of IT controls in a cloud environment. Other success factors related to the organisation ('structures' and 'strategy'*)* and its policies *(*on 'rewards' and 'relational mechanisms') are also considered important factors for this allocation.

Thirdly, this study reveals that cloud computing is transforming the required competencies and skills of IT job roles. When transitioning from the internal IT environment to the public cloud, organisations cede control over IT assets to the cloud provider while accountability and responsibility rests with the organisation's IT department. One of the biggest challenges, and an extremely important step in such a situation, is to identify and allocate the people with the right skills and capabilities to ensure the accountability and responsibility of the cloud based IT controls. This study highlights that the highest desired competency and skill of staff allocated to cloud based IT controls is the ability to evaluate and manage cloud vendors, particularly in terms of risk, compliance and security management. Another significant finding was that staff in the cloud user organisations need to possess significant business (more than technical) competencies to manage cloud based IT controls. Other skills and competencies identified to be important for people allocated to cloud based IT controls include, contract management, performance management, knowledge management, negotiation skills, conflict and change management.

Fourthly, qualitative research input helped in converting generic success factors deduced from the literature into the final validated, refined and ranked success factors relevant and specific to the public cloud. These success factors are not only validated by 12 IT decision makers from various government and private organisation, but, ranked in the order of their importance, by 44 IT operational level personnel as well. These ranked success factors can provide guidelines to IT management in organisations using public cloud services to mitigate the risk in the accountability and responsibility for managing IT controls.

The rest of this chapter is divided into five sections. Section 8.1 provides a brief explanation of the proposed success factors. While section 8.2 presents the reliability and validity measures of the research, section 8.3 displays the important code of ethics followed in this

study. Section 8.4 summarises the contributions of this thesis, points out limitations of the current work, and discusses the important directions of future work. Finally, section 8.5 summarises and concludes this thesis.

## 8.1 Success factors for roles and responsibilities allocation

From an abductive approach, the research provides not only five key success factors but also a ranked list of sub-success factors under these five key factors, based on which staff can be allocated to the roles and responsibilities of IT controls in a public cloud environment. The following section presents a brief explanation of each of the five key success and ten sub-success factors.

**1. Competencies, skills and mind-sets (People):** Staff in the organisation are allocated to new roles and responsibilities in the public cloud environment based on their skills, competencies and mind-set. While researchers have described people's 'competencies, skills and mind-set' as important for executing the strategic direction of an organisation, the empirical study confirmed them as the decisive success factors in roles and responsibilities allocation. The following ten topics give a brief description of the skills and competencies identified in this study.

**1.1 Vendor evaluation and management:** Cloud vendor evaluation and selection is one of the most vital actions of companies in a supply chain. Therefore, 'vendor evaluation and management' is declared the highest desired competency or skill of people allocated to IT controls that have been migrated to the cloud. This skill is needed for ensuring the implementation of the organisation's strategic road map with the cloud provider.

**1.1.1 'Risks, compliance, & security management'***:* Public cloud models face concerns because of the larger number of cloud users; competing clients sharing services; multi-tenancy characteristics of cloud computing; velocity-of-attack; and threats specific to virtualisation technology. Greater dependency on third parties increases the vulnerabilities in external interfaces that could be fuelled by failings within the cloud service providers. Reliance on the internet as the primary conduit to the enterprise's data introduces connectivity, availability, and other security issues. Data privacy and ownership are also issues to be considered in a public cloud environment. Organisations need people with appropriate competencies to address these concerns and to ensure security against these threats. Knowing that the public cloud environment faces highest security, privacy and legal concerns (Ferrer & Montanera,

2015), it is not surprising that 'risks, compliance, and security management' is the most significant competency required in order to evaluate and manage cloud vendors. Staff need to have the technical capabilities to assess and identify various asset or non-asset based risks (related to reputation and image); as well as the ability to assess and ensure internal and external compliance, and its effectiveness in the context of legal, governmental, and industry regulations. Competencies are required to ensure compliance to policies regarding the confidentiality, integrity, and availability of information.

**1.1.2 Contract management:** Skills to develop and manage contracts are required to ensure the availability of the services drafted in the form of Service-Level Agreements (SLAs). Writing SLAs has been described as the most important part of contract development and management. People need to be skilful in managing SLA updates; licensing and metering costs; and for ensuring rights to data, audit and receivable reports.

**1.1.3. Performance management:** Cloud user organisations need to continuously monitor SLAs in terms of the cloud provider's commitment to fixing bugs and other issues related to the cloud services. Contracts need to be measured against performance by checking the quality of the services and by implementing penalties in the form of fines to be levied against the providers.

**1.1.4. Knowledge management:** Skills to share bidirectional knowledge between the organisation and its cloud provider are required. People need the skills to track generated reports and share documents in the required and acceptable format, to enhance productivity, simplify decision making, and improve the efficiency of collaborative team efforts.

**1.1.5. Technical competencies:** In a cloud environment, cloud vendors manage the technical aspects, leaving cloud customers to the tasks of completing transactions, collecting data in terms of front-end reports, and integrating services. However, cloud is a journey and organisations do not completely switch to a cloud model all at once. They may choose to internally host some services while new ventures are migrated to the cloud providers. Therefore, some technical competencies are needed to integrate and manage the existing systems while the organisation is still on its journey to the cloud.

**1.1.6. Negotiation skills:** Negotiations are required to ensure the rights and obligations of both parties. It may include negotiations with cloud vendors on financial aspects, contracts, and SLAs. To have more negotiating power, it is very important to have market awareness,

including the best time of the year to negotiate and feedback from peers. This skill is crucial for safeguarding the interests of the cloud user organisation and its shareholders.

**1.1.7. Conflict management:** Staff must be able to manage any sort of conflict with the cloud vendor. Conflict with the cloud provider may arise for a number of reasons, such as termination of the contract, conflicts related to security requirements, or due to the cloud provider's poor performance or declared bankruptcy.

**1.2 Processes:** Processes are connected sets of activities that illustrate the movement of information. When moving to a cloud, new processes are formed or the current ones undergo changes. When processes cross organisational boundaries, as is the case in a cloud environment, people must have the competencies to be able to integrate their business processes with the best practice solutions offered by cloud providers and understand multiple applications.

**1.3 Mind-set:** People resist new technology because of the fear of job loss, due to the lack of skills and capabilities, or because they do not want to leave their comfort zone. People who have the mind-set to take on challenges, embrace change, and are ready to learn new technologies will be best suited for allocation to cloud based IT controls.

**2. Structure:** Structures constitute the location and distribution of power within an organisation and impacts role allocation. Structures determine the type and number of job specialties used in performing the work and the task allocation in turn depends upon the number of people in the department at each level of the structure. Structures establish segregation of duties, ensuring good governance and thereby avoiding any conflict of interest. Structures have a major impact on the decision to move to a cloud as de-centralised business units may adopt a separate cloud strategy.

**3. Strategy:** Strategy defines the type of cloud-based products that the organisation will use depending on trade-offs between cost, competitiveness, complexity, time, and suitability to the business needs. Such an organisational policy determines the tasks to be performed and, therefore, the skills and competencies required. People can be critical sources of competitive advantage if their skills are unique. The decision as to whether a firm should develop and allocate internal employees to the IT controls or depend on cloud providers for such skills depends upon the strategy, internal capabilities, and the uniqueness of employee's skills.

**4. Rewards:** People can be rewarded by being given challenging tasks or tasks that give them recognition. People are rewarded and motivated by assigning them to tasks that allows them

to learn new and challenging technologies. They get a sense of stability from the feeling that the organisation is investing in them and providing them with an opportunity to grow. 'Training' for staff to fit into their new roles has been identified as a highly recommended reward and as an important allocation factor.

**5. Relational mechanisms:** Staff are allocated to various roles and responsibilities in order to build relationships between business and IT departments/units through assignment collaborations, job rotations, and teamwork. Organisations can break the barriers between IT and business by allocating people from various departments/units on the basis of job rotation so as to share best practices from highly qualified people or to give others an opportunity to grow. The size and complexity of the organisation determines the importance of this factor.

## 8.2 Reliability and validity of the data

Reliability and validity determines the strength of the data. This research used a triangulation method involving literature review, interviews and the Delphi technique to generate data, thereby ensuring the credibility and validity (Hussein, 2015) of the data. Furthermore, rigour and trustworthiness of the findings from the qualitative data was accomplished through 'member checking' (Leech & Onwuegbuzie, 2007). Member checking involved showing the transcribed notes to the interview respondents for assessment of accuracy. Additionally, the transcribed notes were reviewed by an experienced academics who is also an active qualitative researcher. He checked the themes from a randomly picked interview to ensure the correctness of the coding.

Reliability describes how a test, such as a questionnaire, will show similar results in different situations (Karlsson & Welander, 2015). According to Bell (2010) it is equally unreliable if the question shows varying answers. Reliability of the proposed success factors is confirmed by their validity and similar responses to the questionnaires obtained from forty-four Delphi panellists. Using Schmidt's (1997) interpretation of Kendall's W coefficient, the level of consensus of 0.79 in the first section, 0.84 in the second section, and 0.89 in third section of the questionnaire indicated a strong agreement between the panellists on the success factor rankings. Therefore, Kendall's W coefficient results provided a good degree of consensus among panellists, giving confidence in the reliability of the results. Furthermore, following Yin (2014) guidelines, table 8.2 illustrates the strategies planned and the actual steps taken to ensure reliability and validity of the data.

Table 8.1: Study tactics for four design tests (planned in chapter 4, table 4.7)

| Tests | Strategies (actions planned – detailed in table 4.7) | Actual Steps Taken |
|---|---|---|
| Construct Validity | Use of literature review, interviews and the Delphi technique for data collection. | The triangulation method research design of the study used to ensure construct validity. |
| | Following the evidence from the research question to the organisational report and tracing it back to the question. | Done through the correlation of the evidence between the identified literature (theoretical success factors) and empirical data. |
| | A copy of the transcribed notes to be emailed to participants for their use, review and approval. Delphi participants to be reviewing the factors as well. | Transcribed notes emailed to each interview respondents. Results shared with Delphi participants through two rounds. |
| Internal Validity | Creation of patterns to be done by grouping together categories that relate to each other so as to resemble a coherent entity or phenomenon under study. | As a validity procedure, researcher looked for convergence among multiple and different sources of information to form themes or categories (see chapter 6; section 6.1.1 and 6.1.2). |
| External validity | Use of theoretical replication via a set of ten private and government organisations in UAE. | Theory tested through theoretical replication of findings from a set of eight diverse private and three governmental organisations in the UAE. |
| Reliability from case study | Contains interviews, procedures and general rules that should be followed when using the instruments and is created prior to the data collection phase. | Appendix A outlines the interview protocol, created and followed prior to the data collection phase.<br>LeCompte's analysis protocols were followed, as specified in Chapters 5 and 6. |
| | Data (interview transcripts and the researchers' field notes from the data collection) to be coded and stored. | Done. Detailed in Chapter 5, Section 5.2.1. |

## 8.3 Ethical considerations

The following procedures were used to ensure ethical practices in this research:

- Interview respondents provided their consent through forms sent to them prior to the interview. The consent form (Appendix A) presented the purpose of the study as well as a statement indicating that the respondent was able to withdraw from the interview at any time and with no questions asked.

- This research respected ethical and legal obligations by obtaining ethical approval from the College of Science and Technology Research Ethics Panel (CST), prior to the process of collecting, using, and sharing data. One of the requirements of this ethical approval was the development of a consent form.

- Interview respondents were provided assurances about their anonymity and confidentiality in the invitation letters sent to them (Appendix A: 'participant invitation letter' and consent form). Confidentiality and anonymity of the participants and their organisations was observed by using numerals (e.g. R1) to represent the respondent and Case X (where X is a number from 1 to 11) to represent the organisation.

- To maintain anonymity and confidentiality of the participants, recorded interviews (audio files) were deleted from the iPhone and all respondent related files (transcripts and audio files) were encrypted with passwords to ensure data confidentiality. Hard copies, including the consent forms and any other relevant materials, were stored separately in the researcher's drawers. All files were anonymised by using the interviewee's coded numbers and the date of creation.

- Participants were informed about the purpose of the interview and Delphi event beforehand, thereby ensuring them the freedom to choose not to participate in the research activity. They were also given a choice to withdraw at any time from the research process during both the interview and Delphi rounds.

## 8.4 Contributions, limitations and future work

This study makes several useful contributions to IS research, and has important implications for IT practitioners. However, this study is not without its drawbacks. Limitations of this study are highlighted below and they provide directions for future research.

### 8.4.1 Contribution to practice

Industries are choosing technological scalability by moving their enterprise architecture to the next level of the cloud. In this age of digital metamorphosis, the prerequisite for a great plan of technological scalability is a good governance model. This study has implications for IT decision makers faced with establishing IT-centric governance arrangements that are focused to match such scalable systems.

- Firstly, the results of the study guides IT decision makers to assess the potential effects that public cloud deployment model may have on their existing IT governance arrangements. The cause and effect of the different success factors assist the managers to consider them when deciding to move into the cloud. In this regard, the research identifies the changes that the cloud technology is bringing to staff's roles and responsibilities.

- Secondly, the research has highlighted 'people's competencies and skills' at evaluating and managing cloud vendors as the dominant success factor to be considered during the roles and responsibilities allocation. This study, therefore, helps ITG authorities and policy-makers to understand good practices related to people's skills and competencies from a cloud perspective. It provides information and direction for the practice of IT audit and assurance. It demonstrates that an inventory of skills and competencies should be maintained by an organisational unit to evaluate the gap between the necessary portfolio of skills and competencies and the current inventory of skills and capabilities. Therefore, this study responds to suggestions of other researchers by producing results that are beneficial to the IS practising community by being relevant to practice (Kuechler & Vaishnavi, 2011), particularly to policymakers (Gallivan & Aryal, 2012).

- Thirdly, the success factors obtained from this study helps IT decision makers (in the cloud user organisations) in the selection of appropriate people for allocation to the cloud based IT controls, based on an organisational priorities, using weighted decision matrix.

- Fourthly, results of this research will help IT decision makers to make informed decisions on hiring people with the right skills and competencies for successful cloud ventures. Research results will also help IT decision makers to assess their staff's capabilities to meet their business needs and to plan appropriate training for them.

- Fifthly, 'security, risk and compliance' management has emerged as an important element for vendor evaluation and management. While security has been a major concern for managers when migrating to the cloud, this research has pointed out this factor's overarching role in allocating people to manage IT controls that are relevant to security in a cloud environment.

- Sixthly, this research provides a set of success factors for governance frameworks. Governance in the cloud requires defining policies and implementing well-defined roles and responsibilities for these migrated IT assets. It was observed that popular ITG authorities like COBIT, ITIL and PMBOK use RACI charts for allocating roles and responsibilities but none of them provides any RACI charts allocation guidelines for IT controls that have been migrated to the cloud. This research addresses the gap by providing five key success factors ('competency, skills & mind-sets'; structures; strategy; rewards; and relational mechanisms) involved in deciding the allocation of people to the changed roles and responsibilities of IT controls in the cloud environment. These success factors can be used by ITG authorities as

an extension to their guidelines to organisations (from a cloud perspective) on RACI chart allocations.

### 8.4.2 Contribution to theory

- This is the first study that strives to obtain an understanding of the success factors for allocating people to the roles and responsibilities of IT controls in a cloud perspective (integrating three domains, namely, cloud computing, IT governance and organisational theory), specific to a developing economy, and using a qualitative approach.

- This study contributes by reducing the deficiency in academic research on ITG. Furthermore, this research uses a triangulation method involving literature review, interviews and the Delphi technique to generate data. While in-depth and semi-structured interviews in this study enabled IT decision makers to validate the success factors, the Delphi technique provided further validation and ranking of the success factors among a much wider audience, who work at IT operational levels. The triangulation method research design of the study contributes a rich description of user participation, thereby answering calls for studies of user participation in current contexts (Markus & Mao, 2004) and multi-method studies in IS (Mingers, 2001).

- Finally, this research provides pointers to academia which seeks to identify the IS skills and capabilities required to prepare graduates adequately and according to industry needs (Gefen et al., 2012; Ragowsky et al., 2012). Skills and capabilities identified in this research, can help academia to align their IS curriculum to the needs of the industries.

### 8.4.3 Limitations and future work

This study further contributes to theory by providing directions for future researches in the following areas:

- This study uses qualitative approach to obtain an in-depth understanding of business related decision making. While this approach is important, it restricts the ability to generalise in a statistical sense. Similarly, because national culture has been found to have a substantial effect in IS studies (Leidner & Kayworth, 2006), generalising these results to other cultures is encouraged through multiple methods. It might, for example, be that organisations operating in Europe have very different views on roles and responsibilities allocation factors compared to organisations operating in the UAE. This study, therefore, paves the way for further

qualitative and quantitative research to conduct a global study, encompassing countries of diverse cultures, which can aid in the generalisation and validation of these success factors in multiple contexts.

- Results of this work provide guidelines to IT practitioners for allocating people to roles and responsibilities of IT controls, with its boundary being restricted to the public deployment model. It provides a ground for future researchers who can modify these success factors for other cloud deployment models (private and hybrid).

- The study resulted in a set of success factors for a cloud environment. It has been observed that most of the IT control implementations of IT governance models take place in a non-cloud environment where the ITG manager allocated responsibility and accountability. While a few respondents mentioned that this set (success factors) can also be applied in a non-cloud environment, further studies are encouraged to take this set and assess its applicability in a non-cloud environment.

- DeLone and McLean (2003) developed an IS successful model which has become a benchmark for researches in the area. Future studies can be undertaken to evaluate the effectiveness of these success factors using the DeLone and McLean model of IS success.

- It is acknowledged that the use of IT governance practices might vary according to the type of industry (Haes & Grembergen, 2008). Research can build on the findings of this study by conducting selective analysis of firms with the same size, age or cloud level focus, in a particular sector, to produce results that are more comparable.

- The UAE is proactive in adopting the latest trends in the information systems domains. In this regard, 95% of the organisations in the UAE have already applied, or have a plan to apply, a cloud computing model (D'Mello, 2015). Additionally, industry experts are predicting a massive shift to cloud adoption by businesses in the UAE (D'Mello, 2015). However, the IT industry within the UAE is relatively small and relies on acquiring skills from abroad which, apart from increasing costs and reducing efficiency, leads to instability and job insecurity. Impact of such job market conditions on the allocation of people to roles and responsibilities deserves further investigation and is a potential future research area. Furthermore, this study did not consider external factors such as changes in economies and technologies. It would be useful to examine the success factors under the influence of such changes.

## 8.5 Conclusion

There is no doubt that lack of guidance and resulting inappropriate allocation of personnel to the roles and responsibilities of cloud based IT controls is a key problem that IT managers encounter in organisations. The results of this study, although qualified by their limitations, identify the skills and competencies required for handling public cloud based IT controls. This study, therefore, highlights cloud vendor evaluation and management, especially in terms of risks, compliance, and security, as important competencies and skills for staff allocated to manage cloud based IT controls. Staff's competencies to handle different sets of processes, in addition to their readiness to adopt new technology, will impact IT managers decision to allocate staff to manage cloud based IT controls. Apart from competencies, skills & mind-set, this study further suggests organisational structures, strategy, and policies on rewards and relational mechanisms as key success factors for allocating personnel to the roles and responsibilities of such IT controls. Results of this research will aid IT decision makers to make informed decisions on hiring and allocating people with the right skills and competencies for successful control of IT resources which have migrated to the cloud. Furthermore, research results will also help IT decision makers to assess their existing IT governance mechanisms to make them IT-centric, in addition to assessing IT workforces' capabilities to meet their business needs.

This study highlights several directions for future research. First, since the scope of the study has been limited to organisations within one country (UAE), a global study encompassing countries of diverse cultures and different sectors can aid the generalisation of these success factors. Second, it provides a ground for future researchers who can modify these success factors in a non-cloud environment, as well as for different cloud deployment models (private and hybrid). Third, future studies can also be undertaken to evaluate the effectiveness of these success factors using the DeLone and McLean (2003) model of IS success. Fourth, the impact of external factors, such as emerging job markets, changes in economy or technology, on the allocation of people to roles and responsibilities is another potential area for future research. Fifth, future research can build on the findings of this study by conducting selective analysis of firms with the same size, age or cloud level focus, in a particular sector, to produce results that are more comparable.

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# APPENDICIES

The title of this thesis was "An Integrated Model for the Allocation of Roles and Responsibilities of IT Controls in a Cloud Environment". This title can be seen in interview related forms.

Based on this research, a paper has been published in an international peer reviewed and ranked journal (Journal of Information Technology Case and Application Research, JITCAR). As per the suggestions of the journal reviewers, results of this research provides guideline rather than being a model. Similar observations were made by the local supervisor as well. Accordingly, the final output of this research rather than being a model has been updated to be a set of 'success factors'. Subsequently, it meant minor modification to the title of the research. Therefore, title has been changed to: 'IT Controls in the Public Cloud: Success Factors for Allocation of Roles and Responsibilities'. This change was reflected in the updated learning agreement too. Change being minor, had no impact on the research methods or ethical considerations.

# 10 APPENDICIES

## Appendix A: Interview related forms

### Participant Invitation Letter

Dear **participant's name**

We are conducting interviews as part of a research study to increase our understanding of how organisations are allocating roles and responsibilities of IT controls that have been migrated or are going to be migrated to the public cloud.

Roles and responsibility allocation is an IT governance activity. As a(n) **participant's role** specialist at **participant's organization,** you are in an ideal position to give us valuable first-hand information, from your own perspective.

The semi structured interview takes around 1 hour and is very informal. A copy of the interview questions is attached. **Your responses to the questions will be kept anonymous and confidential. Each interview will be assigned a number code to help ensure that personal identifiers are not revealed during the analysis and write up of findings.**

There is no compensation for participating in this study. However, your participation will be a valuable addition to our research. Findings from this empirical research will provide guidance to organizations and researchers on factors for the allocation of roles and responsibilities of IT controls in the cloud. This study also seeks to guide organizations in recruiting or developing people with appropriate skills and capabilities for handling cloud based projects. This study may be also help academia in identifying the right courses to prepare students with adequate IS skill and capabilities, according to the industry needs.

If you are willing to participate please suggest a day and time that suits you and I'll do my best to be available. Please find the information related to the interviews in the attached 'Participant Information Sheet'. For any further queries, please feel free to contact me on **xxxxxx**

Appreciate your support.

Best Regards,
**Researcher's name**
**Dated: dd mm yyyy**

# Participant Information Sheet (Individual)

**Date Information Sheet Produced:** dd mm yyyy

**Project Title:** An Integrated Model for the Allocation of Roles and Responsibilities of IT Controls in a Cloud Environment

## An Invitation

It is a privilege to be associated with you for the purpose of this research. I am a PhD student from the School Of Computing, Science and Engineering, University of Salford, UK undertaking empirical research as part of the requirement of the award of the Doctor of Philosophy. Please note that your participation is voluntary and that you may withdraw at any time.

## 1. What is the purpose of this research?

The purpose of this research is to propose a set of factors that can be used for the assignment of roles and responsibilities of IT controls that are planned to be migrated, are being migrated or have been migrated to the cloud. This research is part of the course work on the Doctor of Philosophy that the researcher is undertaking. The results of the study will be analysed and published in the form of a doctoral thesis and confidentiality (explained in question 7) of the participants and organisations will be strictly maintained.

## 2. How was I chosen for this invitation?

The researcher seeks to select IT governance stakeholders working as 'Board and executive management', 'IT management and process owners', 'Risk, compliance and legal experts' and IT auditors working in organizations that have adopted public cloud strategy. Since you come in one of the mentioned group, it seemed appropriate to contact you for the purpose.

## 3. What will happen in this research?

Theory developed through detailed literature review provided the initial list of factors for roles and responsibilities allocation in a cloud environment. This initial list will be complemented by case research. The results from the case study will be further refined and ranked by soliciting expert's opinion using Delphi technique.

## 4. What are the discomforts and risks?

Since cast study is an exercise that involves providing input to a set of technical questions, there are no discomforts or risks.

## 5. What are the benefits?

The benefit for you in this regard is that through this exercise you will come to know of a factors that can be used as a guide for the allocation of people to IT controls that have been migrated to the clouds. The researcher will get the input on the criteria as well as the benefit of receiving independent feedback on the effectiveness of these factors.

## 6. How will my privacy be protected?

**Your confidentiality and privacy will be maintained as in this data collection method. The names of the participants and/or the organisation will not be mentioned anywhere. Moreover all the collected data will be stored securely in the office of the researcher and the primary supervisor whose details have been provided at the end of this form (Question 12.b).**

## 7. What are the costs of participating in this research?

The cost in terms of participating is the time duration required to interview. Depending on the size of the organization and its cloud maturity, it may take around 60 minutes.

## 8. What opportunity do I have to consider this invitation?

The researcher will appreciate if you could send a reply within two weeks of the receipt of this form.

## 9. How do I agree to participate in this research?

Once you agree to participate in the research, you may fill up consent form that is given along with this sheet and send it across to the researcher's email address in the form.

## 10. Will I receive feedback on the results of this research?

If you so desire, you will be given a copy of the result of the study. The results are scheduled to be released by the second quarter of the year 2017.

## 11. What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Researcher's local Supervisor: Supervisor's name and contact details here.

Concerns regarding the conduct of the research should be notified to the Ms. Nathalie Audren Howarth, College Research Support Officer, University of Salford, n.audren@salford.ac.uk, 0160 295 ext 55278.

## 12. Whom do I contact for further information about this research?

Researcher can be contacted for any details about the research. You may also contact researcher's main supervisor: Main Supervisor's name and contact details.

**a. Researcher Contact Details:**

Researcher's name and contact details here.

**b. Project Supervisor Contact Details:**

Local Supervisor's name and contact details here

***Approved by the University of Salford, Academic Audit and Governance Committee, College of Science and Technology Research Ethics Panel on type the date on which the final approval was granted CST Reference number type the CST reference number***

## Consent Form (participant)

*Project title:* **"An Integrated Model for the Allocation of Roles and Responsibilities of IT Controls in a Cloud Environment"**

*Project Main Supervisor:* ***Main Supervisor's name***

*Project Local Supervisor:* ***Local Supervisor's name***

*Researcher:* ***Researcher's name***

- ○ I have read and understood the information provided about this research project in the Information Sheet dated dd mmmm yyyy.
- ○ I have had an opportunity to ask questions and to have them answered.
- ○ I understand that the interviews will be audio-taped and transcribed. If there are any issues with recording the conversation, time will be given for writing the interviews.
- ○ I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.
- ○ If I withdraw, I understand that all relevant information including tapes and transcripts, or parts thereof, will be destroyed.
- ○ I agree to take part in this research.
- ○ I wish to receive a copy of the report from the research (please tick one): Yes○ No○

Participant 's signature:
.....

Participant 's Name:.....

Participant 's Contact Détails (if appropriate):……..……..

Date:

***Approved by the University of Salford, Academic Audit and Governance Committee, College of Science and Technology Research Ethics Panel on type the date on which the final approval was granted CST Reference number type the CST reference number***

*Note: The Participant should retain a copy of this form.*

# An Integrated Model for the Allocation of Roles and Responsibilities of IT Controls in a Cloud Environment

## Interview # X

## Questions on the Organization and the Interviewee

### Organization

**Name:**

**Industry:**

**Size. of organization(number of employees):**

**Size. of IT dept.:**

**Cloud models adopted:**

### Interviewee

**Name:**

**Position:**

**Role:**

**Gender:**

**No. of years in organization:**

**Total experience in IT field (yrs):**

**Qualification (including certification):**

**Section 1: Questions about the nature of people's role & responsibilities allocation in the organisation.**

1. Which ITG framework or standard are you using in your organization?

2. What percentage of your IS has moved to the public cloud?

3. Which IT resources (processes/assets) have been migrated to the public cloud?

4. Are you facing any challenges in cloud adoption in terms of people's roles and responsibilities?

5. How do you allocate people to IT controls in a public cloud? Is your allocation based on any criteria/factors?

6. If you are provided with a set of factors for assigning roles and responsibilities of IT controls that are in public cloud, would you find that useful?

**Instructions**: Factors will be shown to the interviewee and rest of the questions will be pertaining to the factors that can be used to allocate roles and responsibilities of IT controls that have been moved to the public cloud.

## Section 2: Questions related to the validation of the factors

7. Review the list for completeness. You can suggest to modify, or delete the factor. If you feel that the factor or its definition is needed, then please rank it too.

| **Factors** | Response for **f**actor<br><br>Yes/No Rationale | Taken your personal experience into account, **rate the importance of each factor** for allocating people to IT controls which are in public cloud, for any generic organisation. **Use a score between 0 (not important) and 5 (very important).** | **Definitions** | Response for factors<br><br>Yes/No Rationale | Taken your personal experience into account, **rate the importance of each factor** for allocating people to IT controls which are in public cloud, for any generic organisation. **Use a score between 0 (not important) and 5 (very important).** |
|---|---|---|---|---|---|
| **1. Strategy** | | | Defines whether to build capabilities (like skills, processes, technologies, human abilities) internally or exploit external capabilities. Strategy of an organization leads to the tasks to be performed. | | |
| **2. Structure** | | | Type and numbers of job specialties used in performing the work (Specialization). | | |
| | | | Number of people constituting the departments at each level of the structure (Shape). | | |
| | | | Distribution of power - either to the department dealing directly with issues critical to its mission, or centralization or decentralization of this authority. | | |
| **3. Processes** | | | Type of Information and decision processes (vertical or horizontal) that may cut across the organization's structure. | | |
| **4. People** | | | Fundamental set of competencies, skills and mind-sets required from employees at all levels. | | |
| 5. **Rewards** | | | Motivating people to perform and address organisational goals. Offering nonmonetary rewards such as recognition or challenging assignments. | | |
| **6. Relational mechanisms** | | | Collaboration, relationship, teams, networks, integrative roles and matrix connections building attributes to build interpersonal and collaborative relationships among units and organizations. | | |
| **7. Risk management** | | | Competencies to identify all potential risk that may be associated with critical assets like intellectual property, personally identifiable information etc. that will be stored with the CSP. | | |
| **8. Compliance management** | | | Knowledge of internal and external organisational policies and ensuring the maintenance of same compliance, even when operating in Cloud. | | |
| | | | Knowledge of national and international regulations that constrain the flow of information and mandate the vulnerability assessment of data in the public/hybrid Cloud. | | |
| | | | Competency to assist holding cloud (and other) service providers accountable for how they manage personal, sensitive and confidential information in the public/hybrid cloud. | | |
| **9. Security management** | | | Competencies to handle security concerns in public/hybrid cloud where services can be used by competing clients and where the number of Cloud users is much higher. | | |
| | | | Competencies to handle Cloud security concerns like information assurance, data privacy, and ownership issues arising in public/hybrid Clouds due to the risk of an unauthorized data disclosure and lack of user control on client data. | | |

| | | | | | |
|---|---|---|---|---|---|
| | | | Competencies to ensure the deployment of data privacy mechanisms by CSPs that are compliant with the regional legal regulations. | | |
| **10. CSP management** | | | Skills required for handling activities to evaluate and select CSPs. | | |
| **11. Contract Development** | | | Skills to structure contracts for effective pricing, access rights, data ownership, risk management and for ensuring the availability of data and reports. Specific service level agreements (SLA) can be added to the contract. | | |
| **12. Technical competencies** | | | Competencies to evaluate the on-demand, self-service cloud based solutions, coordinate, implement and integrate the cloud services with the existing systems to create new opportunities and to reduce cost. | | |
| **13. Negotiation skills** | | | Skills to negotiate the contact terms to ensure the firm's rights and obligations for both parties. | | |
| **14. Performance management** | | | Competencies required for setting quality levels, monitoring the CSP against the SLAs and rating the CSP performance | | |
| **15. Conflict management** | | | Skills to assess and avoid negative impact of establishing new business ties or terminating the existing business with a CSP. | | |
| **16. Knowledge management** | | | Attributes required for sharing or transferring knowledge with the CSP, to build trust which will result in supplier improved commitment and thus better results. | | |

8. Do you want to add any factor?

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |

9. Do you want to add any factor?

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |

**Questions regarding suggestions for the improvement of the factors**

10. What are your views regarding the use of these factors for the allocation of people's roles and responsibilities of IT controls in a public cloud?

11. What are the weaknesses of this list?

12. Do you think an organization would benefit from these factors?

13. How can we improve them?

14. Any other feedback/comments on the factors and their definitions?

**Adding the Contextual Data**

**Case Interview # X (CI-X)**

Date:

Time Started:

Time finished:

Location:

Setting (Noisy/Quiet):

Impression of how well the interview went:

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 2 | Success factors | | | Emphasis on validation (D) | Emphasis while emerging (E) | Total weight (D+E) | Scaled to 100% |
| 3 | **1. Competencies and skills (People)** (sum of F3 and F12) | | | | | 259.70% | **57%** |
| 4 | | 1.1 Vendor evaluation & management (sum of F4 to F11) | | | | 233.63% | 90% |
| 5 | | | 1.1.1 Risk, compliance & security | 88.08% | 49.60% | 137.68% | 59% |
| 6 | | | 1.1.2 Contract management | 8.96% | 16.6% | 25.58% | 11% |
| 7 | | | 1.1.3 Performance management | 19.93% | 2.0% | 21.88% | 9% |
| 8 | | | 1.1.4 Knowledge management | 8.17% | 11.41% | 19.58% | 8% |
| 9 | | | 1.1.5 Negotiation skills | 15.34% | -- | 15.34% | 7% |
| 10 | | | 1.1.6 Conflict management | 5.56% | -- | 5.56% | 2% |
| 11 | | | 1.1.7. Change management | -- | 2.23% | 5.00% | 2% |
| 12 | | | 1.1.8 Technical competencies | 2.31% | 0.70% | 3.01% | 1% |
| 13 | | 1.2 Processes | | 22.97% | 3.10% | 26.07% | 10% |
| 14 | **2. Structure** | | | 64.18% | 15.40% | 79.58% | **18%** |
| 15 | **3. Strategy** | | | 26.59% | 24.80% | 51.39% | **11%** |
| 16 | **4. Rewards** | | | 20.22% | 21.30% | 41.52% | **9%** |
| 17 | **5. Relational Mechanisms** | | | 20.87% | -- | 20.87% | **5%** |

Figure A 1.0: Calculation of weights for each success and sub-success factor

# Appendix B: Delphi technique related forms

## Delphi Round 1 Questionnaire (Validating Factors)

**Allocating accountability & responsibility of IT controls in a cloud environment**

| | |
|---|---|
| **STEP-1**<br>**Personal data** | **Instructions:**<br>**Please do provide some personal data about your function and the company you work for. It is not manadtory to enter any of the personal or organizational information. This information will be used only to better understand and interpret the results** |
| **Designation** | |
| **Profile** (business, IT, consultant, audit ) | |
| **Company** | |
| **# Employees in UAE** | **Please tick one option:**<br>**□ < 50 □ < 250 □ > 250** |
| **Email ID** | |
| **STEP - 2**<br>**Validating the roles and responsibilities allocations factors** | **Instruction:**<br>**The list below provides the factors that an organization can use to implement the IT governance activity of allocating roles and responsibilities of IT controls, that have been, or are planned to be migrated to the public cloud.**<br>**Notes:**<br>**1. The list is based on literature and empirical research.** |
| | **IMPORTANT NOTE:**<br>**Please complete the survey for an organization in UAE, that has moved or is planning to migrate its IT controls to the public cloud.** |

| **SURVEY:**<br>**Input on roles and responsibilities allocation criteria in a public cloud environemnt.** | **SECTION 1 -**<br>**Five key factors of the model** | **INSTRUCTION**<br>**Review the list of proposed factors for completeness. Add, delete or modify, if needed. Review the definitions if possible.** |
|---|---|---|
| **Factors** | **Definition** | **Your Comments/feedback** |
| 1. Competencies and skills (People) | People with right competencies, skills and mindsets will impact their allcation to controls on the cloud | |
| 2. Structure | Roles and responsibilities allocation is based on the location of decision-making power and authority that establishes the reporting relationships, power distribution, and communication channels. | |
| 3. Strategy | IT strategy which is in alignment with business objectives will define whether to build capabilities (like skills, processes, technologies, human abilities) internally or to exploit external capabilities available in the form of cloud services. It defines the tasks to be performed. | |
| 4. Rewards | People are rewarded by being allocated to cloud-related tasks so as to give them the opportunity for growth, motivation, recognition, and the challenge of learning new technologies. | |
| 5. Relational Mechanisms | Roles and responsibilities allocation depends on building interpersonal and collaborative relationships among units and organisations. | |
| <Add factors if required | <Add definitions if required> | |

| | |
|---|---|
| **Feedback** | **Instruction:**<br>Provide valuable feedback/comment/suggestions |

| SURVEY: Input on roles and responsibilities allocation criteria in a public cloud environemnt. | SECTION 2 - Two sub-factors of the 'Competencies and skills (People)' factor | INSTRUCTION Review the list of proposed factors for completeness. Add, delete or modify, if needed. Review the definitions if possible. |
|---|---|---|
| **Factors** | **Definition** | **Your Comments/feedback** |
| 1.1 Vendor evaluation & management | People must have competencies and skills to evaluate and manage cloud vendors | |
| 1.2 Processes | Competencies to handle different sets of processes that cross departmental and organizational boundaries. | |
| <Add factors if required | <Add definitions if required> | |
| **Feedback** | **Instruction:** Provide valuable feedback/comment/suggestions | |

| SURVEY: Input on roles and responsibilities allocation factors in a public cloud environemnt. | SECTION 3 - Eight sub-factors of the 'Vendor evaluation & management' sub- factor | INSTRUCTION Review the list of proposed factors for completeness. Add, delete or modify, if needed. Review the definitions if possible. |
|---|---|---|
| **Sub-Factors** | **Definition** | **Your Comments/feedback** |
| 1.1.1 Risks, compliance & security | Competencies to identify and manage all potential critical, legal, and compliance-related risks associated with the cloud.<br><br>Competencies to ensure compliance with internal as well as external policies, regulations, and accountability mechanisms when operating in the cloud.<br><br>Competencies to evaluate cloud vendors to ensure deployment of security mechanisms related to information assurance, data privacy, data confidentiality, ownership, and technology-related issues. | |
| 1.1.2 Contract management | Skills to develop and manage contracts for effective SLAs, pricing, access rights, data ownership, risk management, and to ensure the availability of data and reports. | |
| 1.1.3 Performance management | Competencies required for setting quality levels, monitoring the vendor against the SLA and rating their performance. | |
| 1.1.4 Knowledge management | Skills to share knowledge between cloud users and vendors in both directions, building trust that will result in improved commitment and better overall results. | |
| 1.1.5 Negotiation skills | Skills to negotiate the contract terms to ensure the rights and obligations for both parties. | |
| 1.1.6 Conflict management | Skills to assess and avoid any negative impact from establishing new business ties or terminating existing business with a cloud provider. | |
| 1.1.7 Change management | Ability to handle challenges, and readiness to adopt the new technology. | |
| 1.1.8 Technical competencies | Competencies to coordinate with the cloud vendor to implement/ integrate the cloud services with the existing systems. | |
| <Add factors if required | <Add definitions if required> | |
| **Feedback** | **Instruction:** Provide valuable feedback/comment/suggestions | |

## Delphi Round 2 Questionnaire (Ranking Factors)

**Allocating accountability & responsibility of IT controls in a cloud environment**

| | | | |
|---|---|---|---|
| **STEP 1**<br>**Personal data** | **Instructions:**<br>Please provide your email address. This information will only be used by the researcher for data analysis. | | |
| **Email ID** | | | |
| **STEP 2**<br>**Ranking the roles and responsibilities allocations factors based on its importance** | | | |
| **SURVEY:**<br>**Input on roles and responsibilities allocation factors in a public cloud environemnt.** | **SECTION 1 -**<br>**Five main factors of the model** | **INSTRUCTION 1**<br>**Rank the factors using a score between 1 most important) and 5 (least important). Please do not repeat the rank** | **INSTRUCTION 2**<br>**Kindly fill percentage value totalling to an exact of 100 percent** |
| **Factors** | **Definition** | **Your Rank ( 1 to 5)** | **Your Weigh (%age)** |
| 1. Competencies, skills & mind-set (People) | People with right competencies, skills and mindsets will impact their allcation to controls on the cloud | | |
| 2. Structure | Roles and responsibilities allocation is based on the location of decision-making power and authority that establishes the reporting relationships, power distribution, and communication channels. | | |
| 3. Strategy | IT strategy which is in alignment with business objectives will define whether to build capabilities (like skills, processes, technologies, people abilities) internally or to exploit external capabilities. It defines the tasks to be performed. | | |
| 4. Rewards | People are rewarded by being allocated to cloud-related tasks, so as to give them opportunity for growth, motivation, recognition, and the challenge of learning new technologies. | | |
| 5. Relational Mechanisms | Roles and responsibilities allocation depends on building interpersonal and collaborative relationships among units and organisations. | | |
| | **TOTAL** | | **100%** |
| **Feedback** | **Instruction:**<br>Provide valuable feedback/comment/suggestions | | |
| **SURVEY:**<br>**Input on roles and responsibilities allocation factors in a public cloud environemnt.** | **SECTION 2 -**<br>Two sub-factors of the '***Competencies, skills & mind-set (People)***' factor | **INSTRUCTION 1**<br>**Rank the factors using a score as 1 most important) or 3 (least important). Please do not repeat the rank** | **INSTRUCTION 2**<br>**Kindly fill percentage value totalling to an exact of 100 percent** |
| **Sub-Factors** | **Definition** | **Your Rank ( 1 to 3)** | **Your Weight (%age)** |
| 1.1 Vendor evaluation & management | People must have competencies and skills to evaluate and manage cloud vendors | | |
| 1.2 Processes | Competencies to handle different sets of processes that cross departmental and organisational boundaries. | | |
| 1.3 Mind-set | Ability to handle challenges, and readiness to adopt the new technology. | | |
| | **TOTAL** | | **100%** |
| **Feedback** | **Instruction:**<br>Provide valuable feedback/comment/suggestions | | |

| SURVEY:<br>Input on roles and responsibilities allocation factors in a public cloud environemnt. | SECTION 3 -<br>Seven sub-factors of the '***Vendor evaluation & management***' sub- factor | INSTRUCTION 1<br>Rank the factors using a score between 1 most important) and 7 (least important). Please do not repeat the rank | INSTRUCTION 2<br>Kindly fill percentage value totalling to an exact of 100 percent |
|---|---|---|---|
| **Sub-Factors** | **Definition** | **Your Rank ( 1 to 7)** | **Your Weight (%age)** |
| 1.1.1 Risks, compliance & security management | Competencies to identify and manage all potential critical, legal, and compliance-related risks associated with the cloud.<br><br>Competencies to ensure compliance with internal as well as external policies, regulations, and accountability mechanisms when operating in the cloud.<br><br>Competencies to evaluate cloud vendors to ensure deployment of security mechanisms related to information assurance, data privacy, data confidentiality, ownership, and technology-related issues. | | |
| 1.1.2 Contract management | Skills to develop and manage contracts for effective SLAs, pricing, access rights, data ownership, risk management, and to ensure the availability of data and reports. | | |
| 1.1.3 Performance management | Competencies required for setting quality levels, monitoring the vendor against the SLAs, and rating their performance. | | |
| 1.1.4 Knowledge management | Skills to share knowledge between cloud users and vendors in both directions, building trust that will result in improved commitment and better overall results. | | |
| 1.1.5 Negotiation skills | Skills to negotiate the contract terms to ensure the rights and obligations for both parties. | | |
| 1.1.6 Conflict management | Skills to assess and avoid any negative impact from establishing new business ties or terminating existing business with a cloud provider. | | |
| 1.1.7 Technical competencies | Competencies to coordinate with the cloud vendor to implement/integrate the cloud services with the existing systems. | | |
| | **TOTAL** | | **100%** |
| | | | |
| **Feedback** | **Instruction:**<br>Provide valuable feedback/comment/suggestions | | |

## Delphi Round 2 Results

**Allocating accountability and responsibility of IT controls in a cloud environment**

| STEP 1 Feedback on ranks | | | Final Results | | | | |
|---|---|---|---|---|---|---|---|
| | | | Col. 1 Delphi average ranking | Col. 2 Delphi average weight (%) | Col. 3 Research weight (%) | Col. 4 New rating (%) | Col. 5 New rank |
| **SECTION 1-** Five Key Factors | 1 | Competencies, skills & mind-set (People) | 1 | 48.4 | 57 | 52.7 | 1 |
| | 2 | Structure | 2.8 | 17.9 | 18 | 17.95 | 2 |
| | 3 | Strategy | 2.5 | 18.4 | 11 | 14.7 | 3 |
| | 4 | Rewards | 4 | 8.4 | 9 | 8.7 | 4 |
| | 5 | Relational Mechanisms | 4.7 | 6.9 | 5 | 5.95 | 5 |
| **SECTION 2 -** Three sub-factors of the '***Competencies, skills and mind-set (People)***' factor | 1.1 | Vendor evaluation & management | 1 | 53.8 | 90 | 71.9 | 1 |
| | 1.2 | Processes | 2.2 | 37.5 | 10 | 23.75 | 2 |
| | 1.3 | Mind-set | 2.8 | 8.6 | 2 | 5.30 | 3 |
| **SECTION 3 -** Seven sub-factors of the '***Vendor evaluation & management***' factor | 1.1.1 | Risks, compliance & security | 1.1 | 48 | 59 | 53.5 | 1 |
| | 1.1.2 | Contract management | 2.8 | 12 | 11 | 11.5 | 2 |
| | 1.1.3 | Performance management | 4.2 | 9 | 9 | 9 | 3 |
| | 1.1.4 | Knowledge management | 5.5 | 7 | 9 | 8 | 4 |
| | 1.1.5 | Negotiation skills | 6.3 | 6 | 7 | 6.5 | 6 |
| | 1.1.6 | Conflict management | 7 | 5 | 2 | 3.5 | 7 |
| | 1.1.7 | Technical competencies | 3.7 | 13 | 1 | 7 | 5 |
| **STEP 2 Feedback** | | Instruction: Provide valuable feedback/comment/ suggestions | | | | | |