ABSTRACT

Title of Dissertation: INFORMATION TECHNOLOGY PROJECTS IN NONPROFIT UNIVERSITY: A PROJECT GOVERNANCE PERSPECTIVE

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The universities rely on the Information Technology (IT) projects to support and enhance their core strategic objectives of teaching, research, and administration. The researcher's literature review found that the level of IT funding and resources in the universities is not adequate to meet the IT demands. The universities received more IT project requests than they could execute. As such, universities must selectively fund the IT projects. The objectives of the IT projects in the universities vary. An IT project which benefits the teaching functions may not benefit the administrative functions. As such, the selection of an IT project is challenging in the universities. To aid with the IT decision making, many universities in the United States of America (USA) have formed the IT Governance (ITG) processes. ITG is an IT decision making and accountability framework whose purpose is to align the IT efforts in an organization with its strategic objectives, realize the value of the IT investments, meet the expected performance criteria, and manage the risks and the resources (Weil & Ross, 2004). ITG in the universities is relatively new, and it is not well known how the ITG processes are aiding the nonprofit

universities in selecting the right IT projects, and managing the performance of these IT projects. This research adds to the body of knowledge regarding the IT project selection under the governance structure, the maturity of the IT projects, and the IT project performance in the nonprofit universities.

The case study research methodology was chosen for this exploratory research. The convenience sampling was done to choose the cases from two large, research universities with decentralized colleges, and two small, centralized universities. The data were collected on nine IT projects from these four universities using the interviews and the university documents. The multi-case analysis was complemented by the Qualitative Comparative Analysis (QCA) to systematically analyze how the IT conditions lead to an outcome.

This research found that the IT projects were selected in the centralized universities in a more informed manner. ITG was more authoritative in the small centralized universities; the ITG committees were formed by including the key decision makers, the decision-making roles, and responsibilities were better defined, and the frequency of ITG communication was higher. In the centralized universities, the business units and colleges brought the IT requests to ITG committees; which in turn prioritized the IT requests and allocated the funds and the resources to the IT projects. ITG committee members in the centralized universities had a higher awareness of the university-wide IT needs, and the IT projects tended to align with the strategic objectives. On the other hand, the decentralized colleges and business units in the large universities were influential and often bypassed the ITG processes. The decentralized units often chose the "pet"

IT projects, and executed them within a silo, without bringing them to the attention of the ITG committees. While these IT projects met the departmental objectives, they did not always align with the university's strategic objectives.

This research found that the IT project maturity in the university could be increased by following the project management methodologies. The IT project management maturity was found higher in the IT projects executed by the centralized university, where a full-time project manager was assigned to manage the project, and the project manager had a higher expertise in the project management. The IT project executed under the guidance of the Project Management Office (PMO) has exhibited a higher project management maturity, as the PMO set the standards and controls for the project. The IT projects managed by the decentralized colleges by a part-time project manager with lower project management expertise have exhibited a lower project management maturity. The IT projects in the decentralized colleges were often managed by the business, or technical leads, who often lacked the project management expertise. This research found that higher the IT project management maturity, the better is the project performance. The IT projects with a higher maturity had a lower project delay, lower number of missed requirements, and lower number of IT system errors.

This research found that the quality of IT decision in the university could be improved by centralizing the IT decision-making processes. The IT project management maturity could be improved by following the project management methodologies. The stakeholder management and communication were found critical for the success of the IT projects in the university. It is hoped that the findings from this research would help the university leaders make the strategic IT decisions, and the university's IT project managers make the IT project decisions.

Keywords: IT governance (ITG), project management, IT project, case study, Qualitative Quantitative Analysis (QCA), centralized and decentralized university, Nonprofit university

INFORMATION TECHNOLOGY PROJECTS IN NONPROFIT UNIVERSITY:
A PROJECT GOVERNANCE PERSPECTIVE

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Dissertation submitted to the Faculty of the Graduate School of The University of Maryland, College Park, in partial fulfillment of the requirements for the degree of Doctor of Philosophy

2016

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Acknowledgements

I sincerely acknowledge my advisor, Dr. Qingbin Cui. This research would not have been possible without his time, patience, and guidance. I would like to thank my committee members, Dr. Gregory Baecher, Dr. Miroslaw Skibneiwski, Dr. Paul Jaeger, and Mr. John cable. I appreciate your time, insight, and contribution towards this research. Thanks also go out to all the case study participants. Thanks for the support and encouragement of my family, friends, peers, and mentors, while I worked on my research.

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List of Abbreviations

C1	Case 1
C2	Case 2
C3	Case 3
C4	Case 4
C5	Case 5
C6	Case 6
C7	Case 7
C8	Case 8
C9	Case 9
CIO	Chief Information Officer
CISR	Center for Information Systems Research
CITI	Collaborative Institutional Training Initiative
CFO	Chief Financial Officer
CEO	Chief Executive Officer
CMMI	Capability Maturity Model Integration
COMPASS	COMPArative methods for Systematic cross-caSe analysis
ECAR	Educause Center for Analysis and Research

ELMS	Enterprise Learning Management System
ERP	Enterprise Resource Planning
EVM	Earned Value Management
HPC	High Performance Computing
IRB	Institutional Review Board
ISACA	Information Systems Audit and Control Association
IT	Information Technology
ITG	Information Technology Governance
ITGI	Information Technology Governance Institute
MIT	Massachusetts Institute of Technology
MOU	Massive Online University
NASCIO	National Association of State Chief Information Officers
P1	Participant 1 in a particular case study
P2	Participant 2 in a particular case study
P3	Participant 3 in a particular case study
P4	Participant 4 in a particular case study
P5	Participant 5 in a particular case study
PCI-DSS	Payment Card Industry Data Security Standards

Ph.D.	Doctor of Philosophy
PMBOK®	Project Management Body of Knowledge
PMI	Project Management Institute
PMO	Project Management Office
PMP	Project Management Professional
RFI	Request For Information
RFP	Request For Proposal
SLMS	Synchronous Learning Management System
SME	Subject-Matter Expert
SWOT	Strength Weakness Opportunity Threat
UMD	The University of Maryland, College Park
WBS	Work Breakdown Structure
QCA	Qualitative Comparative Analysis
USD	United States Dollar
USA	United States of America
U1	University 1
U2	University 2
U3	University 3
U4	University 4

U1C1	University 1, Case Study 1
U1C2	University 1, Case Study 2
U1C3	University 1, Case Study 3
U1C4	University 1, Case Study 4
U1C5	University 1, Case Study 5
U1C6	University 1, Case Study 6
U2C7	University 2, Case Study 7
U3C8	University 3, Case Study 8
U4C9	University 4, Case Study 9
WWW	World Wide Web

Chapter 1 : Introduction

Research Background and Need

In 1987, Nobel Prize winner economist Robert Solow noted that we see the computer age everywhere, other than in productivity (Dehning & Richardson, 2002). A survey in 2002 by the Gartner. Inc. reported that twenty percent of the IT expenditure was wasted worldwide, which represented an annual destruction of the United States Dollar (USD) six hundred billion worldwide (Roberts, 2002). A survey of more than 13,500 IT projects reported that only thirty-four percent of the IT projects were considered successful, fifteen percent failed to meet a success criteria, fifty-one percent had an overrun on time and cost, and the projects delivered only fifty-two percent of the expected features (Chaos Report, Standish Group, 2003). The headlines from the world-wide organizations also reported less than satisfactory results on the IT project performance. Nike Corporation reported a loss of USD two hundred million because of the problems in implementing the IT supply chain system; Tokyo Gas reported a loss of USD 46.6 million due to the IT project mismanagement; the United Kingdom Department for Work and Pensions lost two billion pounds by mismanaging three major IT projects (ITGI, 2008, p. 10). It was noted that when the organizations undertook the IT projects without an adequate governance regime, they were exposed to a high probability of failure and financial loss (Miller & Hobbs, 2005).

On the other hand, the existing literature indicated that the application of ITG and project management methodology has helped the organizations realize the expected project objectives. ITG is the IT decision rights, and accountability framework to achieve the desirable IT behavior in a consistent, repeatable and flexible manner through *"cost-effective use of IT, effective use of IT for asset utilization, effective use of IT for growth, effective use of IT for business flexibility"* (Weill & Ross, 2004a). With the collapse of large corporations, such as Enron and WorldCom in 2002, and the passing of Sarbanes-Oxley Act in the USA, the governance of IT decision came into scrutiny for the for-profit organizations. Since then, the for-profit organizations have put emphasis on forming ITG. The existing literature noted that the for-profit organizations have realized benefits by setting the ITG processes.

- Over two hundred organizations in twenty-three countries used the ITG processes to improve the operational efficiency and profit (Weill & Ross, 2004a).
- The higher is the use of the ITG processes, the higher is the perceived value delivery of the IT (Cutter Consortium, 2009).
- Strong governance processes increase the potential for success for multiple, overlapping IT projects in a project portfolio (Misner, 2008).
- A study of ten for-profit organizations noted that the ITG processes and the IT project management helped these organizations realize the expected project objectives (Sharma, Stone & Ekinci, 2009).

The nonprofit universities in the USA have followed the footsteps of the for-profit organizations by forming ITG. The appendix shows that many large and small, nonprofit universities in the

USA have formed ITG. The IT decision making in university is challenging as the priorities and the objectives of the IT projects compete, and an IT project that satisfies one group of stakeholders may not satisfy another group (Nakatani & Chuang, 2005).

- *"One of the most difficult questions facing any enterprise, including colleges and universities, is where to invest limited information technology resources for the maximum benefit of customers, and institutional mission. Now, compounding this difficulty, constrained and shrinking IT budgets are colliding with increasing demand for technology projects"* (Weir, 2004).
- *"Many departments struggle to balance a growing list of new and pending projects, while the need for core services continues, often with less funding. Deciding how to prioritize and separate the high priority projects from lower priority projects can be daunting"* (Gosenheimer, 2012).
- *"One of the most challenging issues is the unlimited number of projects and initiatives, yet the finite resources (financial and staff) to work on those projects"* (Grand Rapids Community College, 2015).

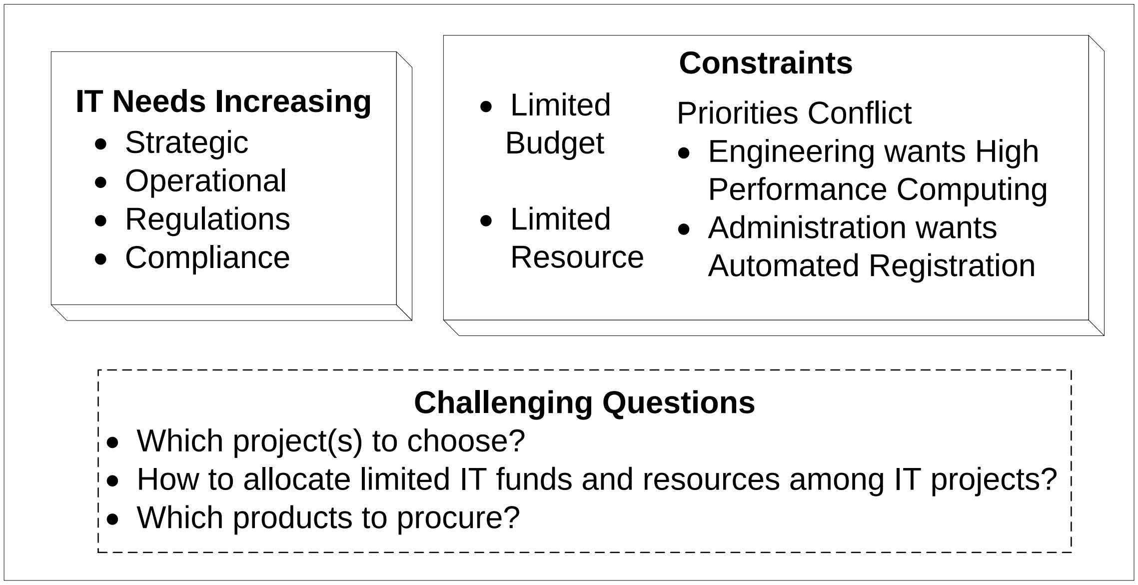

Figure 1.1 IT decision-making challenges in university

Even with ITG is in place, the universities continued struggling on how to prioritize the IT project requests. A report from The University of North Carolina system (2009) noted that the IT services were still redundant, the strategic IT projects on process automation were not funded, and the ‘hidden’ IT infrastructure from within various decentralized departments were not consolidated. The researcher’s literature review found that the ITG in the nonprofit universities in the USA is relatively new and it is not well known how ITG is aiding these universities in selecting the right IT projects, how the IT projects are managed, and what had been the project performance. This research added to the body of knowledge by exploring the IT decision-making in nonprofit universities under ITG, the maturity of IT project management in university, and the performance of the IT projects.

Table 1.1 ITG knowledge gap in nonprofit university

ITG Knowledge Gap	**Source**
IT initiatives in the universities lack planning and do not always align with universities strategic objectives.	Survey of eighteen Malaysian universities, Titthasiri, 2000
The university’s ITG draws different responses from different committees as if five blind men explaining an elephant.	Gayle, Tewarie & White, 2003
The university's strategic goals are not well understood by the ITG members.	Golden et al., 2007
The ITG policy in the university is not well defined. IT project investments fail to meet the expected performance criteria.	Bhattacharya & Chang, 2007
It is not well known how successful the IT projects are under the governance structure.	EDUCAUSE, 2008
The senior IT leaders in the university do not have a good understanding of the ITG principles and its implementation.	Kvavik, 2004, Study on four Australian universities, Ko & Fink, 2010, Jairak et al., 2011
The initial implementation of ITG did not increase the university-wide IT awareness and did not effectively communicate the IT needs.	The University of Maryland (UMD) ITG, 2014

This study is important because it contributes to the knowledge of the IT decision making and the IT project management in the nonprofit universities. This study explores whether the right IT projects were selected by the nonprofit university and whether these projects met the expected objectives. The selection of the right IT project and meeting the project success criteria are critical for the university to support and enhance its core strategic objectives of teaching, research, and administration (Hilton, 2009). It is the responsibility of university’s ITG to help select the right IT projects and decide the fund allocation between the IT project requests (Grajel, 2013). It is critical to understand how the IT projects were selected and executed, as because the universities face continual changes in technology, budget reduction, and tuition discount, and an increase in IT costs (Clark, 2005). “*It is important to study whether the IT investment decisions, improve teaching, learning, research, university operations, decisions making, communication, collaboration and risk management”* (Denna, 2014).

Research Problem Statement

Forming ITG was discussed as one of the top priorities of the CIOs of the nonprofit organizations, but the nonprofit organizations struggled in establishing the ITG guidelines (NASCIO, 2008). ITG in the university gets a negative connotation as a bureaucratic process formed of uninformed and controlling decision makers (Romero, 2012). The IT decision making in university continues to be a challenge, even with ITG is in place. *"Competing IT requirements need to be carefully evaluated and deployed to ensure the optimal investment of limited funds and resources"* (The University of Arizona, The office of IT, 2014).

The universities must carefully choose the IT projects on which to use the limited funds, and resources. These investments are expected to align with the university's strategic objectives, deliver value, and meet the expected performance requirements. The research problem statement is as follows.

- The nonprofit universities continue facing a challenge in prioritizing the IT projects, even with ITG in place.
- ITG is a contemporary topic. It is not well known how the ITG processes are aiding the nonprofit universities to select the right IT projects.
- It is not well known what had been the performance of the IT projects selected under the governance structure and what had been the end user satisfaction.

Research Approach

This research was started by first conducting the literature review to identify the existing knowledge on the IT decision making and the IT project management in the nonprofit universities. The knowledge gaps were identified from the literature review. The research questions were designed to explore the areas where the knowledge gap exists. The case study research methodology was found as the right fit for this research. This research conducted a case study on nine IT projects from four nonprofit universities in the USA. The research data were collected using the case study protocol, from multiple sources of evidence, such as the interviews, the project documents, and the help desk call log. The case data were analyzed using the multi-case analysis and QCA. Institutional Review Board (IRB) protocol was followed in this research.

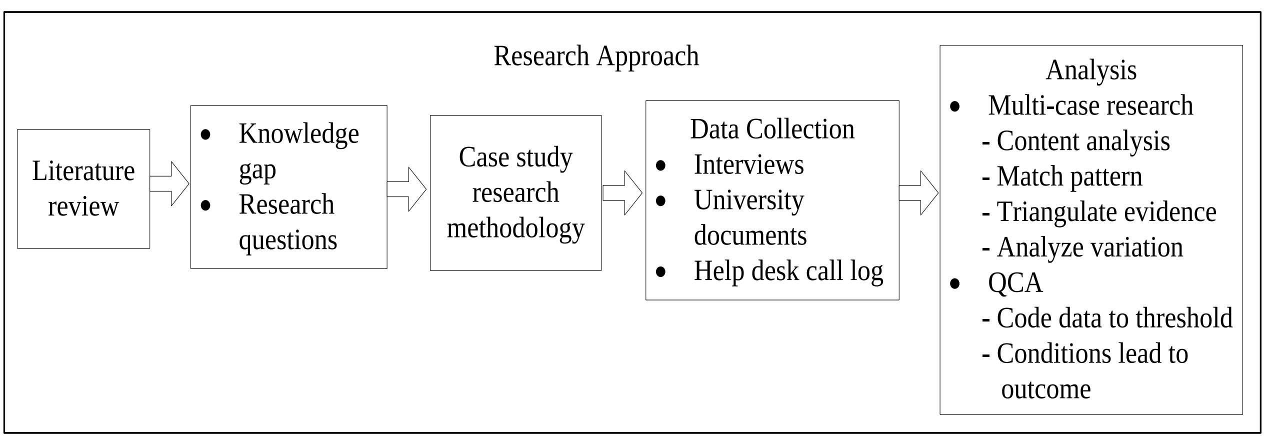

Figure 1.2 Research approach

This research explored the IT decision making, the IT project management, and the IT project performance on the nonprofit university by asking the “how”, and “why” questions. The “how” and “why” questions are fundamental in a case study research (Schramm, 1971, Yin 2009). This research was designed to answer the questions in three main areas.

- The IT project decision making in the large, decentralized and the small, centralized university.
    - How is the IT project selection process influenced by ITG?
    - Why does the IT project selection process vary between the universities?
- IT project management in the large, decentralized and the small, centralized university.
    - How are the IT projects managed?
    - Why does the IT project management maturity vary between the universities?
- IT project performance in the large, decentralized and the small, centralized university.
    - How are the IT project performances measured?
    - Why do the IT project performances vary between the universities?

Structure of Dissertation

The dissertation is broken into six chapters. Chapter one is an introduction, which provides a high-level summary of the research topic. Chapter two is a review of the existing literature to identify the existing knowledge and the knowledge gap. Chapter three explains the research methodology and the research approach followed in this dissertation. Chapter four and five discusses the research findings. Chapter four is a knowledge contribution to the IT project selection in centralized and decentralized university. Chapter five is a knowledge contribution on the IT project management maturity and IT project performance in the university. Chapter six is the conclusion.

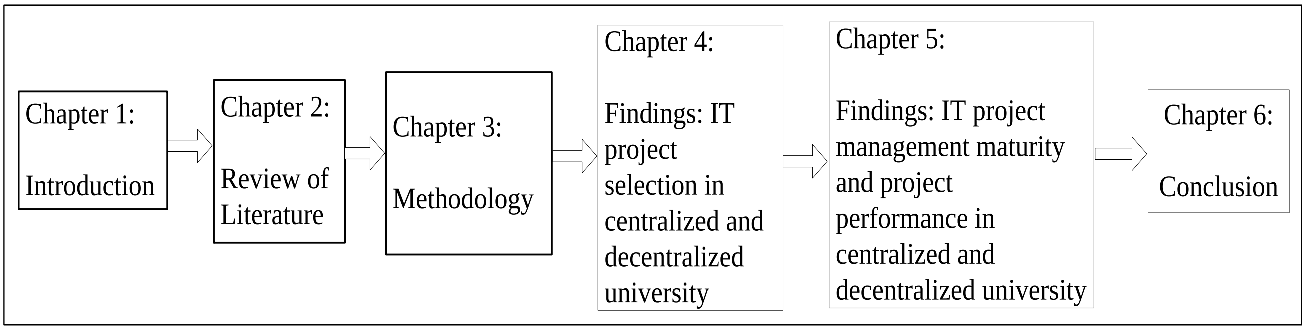

Figure 1.3 Structure of dissertation

Chapter 2 : Review of Literature

Organization of Literature Review

This literature review was organized thematically. The sources were grouped based on the theoretical concepts. The existing literature was reviewed to find out the known knowledge, and the knowledge gap. The articles from the articles from the academic and practitioner journals were reviewed. EDUCAUSE Center for Applied Research is a nonprofit association to advance higher education through the use of IT. The articles from EDUCAUSE with a focus on university IT and ITG were reviewed. IT Governance Institute (ITGI) is a global professional organization to advance the governance and management of the enterprise IT. The articles from ITGI with a focus on governance were reviewed. The Massachusetts Institute of Technology (MIT) Center for Information Systems Research (CISR) was established in 1974 to conduct a field-based research on the IT organizations. The articles from MIT CISR with a focus on the ITG processes in the organizations were reviewed. The case studies on the university IT and the information available from the university websites were also reviewed.

ITG Background

The concept of ITG dates back to the 1960s. Garrity (1963) used the term *"computer systems management control"* in studying how the various organizational decisions affect the return on technology investment. He surveyed twenty-seven companies with four years of computer usage and noted that the senior leaders of an organization influence the selection and management of the IT systems. A later research by Olson and Chervany (1980) studied twenty-eight large private organizations. They used the term *"control of information services"* and found that the organizational structure and leadership affected the IT decisions in an organization. Boynton and Zmud (1987) used the term *"IT management responsibility"* in determining the organizational need to share information with various business units and the external agencies.

Loh and Venkatraman (1992) used the term *"technology governance"* to explain the influence of governance on the decisions to outsource the IT services. The word IT Governance was officially coined by Henderson and Venkatraman (1993) in their seminal paper in IBM Systems Journal. This paper proposed that ITG is a strategic alignment model, it is the connection between the business strategy and IT strategy and aims to derive the expected value of IT investment. In the same journal, Luftman, Lewis, and Oldach (1993) proposed that ITG is the linkage between the business strategy, information technology strategy, and organizational infrastructure.

In the 1990s, more research emerged to explore the structure of ITG. Brown and Magill (1994) found that ITG structure had two different categories, namely, centralized and decentralized. This research noted that the organization-wide IT functions fit better into the centralized structure while the IT functions specific to the operational units fit better into the decentralized structure. Sambamurthy and Zmud (1999) noted that the organizational enterprise structure, its resource sharing model, and the IT knowledge of the workers dictate whether an organization would take the form of a centralized IT or a decentralized IT. The centralized and decentralized structure was found to be also influenced by the organization's IT investment characteristics, its external environment, and its internal context (Xue, Liang & Boulton, 2008).

Starting with the year 2000, different ITG frameworks were proposed by the researchers. Korac-Kakabadse and Kakabadse (2001) defined ITG as a framework that aids in achieving organizational goals through value add, and by balancing the risks and return on IT projects. ITGI (2003) defined ITG as the organizational structures and processes to ensure that the organization sustains and extends its strategy and objectives, drive alignment, delivers value, manages risks, resources, and performance requirements. Grembergen and De Haes (2004) defined ITG as the organizational capacity, which is exercised by organization's senior executives achieve the synergy between business and IT. Rau (2004) debated that the decision-making authority should not only involve the board of directors, but also involve the IT line leaders, and project managers. Peterson (2004) defined ITG as the framework to align to IT efforts to the organizational priorities. Weill & Ross (2004a) defined ITG as the accountability and decision-making framework. Simonsson and Johnson (2006) defined ITG in line with the existing definitions by stating that it is the decision-making process with regards to the organization's IT goals, processes and people on tactical and strategic levels. Webb, Pollard, and Ridley (2006) supported the ITG strategic alignment definition by Weill and Ross (2004a) and noted that the ITG decision-making structure emphasizes on the alignment of IT with business so that the desired business value is achieved by developing, and maintaining effective IT control and accountability.

Table 2.1 Evolution of ITG research

ITG Research Areas	**Source**
Inception of ITG	Garrity, 1963, Olson & Chervany, 1980, Boynton & Zmud, 1987, Loh & Venkatraman, 1992, Henderson & Venkatraman, 1993
Centralized and decentralized IT	Olson & Chervany, 1980, Tavokolian, 1989, Brown & Magill, 1994, Sambamurthy & Zmud, 1999, Xue, Liang & Boulton, 2008
ITG frameworks	ITGI, 2003, Peterson, 2001, 2004, Korac-Kakabadse & Kakabadse, 2001, Weill & Ross, 2004b, Peterson, 2004, Grembergen & De Haes, 2005, Webb, Pollard & Ridley, 2006, Simonsson & Johnson, 2006

A global survey of 695 organizations in 2006 by ITGI reported that eighty-seven percent of the participants considered that ITG played a critical role in IT decision-making in their organizations (ITGI, 2006, p. 6). A follow up worldwide survey of over 2,000 CIOs revealed that implementing ITG was one of the top priorities of the CIOs (Pettey & Van Der Meulen, 2013). Weill and Ross (2004a) from their research of over two hundred organizations in twenty-three countries found that the organizations with an effective ITG made twenty percent higher profit than the organizations with similar strategies. Their research indicated that the organizations with an effective ITG have the following capabilities.

- The ability to clarify business strategy and the role of IT and align IT with business objectives.
- The ability to measure and manage the amount of money spent on IT and the value derived.
- The ability to add clarity on decision making through accountability and decision rights and learn from each implementation.
- The ability to share and reuse IT resources with the oversight of the governance.

The IT subject matters are complicated, and it significantly affects the budget and reputation of an organization (Read, 2004). As such, ITG is a must for any organization that wants to achieve the desired value and performance outcome of its IT investment. The organizations are now moving towards implementing the ITG practices to enhance the IT and business alignment (Milne & Bowles, 2009). ITG in an organization should be designed to support the business goals, maximize the IT investment benefits, and properly manage the IT related opportunities, and risks (Iskandar et al., 2010).

ITG Frameworks

The researcher's literature review found three main ITG frameworks. These frameworks suggest the standards and guidelines. They are not prescriptive, and the implementation of ITG could vary. These ITG frameworks are as follows.

- ITGI framework (2003, p. 20). This framework proposed five focus areas of ITG, which are strategic alignment, value delivery, performance measurement, risk, and resource management.
- Weill and Ross framework (2004b). This framework proposed that ITG is the IT decision making and accountability framework. The IT domain areas need to be considered in the decision-making. The IT decisions are expected to align IT with the organization's strategic objectives, realize the expected value, manage risks, and resources, and meet the performance criteria.
- Grembergen and De Haes framework (2005). This framework proposed that ITG is formed of the structure, process, and relational mechanism of an organization.

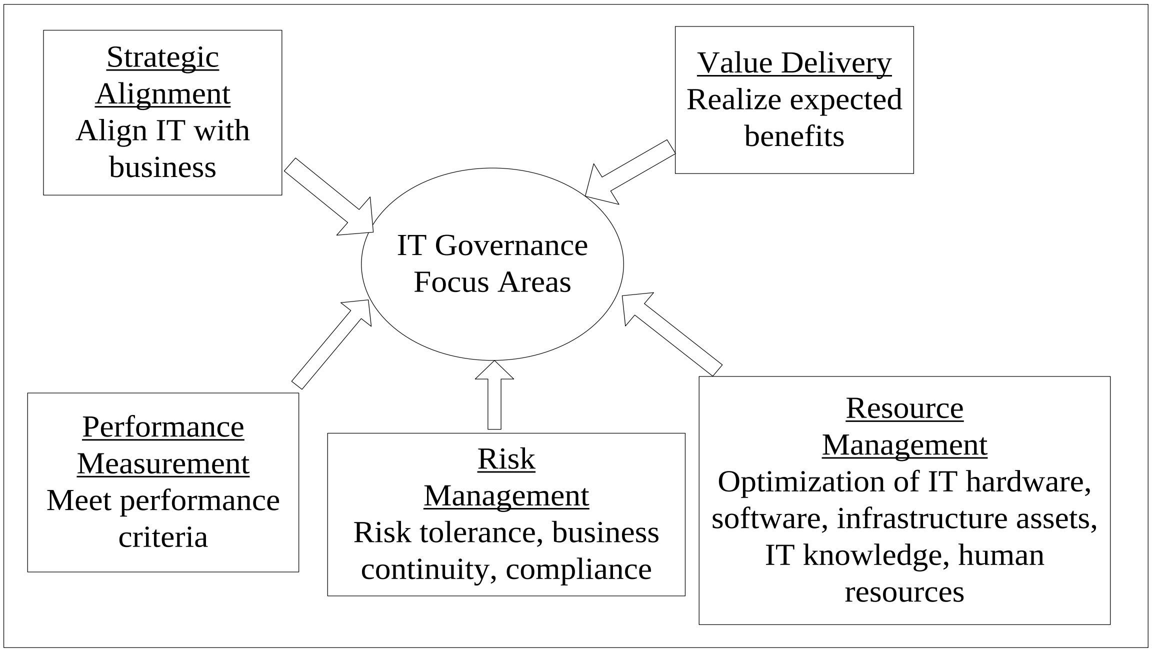

Figure 2.1 ITGI framework (ITGI, 2003, p. 20)

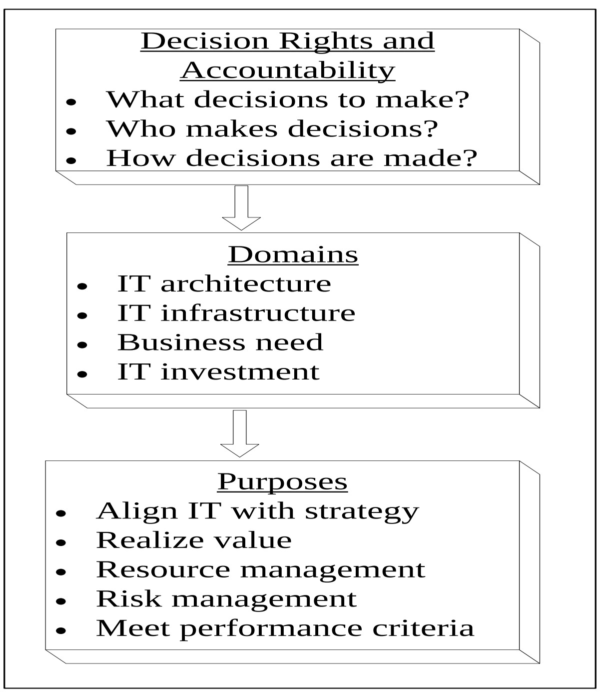

Figure 2.2 Weill and Ross framework (Adapted from Weill & Ross, 2004b, pp. 1-55)

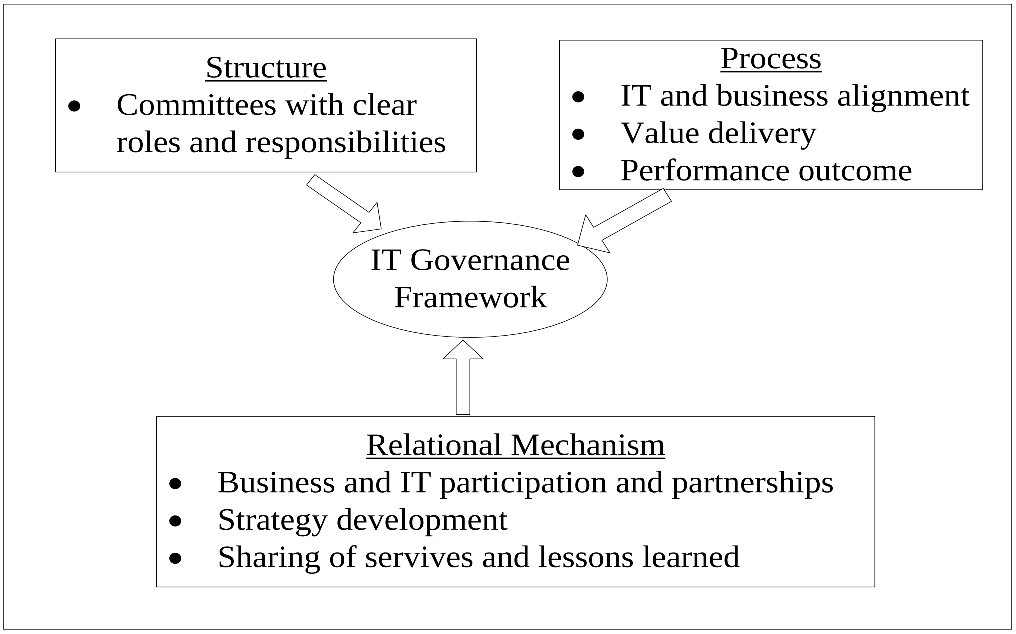

Figure 2.3 Grembergen & De Haes framework (Grembergen & De Haes, 2005)

The purposes of Weill and Ross framework (2004b) matches closely with the focus areas of the ITGI framework (2003). Weill and Ross framework (2004b) put an emphasis on how the decisions are being made, not just its purpose. Grembergen and De Haes framework (2004) emphasized on the inter-connectivity between the business processes, technology, and people. Weill and Ross (2004b, p. 10) noted that an effective ITG must address the following three questions.

- *"What decisions must be made to ensure effective management and use of IT?*
- *Who should make these decisions?*
- *How will these decisions be made and monitored?"*

ITG requires the attention and commitment of the senior management and the board executives (Ko & Fink, 2010). The upper management is held responsible for the decision rights, which is the central aspect of ITG (Trautman & Altenbaumer-Price, 2011). A strong support from the senior leaders would make ITG successful (Luftman, Lewis & Oldach, 1993). In a survey of 168 organizations from various sectors found that the success of ITG depends on the following (Teo & Ang, 1999).

- The commitment of the senior executives on the strategic use of IT,
- The IT executives are knowledgeable about the business requirements,
- The top management has confidence in the IT division.

The board members of the organization carry a heavy weight on the decision rights (Rau, 2004). The decision rights and responsibilities of each committee should be clearly defined (Gerrard, 2010).

The ITG domains are the IT areas on which the decisions need to be made. Weill and Ross (2004b, p. 10) defined five ITG domains, which are as follows.

1. IT principles. Decisions on how to use the IT, such as promoting innovation through IT, standardization, the rapid development of the application, build versus buy.
2. IT architecture. Decisions on the IT technical choices, policies, and guidelines such as integration of data, building shared services.
3. IT infrastructure. Decisions on how to upgrade the base foundations of the organization such as network, telecom, hardware, internet services.
4. The business application needs. Decisions on how to meet the business need using IT, and any exception to the IT standards.

5. IT investment decisions and priorities. Decisions on how to acquire the IT funds, how much money to spend, and where to spend.

ITG is not the same as IT management. IT management is about the day to day IT operations, projects, and deliverables; while ITG is about transforming and positioning IT to meet the current and future business challenges (Peterson, 2004, Grembergen & De Haes, 2005, Gheorghe, 2010). ITG sets the foundation for an effective IT management by creating an environment that is conducive to the IT operations and services (Bhattacharya & Chang, 2007).

IT Decision Making Challenges in Nonprofit Universities

The universities receive more IT project requests than it can support with its level of funding and resources. The IT project objectives vary. An IT project that satisfies the need of one group of stakeholders may not satisfy the need of another group of stakeholders. The university's IT decision makers struggle with selecting the IT projects, as the project priorities compete. "*Competing and growing IT requirements need to be carefully evaluated to ensure the optimal investment of limited funds and resources*" (Technology Services, The University of Arizona, 2014). Reaching a consensus on the IT decisions is difficult because of the campus politics (Kvavik, 2004).

Weir (2004) noted the following challenges in the IT decision-making at the university.

- Most senior leaders on campus are not experts in understanding the IT opportunities and risks. Those who understand the IT issues may only understand them from within their own functional areas, but lack the understanding of the diverse needs of the university. They may lack the understanding of the emerging technologies, and trends.
- The IT budget in university is not increasing to meet the increase in demand for the IT services.
- The IT stakeholders in the university have varying needs, and the projects offer varying challenges and values. The IT registration system in a university helps the administrative staff while the classroom technology helps the faculty members and the students. All these projects contend for the same IT budget and resource.
- The IT project performance is not easy to measure, as many of the benefits are intangible and are realized over a long period of time.

As a result, the universities struggle in answering the hard questions about the following (Hilton, 2009).

- How to reduce the cost of the essential IT services.
- How to commoditize the services and take advantage of economies of scale.
- How to let go of the IT services that are no longer needed.
- How to find money to invest in the new, strategic IT projects.

The majority of the university's IT budget is spent on sustaining the current services, which is "keeping the trains running," and after that, the universities are not left with sufficient fund to invest in the new projects (University of Washington, 2014). As such, it is critical to choose the right IT projects, on which the limited IT fund should be spent.

Table 2.2 IT decision-making challenges in university

IT Decision Challenges in University	**Source**
The IT project priorities compete, and the priorities of the IT stakeholders vary.	Weir, 2004, Yanosky & McCredie, 2008, McElheran, 2012
The university's IT priorities evolve, and the IT decisions have to adapt to the changes.	Clark, 2005, Kvavik, 2004, James Madison University Strategic Plan, 2013
The IT requests exceed the university's capacity. The university must selectively choose a project because the IT funds and resources are limited.	Gayle, 2003, Weir, 2004, Hilton, 2009

Forming ITG in Nonprofit University

A survey of the CIOs of the universities in the USA reported that setting up the governance structure is one of the top priorities in the universities (Dewey & DeBlois, 2006). A review of the publicly available information from the university websites revealed that many large and small nonprofit universities in the USA have now formed ITG. ITG is relatively new in the majority of the nonprofit universities in the USA. ITG in the university is the decision-making structure of the IT investments and the project decisions to support and enhance teaching, research, and administration (ECAR, 2008). The drivers to form ITG in the university are to ensure that the IT efforts align with the university's mission, meet the expectations of end users (Weir, 2004). The ITG decisions at the university are aimed to improve the experience and operational efficiency of the students, staff and faculty members (Denna, 2014).

ITG in the university was defined as follows.

- The structure and the process to make an authoritative decision on the IT issues in the university. These decisions have a significant importance to the internal stakeholders, the university employees, and students; and also on the external stakeholders, vendors, consultants and the community (Gayle, Tewarie & White, 2003).
- The committee structure to collect the opinions, viewpoints, and data to make the IT decisions in the university (Secondat & Montesquieu, 2008).
- The guideline that provides a set of procedures, policies, and best practices to guide and control the IT functions at the university (Gheorghe, Nastase, Boldeanu & Ofelia, 2009).
- The principles to align the IT projects with the university's strategic objectives (Yanosky & McCredie, 2008).

Table 2.3 Drivers to form ITG in university

Drivers to Form ITG in University	**Source**
Make strategic IT decisions to support and enhance teaching, research, and administration.	EDUCAUSE 2003, Gayle et al., 2003, Dewey & DeBlois, 2006, UMD ITG, 2014
Make the operational IT decisions to support essentials IT services and strategic need.	Hilton, 2009
Make the IT decisions to promote innovation, and advance the use of technology.	Bowen, Cheung & Rohde, 2007, Yanosky & McCredie, 2008
Align IT with the university's strategic objectives.	Albrecht & Pirani, 2004, University of Colorado Strategic Plan, 2010
Business continuity, protect data, promote innovation.	University of Colorado Strategic Plan, 2010 office of CIO, Ohio State University, 2012
Manage and maintain hardware, software, desktop, and network, telecommunication and conduct capacity planning for future growth.	James Madison University IT Policy 2014, University System of Georgia IT Handbook, 2014
Meet the need of university stakeholders, increase customer satisfaction, standardization, eliminate duplicate technology, reliable and cost effective service.	Utah State University office of IT, 2014, Clark University Information Technology Services, 2014, Yale University IT Services, 2014, Elizabeth City University IT Services, 2014

Yanosky and Caruso (2008) suggested that the following are the elements of an effective ITG in the university.

- Clearly state the IT decision-making roles and responsibilities.
- The key IT decision makers should have an understanding of the high-level IT processes.
- Include the key stakeholders in the IT decision making.
- Use the ITG processes in the project portfolio, project prioritization, and project approval.

The key benefits of implementing an effective ITG are the efficiency and control of IT functions, clear allocation of roles and responsibilities, effective IT management, standardization, and prioritization of IT effort, alignment between business and IT, and competitive advantage over the other organizations (Wessels & Loggerenberg, 2006). Kvakik (2004) suggested the following guidelines for establishing an effective ITG in the university.

- Represent and advocate the existing organizational structure, and drive towards a positive organizational change.
- Make sure that the ITG committee members have the necessary knowledge to fulfill their responsibilities.
- Obtain a strong support and sponsorship from the higher up executives.
- Align the IT effort with the university's vision and priorities.

A summit by EDUCAUSE in 2007, attended by over thirty higher education leaders emphasized on the following expectations of the university's ITG (Golden, Holland & Yanosky, 2007).

- Align the IT with the university's strategic goals. ITG must be a topic of discussion among the board members.
- The university’s CIO must be a part of the university-wide enterprise strategic decision. The CIO will help the other executives understand the critical role of IT so that collaborative decisions can be made.
- The university politics should not affect ITG. The IT decision makers in the university need to trust the ITG process, and the CIO should work towards building this trust.

ITG was formed in the universities with a lot of fanfare with the expectation that it would align the university’s IT endeavors with its priorities (Kvavik, 2004). Good ITG in the university is expected to ensure the accountability; so that when something goes wrong, it is easier to trace what happened, and what could be done about it (Chavira, 2004). ITG in the university is expected to engage the diverse stakeholders, establish the priorities and policies, align the IT with institutional goals, and promote the transparency and accountability (Goldstein, 2010). ITG is expected to make the important decisions about the security and data recovery, learning management system, hardware, software, infrastructure, outsourcing, and utilization of shared IT resources (Lorenzo, 2008).

A survey of representatives from thirty-five universities in the USA reported that those universities formed ITG with the expectation that ITG would help make the IT project investment decisions (Golden, Holland & Yanosky, 2007). The University of Utah formed ITG to help make the decisions on how to prioritize the IT projects and to improve the IT investment decisions (The University of Utah, 2014). The University of Michigan formed ITG to make the decisions on how to effectively and efficiently use the university resources and capabilities (The University of Michigan, 2014).

Yanosky and McCredie (2008) highlighted that ITG in the university is expected to make decisions in the following areas.

- IT funding. The declining enrollment and reduced government fund may require ITG to decide how to lower the IT cost, or do more with the existing level of IT funding.
- Research. Make the decisions on how to support computationally intensive studies.
- Teaching. Make the decisions on how to enhance the learning experience through the innovative use of IT and online learning.
- Regulations. Make the IT decisions on how to meet the regulations and compliance. The data stored in the university's IT systems needs to be secure. The regulatory requirements require the IT processes to be transparent and auditable. This puts a pressure on ITG to set the standards to protect the data.
- IT changes. Innovations in IT, mobile services, and cloud services are putting pressure on ITG to come up with standards, and procedures.

ITG in the university is expected to make the decisions, so that the IT projects meet the expected performance outcomes, align the IT with the university's strategic plan (Basu, Hartono, Lederer & Sethi, 2002), and meet the expectations of the university's IT stakeholders (Yanosky & McCredie, 2008).

ITG in Centralized and Decentralized University

The IT decisions at the university are made in a centralized or decentralized manner. These decisions have various implications. The centralized IT gives the decision-making power to the central body of the organization while the decentralized IT gives the decision-making power to the individual business units or processes (Brown, 1997). The centralized IT allocates the decision-making responsibilities to the office of the CIO, the office of IT, or the university's central IT; while the decentralized IT delegates the majority of the decision authorities to the college heads and the business unit managers (Heier, Borgman & Maistry, 2007). The centralized IT provides enterprise-wide perspective, and economies of scope; while the decentralized IT in the colleges and business units meet the compartmentalized need of the unit (Bhattacharya & Chang, 2007, Voloudakis, 2010). Centralizing the shared IT services in university improve resource and cost sharing (Salle, 2004). The unique needs of the colleges are not always met by the centralized IT, which gives rise to the hybrid of the centralized and decentralized hierarchy in the university (Yanosky, 2010).

The decentralized control is often blamed for disappointing IT performance, and the high cost of technology ownership; although, the centralized IT solutions do not always address the comprehensive requirements for a large university with varying needs across departments (McElheran, 2012). As such, it is important to understand whether the IT authority should be centralized, decentralized in the university. There is no perfect model, a structure which fits well in one organization, or at one stage in an organization's life cycle, may not be the right fit for another organization (Pastore, 2008). A single IT structure does not fit all, as the organizational needs and environments differ (Brown & Magill, 1994). The IT needs are unique to the environments, in which they operate (Agarwal & Sambamurthy, 2002). The central IT and decentralized IT in university is expected to be participative, inclusive, open, and work together to meet the university's strategic needs (Kvavik, 2004).

ITG Complexity in Centralized and Decentralized University

ITG in the universities is comprised of various committees (McCredie, 2006). These committees make the IT decisions to support and enhance the university's teaching, research and administrative needs. The large, decentralized universities, such as UMD, University of Cincinnati, The University of Texas, Austin have formed multiple committees and sub-committees under the governance structure. The large, decentralized universities struggle to establish the common ITG policies because the interests of colleges differ, and the ITG lacks the support of the key individuals (McCredie, 2006).

The ITG committee members in the university lack interest in serving on the committees and the members had a varied level of understanding of the university-wide IT needs (Nakatani & Chuang, 2005). A survey of more than five hundred IT leaders in the universities in the USA also supported that the ITG committee members lacked the understanding of university's ITG policies, and their roles and responsibilities were not clear (Allison & DeBlois, 2008).

- At The University of Minnesota, it was difficult to build a consensus on campus-wide IT strategy, and the ITG policies were not well understood by the committee members (Kvavik, 2004).
- At Indiana University, the enterprise goals of the university were unclear, the leadership lacked interest in IT, the decision making was slow; and as such, a revolutionary change in ITG was needed (Golden, Holland & Yanosky, 2007).
- A survey of the CIOs of over fifty universities in Thailand revealed that the IT decision makers lacked the understanding of the ITG policies, and the IT performance (Jairak & Praneetpolgrang, 2011).
- The prior ITG structure in UMD was out of touch with the university priorities, top heavy, and the IT decisions lacked clarity (UMD ITG, 2014). It was difficult to achieve a high level of engagement and support from all the IT community at the university.

The ITG issues are more strategic in the large universities than in the small universities, as the larger universities are focused on research and innovation, not just teaching (McCredie, 2006). As per McCredie (2006), some of the concerns of ITG in the large, decentralized universities are as follows.

- The large universities have multiple IT divisions, which do not collaborate or share the ITG best practices. Their effort may cater to their unit needs, instead of being aligned with the organizational priorities.
- ITG consists of a hybrid of autonomous departments, and the centralized unit, whose interests might conflict.

ITG in the university struggles to prioritize the IT project requests, as the IT projects offer different values to different decentralized college units (Jaafar & Jordan, 2011). An IT project supporting computational research might benefit the college of science but might not benefit the college of arts, and the administrative business unit.

- At The University of Cincinnati, the central IT and the decentralized IT worked within a silo, without much of collaboration and knowledge sharing (Albrecht & Pirani, 2004).
- The research at the public university in Malaysia supported that the departments and business units had divergent interests (Ismail, 2008).
- The University of Texas, Arlington, made the decision on whether to execute an IT project under the centralized IT or the decentralized IT by comparing the university's centralized services and the distributed services, standardization and autonomy, consensus and efficiency (The University of Texas, Arlington UT, Arlington, 2014).

ITG has to fit an adaptive and interactive process (Grembergen & De Haes, 2005). As the organizational priorities change, the "*desirable behavior change, IT governance also changes"* (Weill, 2004). ITG in the university will continue staying dynamic. The issues that currently require executive attention will fade away, and will be replaced by different priorities, as the technology evolves (Secondat & Montesquieu, 2008). As such, implementing an effective ITG structure in the university is a challenge, and requires a practical and practitioner knowledge (Bermejo, Tonelli, Zimbalde, Brito & Todesco, 2012).

Project Management under ITG

ITG aims to contribute to the success of project management by selecting the IT projects that align with the organization's strategic objectives. ITG sets the foundation and guidelines for IT project to be successful. Project Management Body of Knowledge (PMBOK®, 2013, p. 3) defined a project as a temporary group of activities to produce a unique product, service, or result. Project management is the application of knowledge, skills, and techniques to execute the projects effectively and efficiently. PMBOK® (2013) defined forty-seven processes, which fell under five process groups, which are initiating, planning, executing, monitoring and controlling and closing. It defined ten knowledge areas, which were integration, scope, time, cost, quality, procurement, human resources, communications, risk management and stakeholder management (PMBOK®, 2013, p. 61). The universities often procure vendor products for the IT projects. Project procurement is one of the knowledge areas of project management. Procure management covers the processes of planning for procurement, deciding the selection criteria, conducting make or buy analysis, bidder conference, awarding contracts and monitoring contract performance (PMBOK®, 2013, p. 355).

Project Management Office (PMO) in an organization helps standardize the project related governance, sets the project management methodologies and provides the support in three different ways, which are defined as follows (PMBOK®, 2013, p. 11).

- Supportive. Plays a consulting role by providing the templates, best practices, lessons learned from the other projects and serves as the project knowledge repository. The degree of control is low.

- Controlling. In addition to being supportive, it ensures that the projects use the guidelines and templates set by the PMO, and propose the project management methodologies. The degree of control is moderate.
- Directive. Manages the project and the degree of control is high.

Table 2.4 ITG influencing project management

ITG Crosscuts into Project Management	**Source**
California Department of Food and Agriculture leveraged ITG and PMBOK® for project and portfolio configuration to execute the IT initiatives in its organization, hedge the risk of large project failure, and consequently stabilized California's agriculture industry.	California Department of Food and Agriculture, 2008
A lack of support from the ITG committee sponsors and an ineffective management of the project affected the project outcome.	Lee, Lee, Park & Jeong, 2008
Clearly defined ITG process, and the strong presence of PMO helped IT project realize its value.	Gerrard, 2010
A study of 389 organizations revealed that an effective project portfolio prioritization by the ITG stakeholders and an effective use of project management practices reduced the project risk.	Milne & Bowles, 2009
A case study of ten organizations noted that the incorporation of project management practices into ITG helped with project prioritization, budget planning, and risk management of the IT projects.	Sharma, Stone & Ekinci, 2009

Weill and Broadbent (1998, p. 26) suggested classifying the projects into four categories, such as informational, strategic, transactional and infrastructure. These categories matched with the purposes proposed by the ITG frameworks of ITGI (2003) and Weill and Ross (Weill & Ross, 2004b), and emphasized the cost, quality, and efficiency of the IT projects.

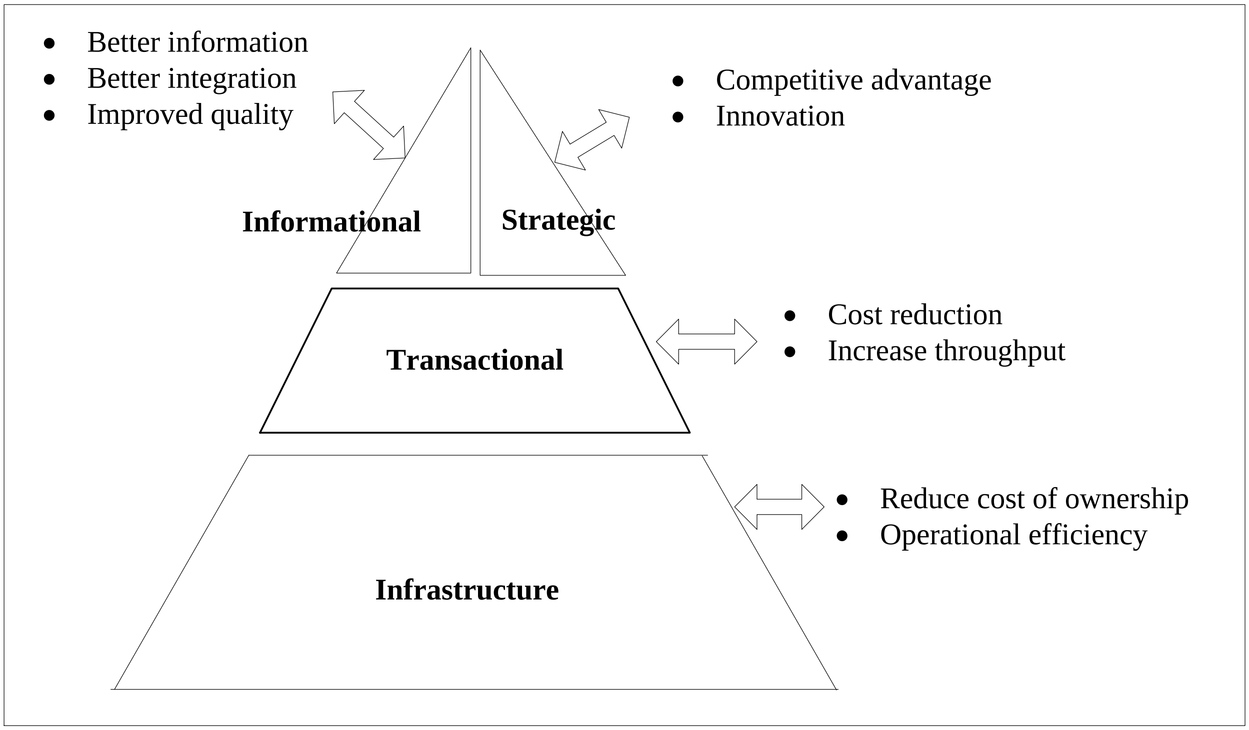

Figure 2.4 IT project categorization (Source: Weill & Broadbent, 1998, p. 26)

The Capability Maturity Model Integration (CMMI) published by Carnegie Mellon University is a well-adapted model to measure the project maturity (CMMI, 2010, pp. 27-29). It defined five maturity levels, which are as follows.

- Level 1 - Initial. The project processes are ad hoc and chaotic, and the project success depends on the heroics of the people, not the process. The project meets its objective, but the project frequently exceeds the schedule and budget. The organization tends to over commit to the projects.
- Level 2 - Managed. The projects are planned and executed according to the plan. The project tasks are managed. The project skill and resources are adequate. The expectations

of the project stakeholders are managed, monitored and controlled. The project is managed by milestone, and the project status is reported to the upper management.

- Level 3 - Defined. The project management processes, standards, and tools are defined more rigorously by defining its purpose, input, output, and the verification measures. These processes are made consistent across all the projects in the entire organization and are continually improved. The processes are allowed to be customized to fit the unique project need.
- Level 4 - Quantitatively Managed. The quantitative, measurable goals are set for the project's performance criteria. These quantitative objectives are set based on the need of the end users. The project performance is made predictable by capturing and benchmarking the quality, and the performance metrics.
- Level 5 - Optimizing. The organization uses a quantitative approach to measuring the variations in the processes in a project and continually improves the processes, based on the business need and the project objective. Improvements happen through innovation, process, and technological improvements. At level four, the projects attempt to improve the processes at the project level only. At the level five, the improvements are made across all the projects in the organization.

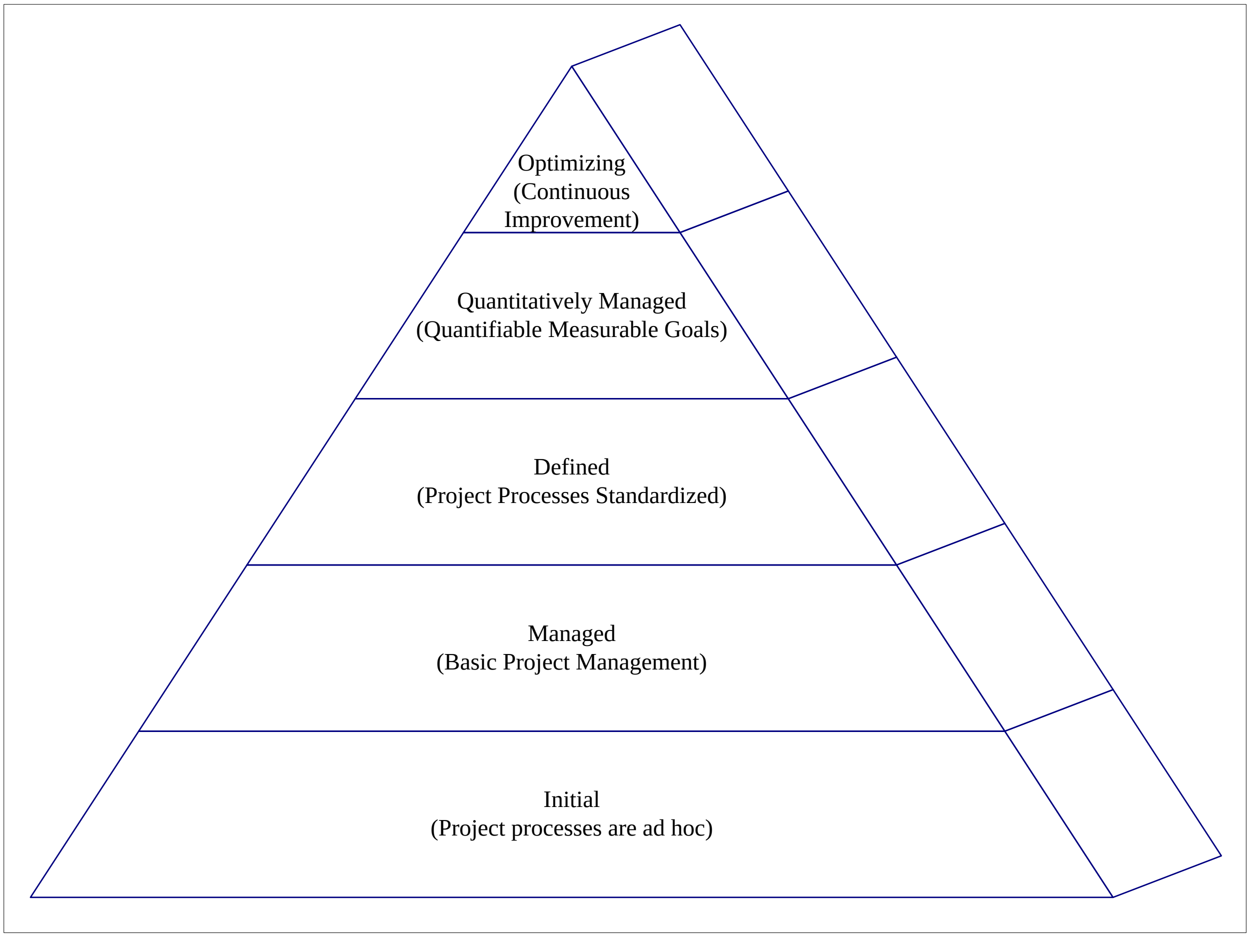

Figure 2.5 Project management maturity level (CMMI, 2010, pp. 27-29)

Large corporations have improved the IT project maturity using the CMMI model. Gibson, Goldenson, and Kost (2006, p.11) in their technical report noted the following.

- JP Morgan Chase achieved a seventy percent reduction in schedule slip by improving to level two.
- DB System GmbH achieved fifty-two percent cost reduction by improving to level three.

- Raytheon Corporation achieved a forty-two percent reduction of rework by improving to level three.
- Systematic Software achieved a ten percent increase in on-time delivery by improving to level four.
- IBM Australia Application Management Services achieved ninety percent on-budget delivery by improving to level five.
- Siemens achieved a seventy-two percent increase in estimation accuracy by reaching level five.

The for-profit organizations have attempted to improve the project maturity and these organizations have achieved the cost, schedule, and production efficiency by increasing the project maturity level.

IT Project Performance

The indicators of the project performance are categorized into two groups, which are the measures of the project performance and the measures of the end user satisfaction. A survey of over one hundred CIOs of the universities in the USA indicated that it is important to set the project performance criteria (Creasey, 2008).

<u>Project Performance Measures</u>

The project performance is measured by how well the project meets the ITG purposes, which are elaborated by Weill and Ross (2004a) and ITGI (2003) as follows.

- Align IT with organizational strategy. It involves aligning the IT projects and services with the objectives of the organization. The IT strategy in an organization should align with the overarching objectives of the organization and comply with regulations (Gheorghe, 2010).
- Value delivery of IT. It involves realizing the value of IT investments, expense optimization, and investing in areas that add value to the organization (Gheorghe, 2010).
- Resource management of IT. It involves effective utilization of human, and non-human resources.
- Risk management of IT. It involves protecting the IT assets, including hardware, software, network and infrastructure, disaster recovery, and business continuity.
- The performance of IT. The performance is measured by meeting the quality criteria, service level agreement, and end-user expectations.

Project performance is measured by the cost and time savings, improved security, modernization, efficiency, and customer satisfaction (PWC, 2006). Clark (2005) suggested the following performance measures for the universities.

- How good should be the IT services and projects in terms of performance, quality, meeting the expectation of the customers?
- What security and privacy risks are acceptable?
- Who is accountable, if the IT initiatives cannot meet the expectations?

End User Satisfaction Measures

Satisfaction was defined as an emotional response towards an object (Locke, 1976), the sum of feelings or attitudes, both positive and negative (Bailey & Pearson, 1983). The IT end users are the users of the IT product and service, who may not be the project team members (Brancheau & Brown, 1993). The IT end user satisfaction is considered as one of the most important measures of project success (Ives and Olson & Baroudi, 1983). The user satisfaction can make, or break the credibility of the organization (Gelderman, 1998).

Meeting User Requirements

It is generally accredited that software development is a dynamic process, and the system requirements may change, or misunderstood. (Kappelman & McLean, 1991). The end user satisfaction of an IT system can be increased by including the features requested by the users, and by having the system tested by the users (Robey & Farrow, 1982). The IT end user satisfaction was defined as the extent to which the users believe the IT system met their requirements (Ives, Olson & Baroudi, 1983). Early researchers proposed measuring the IT end user satisfaction in terms of the quality of the content, format, accuracy, and ease of use and the timeliness of releasing the system (Doll & Torkzadeh, 1988). IT has seen a major growth with the advent of World Wide Web (WWW). The later studies on the web-based systems found that the functions and operations of user interface, web page personalization, navigation, page layout, search functions, and attractiveness contributed to the IT end user satisfaction (Day, 2007). It is important to access the IT end user satisfaction, benchmark it, and compare it to the peer organizations. For a paid product or service, the user satisfaction was seen as a relationship between its cost, and the anticipated benefits (Oliver & Swan, 1989). The IT users of the university do not directly pay for IT products and services, although a part of the tuition and fees go to the university's IT budget.

Quality of an IT System

The quality of an IT system could be measured by the system being error free and meeting the expected response and uptime criteria *(*Gelderman 2002, Zviran, Glezer & Avni, 2006, Kulkarni et al., 2006). The quality of web-based IT system could be affected by download time of the content (Palmer, 2002). In the recent years, the universities have conducted surveys on the level of user satisfaction. These surveys supported that the IT system being error free is a measure of the quality of IT system (McDonald, 2012, UMD ITG, 2014).

User Engagement and Training

A study of 151 IT projects noted that the user participation during the project life cycle had a positive association with the user satisfaction (McKeen, Guimaraes & Wetherbe, 1994). The IT system should be designed with the input from the end users (Guimares, Igbaria & Lu, 1992). The errors made by the users while using an IT system could often impact the user's perception of the quality of the IT system (Berglunda & Ludwiga, 2009). As such, training the end users on the IT system is positively associated with the user satisfaction (Guimares, Igbaria & Lu, 1992). Training the users on the new IT system would increase the user confidence, ability to use the system, and would reduce the help desk calls (Igbaria, Guimares & Davis, 1995). Organizations should train the end users, before releasing a new IT system (Mahmood, Burn, Gemoets & Jacquez, 2000). User training would also increase the user acceptance, and the usage of the new IT system (Nelson & Cheney, 1987).

Summary and Conclusion

The universities have acknowledged the importance of forming ITG. Many nonprofit universities in the USA, both large and small, have now formed ITG. ITG in the universities is formed of the IT committees representing teaching, research, administration, and core IT. The universities exhibit centralized and decentralized IT. The centralized IT is typically responsible for the shared IT projects and services, which typically benefit the entire university. On the other hand, the IT projects executed by the decentralized colleges and business units often benefit the unit. The universities get more IT requests than it can execute because of the fund and resource limitations. Even with ITG, the universities continue facing a challenge in selecting the IT projects.

This literature review shaped the design of this research. The research proposition and the research questions on the ITG processes and the IT project management methodology were developed based on the literature sources. The interview questions were designed using the sources found from the existing literature. The research hypotheses were developed to contribute to the body of knowledge of ITG and IT project management in the nonprofit university.

Chapter 3 : Methodology

Introduction

This chapter elaborates the hypotheses tested in this research, the research methodology used, and the development of the interview questions. The case study research methodology was used in this research. A case study was conducted on nine cases from four nonprofit universities in the USA. This chapter explains the theoretical background of the case study research methodology, rationale behind choosing case study as the research methodology, and how the case study protocol was followed in this research. QCA was used in this research to complement the case study to analyze the conditions for the IT decision making and the IT project management affecting outcomes. This chapter explains the theoretical background of QCA, rationale behind choosing QCA to complement the case study research, and how QCA was used to analyze the causal conditions and outcomes. The researcher completed the necessary training and passed the exam on Collaborative Institutional Training Initiative (CITI) on Social and Behavioral Research. This research was approved by the Institutional Review Board (IRB) of the researcher's degree-granting university, and the IRB of four universities, which participated in this research.

Development of Hypotheses

This section discusses the hypotheses tested in this research and their development. The research proposition is as follows.

> The objective of ITG is to help the centralized and decentralized universities select and prioritize the IT projects. The IT projects following project management methodologies achieve a higher IT project management maturity. The IT projects selected using the effective ITG processes, and well managed, meet the project objectives, strategic objectives, and the end user expectations.

The research hypotheses were developed to support the research proposition. This research proposed three alternate hypotheses.

<u>Hypothesis1 on IT Project Selection</u>

The first hypothesis was developed around how the IT projects are selected by the large, decentralized university and the small, centralized university. The centralized IT gives the decision-making power to the central body of the organization while the decentralized IT gives the decision-making power to individual business units or processes (Brown, 1997). Sambamurthy and Zmud (1999) examined thirty-five organizations and found that the business strategy, economies of scope, and the IT knowledge influence whether an organization would exhibit decentralized, or centralized IT. Small, stable, cost-conscious organizations tend to centralize IT; while large, dynamic, innovative organizations favor decentralized IT (Peterson, 2001, Jewer & McKay, 2012).

There is no single way to make the IT decisions in the universities, as the ITG structures vary between the universities, and the IT decisions are influenced by the campus politics (Kvavik, 2004). University bureaucracy and the diverse IT priorities of the decentralized colleges and business units make the IT project prioritization a difficult task (Nakatani & Chuang, 2005). The first hypothesis was developed to study whether the IT project selection varied between the small, centralized and the large, decentralized university.

> H1: The IT project selection process varies between the small, centralized and the large, decentralized university.

This hypothesis expands the body of knowledge on how the ITG processes influence the IT project selection in the large, decentralized university, and the small, centralized nonprofit university.

Hypothesis2 on IT Project Management Maturity

The decentralized business units in the university execute the IT projects, so does the central IT (Albrecht & Pirani, 2004, McCredie, 2006, Jaafar & Jordan, 2011). The second hypothesis was developed around the level of IT project management maturity on the IT projects executed by the decentralized unit and the centralized IT.

> H2: The IT project management maturity differs between the IT projects managed by the centralized IT and the decentralized units.

This hypothesis expands the body of knowledge on the level of IT project maturity in the universities. It tested whether the IT project management varies between the IT projects executed by the centralized IT and the decentralized units.

Hypothesis3 on Project Performance

The third hypothesis was developed around the relationship between the IT project management maturity in the university and the IT project performance. It is analyzed whether a higher IT project management maturity leads to a better project performance.

> H3: The IT project in the university with a higher project management maturity exhibits a better project performance.

This hypothesis expands the body of knowledge on the relationship between the IT project management and the project performance in the nonprofit university.

Choice of Case Study as Research Methodology

The case study research methodology was chosen in this research. This section explains the reason for choosing the case study research methodology, the processes of case selection and data collection, and the case study research protocol followed in this research.

Background of Case Study Research

A case is a phenomenon occurring in a bounded context, a unit of analysis, which explores a process, or behaviors, which are little understood (Miles & Huberman, 1994, p. 24). A case study is the exploration of the case within its context, using a variety of data sources that allows the revelation and understanding of the multiple facets of the case (Baxter & Jack, 2008). "*A case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within* *its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. The case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result benefit from the prior development of theoretical propositions to guide data collection and analysis"* (Yin, 2009, p. 19). A case study is an up-close, in-depth understanding of a single, or a small number of "cases," set in their real-world contexts (Bromley, 1986). The case study involves a detailed investigation of one or more organizations, or groups within organizations to analyze the context and processes involved in the phenomenon under study (Meyer, 2001).

Schramm (1971, p. 7) suggested that a case study asks the following questions.

- Why a decision, or a set of decisions are made?
- How to carry out the decisions?
- What results were obtained because of those decisions?

Yin (2009, p.27) suggests that for *"case studies, five components of a research design are especially important, a study's questions, its propositions, if any, its unit(s) of analysis, the logic linking the data to the propositions, and the criteria for interpreting the findings. The case study method is most likely to be appropriate for "how" and "why" questions,"* questions on the topics, over which the researcher has limited control. A single case study may include a single case or more than one case. If more than one case is chosen, additional cases are used to test the validity and reliability of the theory, replicate the theory, and to find additional interesting evidence.

“Analytic generalization can be used whether your case study involves one or several cases” (Yin, 2009, p. 39).

Baxter and Jack (2008) defined six different types of the case study, which are as follows.

1. Explanatory. Seeking answers to a question that is too complex for the survey, or experimental strategies.
2. Exploratory. Explores the situations where the evaluated intervention has no clear, single set of the outcome.
3. Descriptive. Describes a phenomenon and its real-life context, under which it has taken place.
4. Multi-Case. Explore the differences within and between the cases, and replicate the findings across the cases. The cases are chosen carefully so that similar results can be predicted across the cases, or contrasting can be found based on the theory.
5. Intrinsic. The researcher has a particular interest in a case and wants to better understand the case. The goal is not to understand a generic phenomenon, but the case specific behavior.
6. Instrumental. Provides insight to an issue, or refine a theory, and provides a supportive role in understanding a theory.

Case study research is based on a constructivist paradigm, builds on the social construction of reality, acknowledges that the truth is relative, and is dependent on the perspective of an individual, which could be subjective (Searle, 1999). The case study allows close collaboration between the researcher, and the participant, and allows the participants tell their stories from the reality; which allows researcher better understand the action of the participants (Robottom, 2005). The experimental, or quasi-experimental studies with data collection and analysis methods are known to hide some details (Stake, 1995). *"Case studies, on the other hand, are designed to bring out the details from the viewpoint of the participants by using multiple sources of data. Case studies are multi-perspective analysis. This means that the researcher considers not just the voice and perspective of the actors, but also of the relevant groups of actors and the interaction between them. This one aspect is a salient point in the characteristic that case studies possess."* (Tellis, 1997).

Applicability of Case Study as Research Methodology

The nature of the research questions dictates what research method should be chosen, and the case study methodology is relevant when the researcher asks a descriptive question as how, and why something happened (Shavelson, Phillips, Towne & Feuer, 2003). The case study asks how and why questions on the contemporary set of events (Leonard-Barton, 1990). According to Yin (2009, p. 19), the case study should be considered as a research methodology when the focus of the study is to answer the following.

1. "How" and "why" questions.
2. Study the contextual conditions as they may be pertinent to the case or phenomenon.
3. Boundaries and interrelation are not clear between the phenomenon and context under which the phenomenon is studied.

A case study is applicable in a naturalistic approach, which seeks to understand the phenomena in a context-specific real world setting, where the researcher does not try to manipulate the phenomenon of interest (Patton, 2002, p. 39).

The exploratory, complex, real-world nature of this research fits case study research methodology. Due to the complex and contemporary nature of ITG, and the paucity of cumulative research, a case study is a good fit to research the IT decision-making (Ribbers, Peterson & Parker, 2002). The “why” and “how” questions asked in a case study fit well with ITG, and IT project research in the university. It is important to understand how and why a specific governance model was adopted by an organization, how the IT decisions are made (Sambamurthy & Zmud, 1999), how the IT projects are managed, and why the IT project performances vary in the universities. This research fits the characteristics of the case study methodology, as it asked the how and why questions on the IT decision-making and the IT project management in the nonprofit university.

Table 3.1 Case study protocol followed

Case Study Protocol	Cases Study Protocol Followed
A case study asks how, why question (Schramm, 1971, Yin, 2009, p. 2).	Studied how IT decisions were made at the nonprofit university, why they were made, and why the IT performances varied.
A case study explores the complex phenomenon (Baxter et al., 2008).	IT decision-making in the university is complex, the project priorities conflicted, and the stakeholder interests varied.
A case study conducts an in-depth investigation (Bromley, 1986).	Conducted an in-depth study of the IT decision making, and IT project management in the universities.
A case study is conducted within its real-world context (Baxter & Jack, 2008, Patton, 2002, Yin, 2009, p. 83).	Conducted interviews in-person and on the telephone.

Multi-Case Research Approach Followed

Nine IT projects or nine cases from four universities were chosen in this research. The cases were chosen from the universities, who were willing to participate. It is neither necessary nor preferred to have a random selection of cases. This is because, it is more important to choose the cases based on theoretical sampling, where the additional cases may either replicate or augment a theory (Eisenhardt, 1989). Harris and Sutton (1986) used a case study to research the organizational behavior. They chose eight organizations, which were going through bankruptcy. This sampling was not random, rather, it was based on theoretical sampling; and the samples were chosen to replicate a case, or to enhance the theory. Two large universities and two small universities are chosen in this research based on theoretical sampling, based on convenience.

The multi-case study is used for theory replication, which is used to predict similar results between cases, or to predict contrasting results, but for predictable reasons (Yin, 2009, p. 39). The advantage of using multiple case study is that the evidence created is stronger, and more reliable (Baxter & Jack, 2008). When choices and resources are available, the multi-case design may be preferred over single case designs, as the *"evidence from multiple cases is often considered more compelling, and more robust"* (Yin, 2009, p. 53). A new theory could be generated from a case study, or an existing theory could be tested (Eisenhardt, 1989). By conducting the multi-case study, the theory can be expanded and generalized (Johnston, Leach & Liu, 1999).

The case study could reach its closure when the theory saturation is reached, which means, additional learning is negligible; or similar behavior is observed, as was noticed before (Eisenhardt, 1989). At that point, the case study could be concluded. Eisenhardt (1989) noted that there is no magic number on how many cases are researched, but a number between four and ten could be sufficient; any less than four may not be sufficient to validate a theory, and more than ten could make it complex. The later cases studied in this research replicated the prior findings and extended the theory, by finding additional details.

Table 3.2 Multi-case protocol

Multi-Case Study Protocol	**Multi-Case Study Protocol Followed**
Multi-case study predicts similar, or contrasting results (Yin, 2009, p. 87, Baxter & Jack, 2008)	Similar and contrasting results from nine cases were analyzed.
Four to ten cases could be sufficient when additional learning is negligible, or similar (Eisenhardt, 1989).	A theory saturation was reached, as additional cases could not find significant additional learning.
Study cases from different organizations, or study multiple cases within the same organization (Yin, 2009, p. 82-83).	Six cases were studied are from the same university, and three cases were studied from three different universities.

Data Collection Approach Followed

The data are collected in a case study in a natural setting so that the phenomenon is studied within its real-world context as an original field work, as opposed to relying on the derived data, and survey response (Bromley, 1986). The findings in a case study can be presented in a tabular format instead of applying statistical significance tests (Eisenhardt, 1989). A collection of data from multiple data sources enhances data credibility (Patton, 2002).

- *"Case study evidence also can include both qualitative and quantitative data. Qualitative data may be considered non-numeric data, e.g., categorical information that can be systematically collected and presented; quantitative data can be considered numeric data e.g., information based on the use of ordinal if not interval or ratio measures. Both types of data can be highly complex, demanding analytic techniques going well beyond simple tallies"* (Yin, 2004, p. 12). The potential data sources may include documentation, archived records, interviews, physical artifacts, direct observations, and participant observation (Baxter & Jack, 2008).
- *"Good case studies benefit from having multiple sources of evidence. In collecting case study data, the main idea is to triangulate or establish converging lines of evidence to make your findings as robust as possible. The most desired convergence occurs when two or more independent sources all point to the same set of events or facts"* (Yin, 2004, p. 9). Each data source would contribute to the understanding of the researcher, support the findings, and allow a better understanding of the case. The data from each source is converged in the analysis process, instead of treating the data individually.

The seminal research by Eisenhardt (1989) on decision making in microcomputer industry used the case study research methodology. She studied eight microcomputer firms and collected the data by interviewing employees with different roles in the firm. For each firm, she interviewed CEO, manager, and non-management employee. She gathered the quantitative data from the questionnaires, which asked the questions on conflict and power. Industry reports and internal documents were used as a secondary source of data. From the interview responses obtained, she conducted a pattern matching and content analysis. Finally, she formulated the research propositions and supported them based on the data collected.

The data gathered from various sources applies rigor, but the researcher has to limit the amount of data so that it does not become overwhelming. The researcher could study the case after it has taken place, and the case research could span a range of time (Schramm, 1971, p. 8). The data were collected in this research from university archives, documents, interviews of the ITG committee members, IT managers, project managers, users, and help desk calls.

Table 3.3 Data collection protocol

Data Collection Protocol	Data Collection Protocol Followed
Collect data in real-world context (Pettigrew, 1985, Bromley, 1986).	The data were collected from the universities, where the cases took place.
Collect data from multiple sources, archival records, documents, interviews, physical artifacts (Patton, 2002, Baxter & Jack, 2008, Yin, 2004, p. 9).	The data were collected from publicly available sources, university website, help desk log and IT project archive. For a single case, four to five participants were interviewed, observed the usage and performance of the IT system.
Interview CEO, manager, non-management employee (Eisenhardt 1989), IT decision makers, managers, IT staff and users (Albrecht & Pirani, 2004, Bhattacharya et al., 2007, Fraser et al., 2003, Plunkitt, 2008)	Conducted structured interview of ITG committee, IT manager, IT staff, IT project manager, and IT end user.

Triangulation Approach Followed

A case study is known as a triangulated research strategy, as triangulation provides an important way of ensuring the validity of case study research (Tellis, 1997). The data collected from different sources, different case participants, and the existing literature could be used to triangulate a finding in support of the research proposition (Eisenhardt, 1989). The desired convergence occurs when the independent sources point to the same set of interpretations in support of the case study proposition (Yin, 2009, p. 28). Denzin (1978, pp. 294-307) classified triangulation in case study research into four categories, which are as follows.

1. Data triangulation. The researcher studies whether the data remains the same in different contexts.
2. Investigator triangulation. More than one researcher examines the same phenomenon.
3. Theory triangulation. The researchers with different views study the same phenomenon.

4. Methodological triangulation. One method is followed by another to increase the confidence level of the finding.

Generalization of the findings in a case study research is done through induction, which is inductive theory-generation, or conceptualization based on the data found from the cases (Johansson, 2003). Generalization depends on the principle of abduction, where curious circumstances and variations are found, which could be explained by the researcher based on the unique context of the case (Johansson, 2003). According to Grounded Theory, this is the way in which generalizations are made through triangulation of findings (Glaser & Strauss, 1967). The objective of the case study is not to represent the universe, but theory could be generalized by studying multiple case studies. Triangulation in the research was achieved by collecting the data from multiple sources.

Table 3.4 Triangulation protocol

Triangulation Protocol	**Triangulation Protocol Followed**
Triangulate evidence from multiple sources of data, using multiple data collection methods, within the case and cross-case analysis, and by using existing literature. (Eisenhardt, 1989, Yin, 2004, p. 9).	The existing sources were used to form the research proposition and the research questions. The data were collected from multiple participants, university archive, documents. The data collected from nine cases were compared and contrasted.

Testing Validity of Case Study Research

Validity test should be conducted to test the quality of the research design. Yin (2009, p. 41) proposes the following validity tests.

- Construct validity. *"Use multiple sources of evidence, establish a chain of evidence, have key informants review draft case study report".*
- Internal validity. *"Do Pattern matching, do explanation building, address rival explanations, use logic models".*
- External validity. *"Use theory in single-case studies, use replication logic in multiple-case studies"*.

Internal validity is also known as logical validity, and it refers to the causal relationships between the conditions and outcome, and can be done by matching the observed patterns (Yin, 20009, p. 41). Under causal relationship, certain conditions are believed to lead to certain outcomes (Kidder & Judd, 1986, pp. 26-29).

Construct validity is the operational measures, for which the case study phenomenon is researched (Kidder & Judd, 1986, pp. 26-29). It is the phenomenon that the case study claims to investigate. Construct validity needs to be considered during the data collection process. It is important not to develop subjective judgments at this phase and to ensure that the participants do not feel any threat. (Yin, 2009, p. 41).

External validity is the domain to which the findings of the study can be generalized (Kidder & Judd, 1986, pp. 26-29). External validity is a generalization of the theory with the belief that the phenomenon occurs not only under the setting under which it is studied but also in other settings

(McGrath & Brinberg, 1983). A single case nor multiple cases allow for statistical generalization to infer conclusions about a population, however that does not mean that the case studies lack generalization. *"Analogy to samples and universes is incorrect when dealing with case studies. Survey research relies on statistical generalization, whereas case studies (as with experiments) rely on analytic generalization. In analytical generalization, the investigator is striving to generalize a particular set of results to some broader theory"* (Yin, 2009, p. 43).

Analytical generalization is done using empirical observations in a case study, rather than using a population. In the widely cited paper of Eisenhardt (1989), it is suggested that a cross-case analysis of four to ten case studies may provide a good basis for analytical generalization and theory generation. The researchers can analyze case studies of different organizations, or multiple cases studies with an organization, and *"multiple levels are likely to fall within a nested arrangement: a broader level (e.g., a field setting) that contains or embeds a narrower level (e.g., a participant in the setting),*" which is known as nested approach (Yin, 2011, pp. 82-83).

Table 3.5 Validity protocol

Validity Protocol	Validity Protocol Followed
Internal validity is tested by cause and effect (Kidder et al. 1986, Yin, 2009, p. 41).	The cause and effect of the IT decision and its outcome; and that of IT project management, and its outcome was studied.
Construct validity is tested by using correct operational measures, (Kidder & Judd, 1986). Participants should not feel a threat (Yin, 2009)	Participation in the case study was voluntary. The participants reviewed the interview questions before the interview. The participants had an opportunity to accept, or decline the interview, not answer a question, or terminate an interview without any effect on their personal and professional matter. The participants did not feel any threat.
External validity tested by generalization (Eisenhardt, 1989, Yin 2009, p. 41)	The cross-case analysis was conducted to generalize the findings on the IT project decisions, IT project management and the IT performance in the nonprofit university.

Testing Reliability of Case Study Research

Reliability in a case study is achieved by setting the "*case study protocol"* (Yin, 2009, p. 41) so that the researcher can follow the same protocol and follow the same procedure to collect the data (Kidder & Judd, 1986, pp 26-29). A reliable case study can help us *"understand a situation that would otherwise be enigmatic or confusing"* (Eisner, 1991, p. 58). Systematic errors are known as predictable errors, and they systematically affect all the samples in the case study. Random errors are due to chance and unpredictability, such as the mood of the case study participant, and are the concerns of reliability. To guard against the random errors, triangulate the evidence, use multiple data sources, multiple observers, and external observers (Tellis, 1997).

The research must make a case study protocol transparent "*that you must describe and document your qualitative research procedures so that other people can review and try to understand them"* (Yin, 2011, p. 19). The transparency can be increased by documentation and clarification of the case study protocol. *"One prerequisite for allowing this other investigator to repeat an earlier case study is the need to document the procedures followed in the earlier case. Without such documentation, you could not even repeat your own work (which is another way of dealing with reliability"* (Yin, 2009, p. 45).

Table 3.6 Reliability protocol

Reliability Protocol	**Reliability Protocol Followed**
Reliability is achieved by repeating the research protocol, and the data collection procedure, and by making the research protocol transparent (Kidder & Judd, 1986, Tellis, 1997, Yin, 2009, p. 41).	The same research protocol and data collection approach were followed in all the cases. The interview participants were asked the same set of questions, and the universities were requested to furnish the same set of records. The research protocol was transparent and was reviewed by the participants ahead of time.

Choice of QCA as Research Methodology

This section elaborates the theoretical background of QCA and why QCA was chosen in this research.

Background on QCA Research Methodology

QCA was introduced by Charles Ragin in the 1980s. QCA is widely used for the applications in the social science research (Gross, 2010). COMPArative methods for Systematic cross-caSe analysis (COMPASS) is a knowledge body, which is dedicated to the QCA research. QCA is designed for analyzing cross-case patterns, complex causal relationships between conditions and outcomes, and is useful in researching five to fifty cases (Rihoux & Ragin, 2009, p. 4). QCA *"strives to achieve some sort of explanation of a certain phenomenon of interest while still providing appropriate allowances for causal complexity"* (Rihoux & Ragin, 2009, p. 10). *"In general, QCA has been characterized as a new, "third" way to conduct social science research that combines the strengths of traditional quantitative and qualitative methods"* (Devers et. al., 2013).

QCA allows modest generalization to support a proposition, or to add new knowledge. *"QCA results may be used in support of limited historical generalizations. Most specifically, from a systematic comparison of comparable cases, it is possible to formulate propositions that we can then apply, with appropriate caution, to other similar cases. This view of generalization is much more modest than statistical inference, which allows very broad generalizations"* (Rihoux & Ragin, 2009, p. 12). Cress and Snow (2000) noted that the primary concern of QCA "*is not with generalizing to the universe, ...but with using our case findings to refine and extend understanding of the determinants of ... outcomes. Given the similarities and differences among our cases in terms of the causal factors and the range of outcomes obtained, they are well suited for assessing the influence of factors thought to affect outcome attainment."* Rihoux and Ragin (2009, p. 11) noted that *"without the ambition to generalize, in the search for an explanation, research would produce only tautologies and descriptions."*

QCA allows replicability, as the other researchers using the same set of data, and choosing the same options would arrive at the same results, and this ability to replicate test *"provides the* *scientific character of the approach, in the sense that it eliminates vagueness and interpretation in the application of techniques"* (Rihoux & Ragin, 2009, p. 14). QCA allows transparency in research and requires the researcher to be transparent about the choices, selection, and thresholds (Rihoux & Ragin, 2009, p. 14).

A comparison between the cases is fundamental in case study research to understand the similarities and dissimilarities between the cases. QCA allows a systematic cross-case comparison while understanding the complexity within a single case. QCA can be successfully conducted with small to a medium number of cases by gaining a sufficient intimacy of the conditions and outcomes of each case, selecting the cases which share sufficient similarities, and produce both positive and negative outcomes (Rihoux & Ragin, 2009, pp. 24-25).

QCA analyzes the conditions on the cases, which lead to an outcome. The conditions are the variables found in the cases. Each condition has a raw data, found in each case. The raw data on the condition on each case is translated into a coded value, based on the threshold values. The outcomes are the results observed in the cases and have raw data. The raw data on each outcome is translate into a coded value based on the threshold values. The threshold values are determined for each condition and the outcome. This determination is made in a transparent manner. The threshold values need to be justified based on the substantive theoretical ground; and if that is not possible, data distribution of the cases, or a cutoff point based on mean, or median of the data could be used (Rihoux & Ragin, 2009, p. 42).

The conditions selected are the ones which vary across the cases, and the number of conditions should be limited between six and seven for the number of cases ranging between ten and forty (Rihoux & Ragin, 2009, p. 28). QCA allows a systematic analysis of Most Similar Cases with Different Outcome (MSDO), and Most Different Cases with Similar Outcome (MDSO) by systematic matching, and the pairing of cases based on the conditions and outcomes (Rihoux & Ragin, 2009, p. 29). As such, the case selection in QCA should include the “most similar,” and “most different” cases, and have an adequate number of cases with both ‘positive,’ and ‘negative’ conditions, leading to ‘positive,’ and ‘negative’ outcomes. The conditions with different threshold are paired to identify different configurations. Next, a minimization process is followed using Boolean algebra to identify the simplest set of conditions, which will result in an outcome.

There are three categories of QCA, which are as follows.

- Crisp-set QCA
- Multi-value QCA
- Fuzzy-set QCA

Crisp-Set QCA codes the raw data on the conditions and outcomes into a dichotomous threshold value of 1 (indicates presence), or 0 (indicates absence). It uses a truth table to represent the data, conducts Boolean logic is used to produce a combined expression and minimize the conditions leading to an outcome (Rihoux & Ragin, 2009, pp. 33-34). If the raw data for a condition and outcome is not found in a case, QCA allows substitution for the absent values using theoretical and substantive knowledge, which is considered a key strength of QCA (Rohwer, 2008).

Instead of limiting to only dichotomous threshold values of 0, and 1 as in crisp-set QCA, multi-value QCA extends crisp-set QCA by allowing the threshold values in the various intervals. The threshold values can be obtained from *"multi-categorical nominal, ordinal scale, or by the use of multiple thresholds of interval data"* (Rihoux & Ragin, 2009, p. 73), and *"in most cases, only three or four values per condition should be used"* (Rihoux & Ragin, 2009, p. 78). The purpose of multi-value QCA is the same as that of crisp-set QCA, and the main objective is to find a minimal solution, which would produce a specified outcome. Multi-value QCA still allows the dichotomous threshold of 0 and 1, along with the multiple values of 0, 1, 2 on the conditions (Cronqvist, 2003). The fuzzy QCA set allows the support for a richer data set by allowing the threshold values of the conditions and outcomes as a decimal value between 0 and 1 (Rihoux & Ragin, 2009, p. 119). This approach allows a more granular information than what could be supported by crisp-set QCA and multi-value QCA.

Applicability of QCA as Research Methodology

QCA was found to be a good fit to systematically analyze the complex causal conditions in ITG and IT project management in university, leading to an outcome. A single IT project on each university was chosen as one case. A total of nine cases was chosen. The raw data on conditions and outcomes was identified in each case. The raw data was coded to a threshold value based on theoretical analysis, using QCA protocol.

Multi-value QCA was used in this research. Multi-value QCA *"can be viewed as a kind of middle-way between the greater parsimony of crisp-set QCA and the greater empirical richness of fuzzy-set QCA. It is ´not quite crisp´ because it allows the use of intermediate values to denote degrees of set-membership, but it is also ´not yet fuzzy´ because the outcome is always dichotomous. Its major advantage, according to its proponents, is that it deals better with the classic QCA problem of contradictory configurations where cases with the same explanatory characteristics display different outcomes and in principle cannot be taken into account for logical minimization."* (Vink & Vliet, 2007).

This research did not have sufficient richness to justify fuzzy-set QCA but had sufficient data to conduct multi-value QCA. Nine cases fit in the size of intermediate cases, which is ideal for multi-value QCA (Herrman & Cronqvist, 2006). *"The explanatory power of a QCA, fs/QCA, and MVQCA analysis is a function of two parameters; the size of a case set on the one hand, and the necessity to preserve the richness of raw data information on the other. A researcher should use QCA for analyzing rather small, middle-sized case sets whose values can be converted into dichotomous scores without a loss of important cluster information. Fuzzy-set QCA, instead, is most useful whenever a researcher wishes to analyze a comparatively large middle-sized case set which requires preserving rich raw data information. MVQCA, in turn, strikes a balance* *between crisp-set QCA, and fuzzy-set QCA as it constitutes the most suitable method for analyzing genuinely middle sized case sets which necessitate the conservation of some raw data information"* (Herrmann & Cronqvist, 2006). Multi-value QCA is a good fit a study with a medium number of cases, such as the nine cases studied in this research.

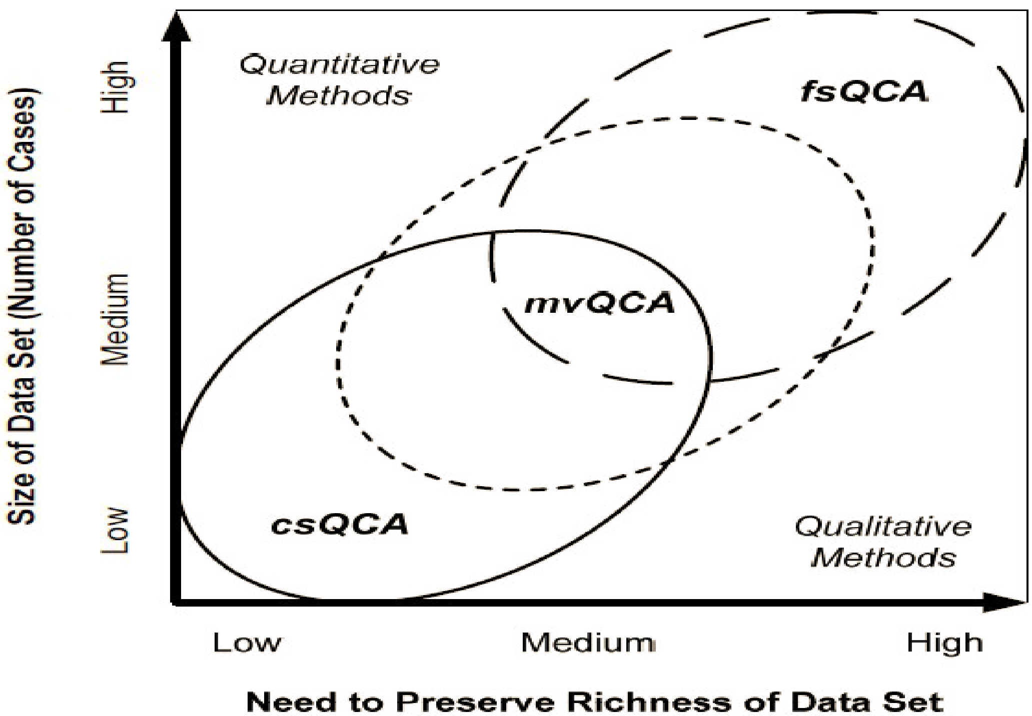

Figure 3.1 Selection of QCA methods (Source: Herrman & Cronqvist, 2006)

In multi-value QCA, the preferred coded values of conditions could have dichotomous values of 0, and 1, or preferably not more than three, or maximum four values; but the outcome should be dichotomous (Cronqvist, 2003, Wagemann & Schneider, 2010). As such, the threshold value set on a condition is either 0, or 1; or 0, or 1, or 2. The threshold value set on an outcome is 0, or 1.

Explaining Steps in QCA

The steps in QCA involve the following.

- Identify the cases.
- Identify the conditions and outcomes.
- Find raw data for each condition, and outcome in each case.
- Determine the threshold values for each condition and outcome, based on substantive knowledge. Assign a threshold value to each condition and outcome of the case.
- Preferably use a tool to conduct QCA to analyze how the conditions affect the outcome, analyze the variances.

A hypothetical example is used to demonstrate the steps of QCA. In this example, three cases are chosen, such as Case1, Case2, and Case3. Each case has three conditions, such as A, B, and C. Each case has two outcomes, such as X, and Y. The raw data is tabulated for each condition, and outcome, for each case. For each condition and outcome, the threshold values are determined. A threshold value is assigned to each condition and outcome of a case. Finally, the coded threshold values are analyzed to understand the causal relation between conditions and outcome.

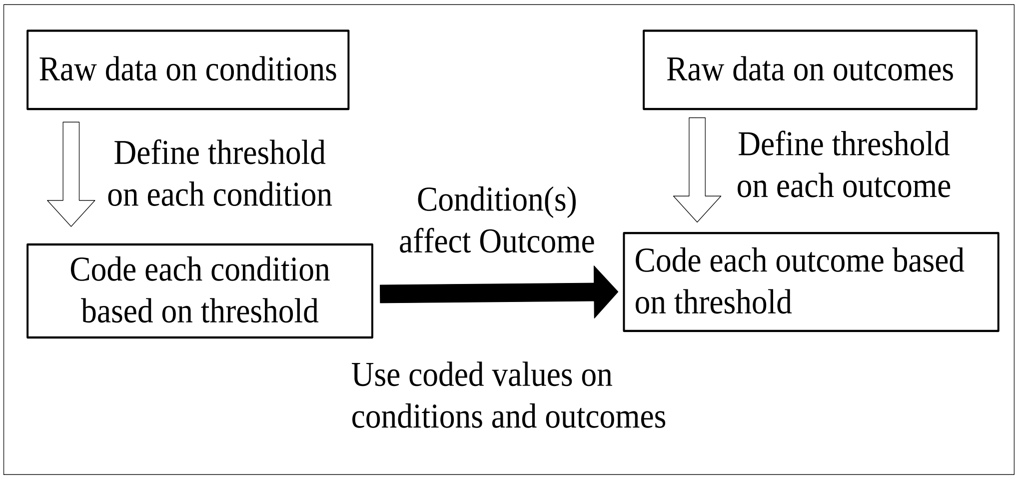

Figure 3.2 Raw data converted to code based on threshold

In this example, QCA is done to understand how the conditions A, B, and C affect the outcome X. Dichotomous threshold value of 0, or 1 are set in each condition and outcome. As such, raw value of A, B and C are coded to either 0, or 1. The raw value of X is coded to either 0, or 1.

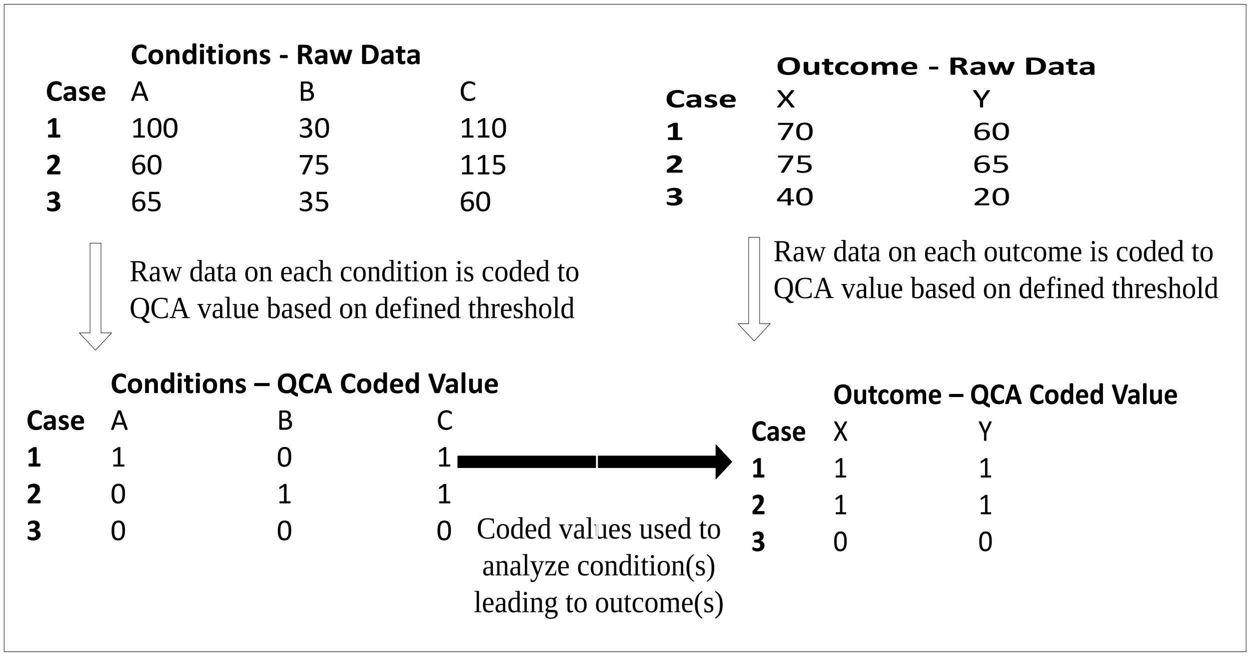

Figure 3.3 Example of converting raw data into coded value

Based on the coded values, all the logical configurations between conditions A, B, and C are identified, which would result in the outcome of 0, or 1 for X. Shown is an example of this analysis based on the figure above.

- A{1} represents the [1] value, the higher value
- A{0} represents the [0] value, the lower value
- B{1} represents the [1] value, the higher value
- B{0} represents the [0] value, the lower value
- C{1} represents the [1] value, the higher value
- C{0} represents the [0] value, the lower value
- X{1} represents the [1] value, the higher value

- X{0} represents the [0] value, the lower value
- Logical “AND” is represented by [*]
- Logical “OR” is represented by [+]

Following are the two available configurations for the outcome of X{1}.

A{1} * B{0} * C{1} =>X{1}

A{0} * B{1} * C{1} =>X{1}

Therefore, minimizing as C{1} =>X{1}.

The minimization indicates that the condition C{1} is found in both the configurations for X{1}. For the purpose of demonstrating the concept of QCA, the dichotomous values of 0 and 1 are chosen in this example. In the same way, the conditions affecting the outcome of X{0}, Y{0}, and Y{1} could be analyzed.

QCA Protocol Followed

QCA protocol was followed in this research in selecting the case, and selecting the conditions and outcomes. It was ensured in this research that the number of cases is sufficient to exhibit both positive and negative behaviors. The validity and reliability were also tested.

Case Selection

QCA allows a systematic analysis of similar and different cases. Nine cases adequately showed the combinations of positive and negative values for the conditions and the outcomes. The cases chosen from the decentralized university had similarity in the IT project selection process and the IT project management practices. They also had differences in the IT system design, as some of the projects procured an IT product while the others developed the IT system in-house. The cases chosen from the centralized university were similar, but they still exhibited differences in the IT project selection process.

Selection of Conditions and Outcomes

The conditions are the variables that distinguish the cases. The number of conditions selected should be limited to six to seven for as many as ten cases (Rihoux & Ragin, 2009, p. 28). This research identified seven or fewer conditions for nine cases. This number of conditions were found optimal. With a large number of conditions, the number of cases needed would increase; while a small number of conditions would result in contradicting outcomes. The conditions affecting the IT decision and the IT project management were analyzed in this research. The conditions chosen were the ones, which were known to affect the IT decision and the IT project management, as supported by the existing literature. The outcomes were the observed behaviors.

Setting Threshold

QCA requires the researcher to be transparent about the thresholds set on the raw data (Rihoux & Ragin, 2009, p. 14). The thresholds set on a condition are 0 and 1, or 0, 1, 2; and the thresholds set on an outcome are 0 and 1 (Cronqvist, 2003, Rihoux & Ragin, 2009, p. 73). The values 0 and 1 represent the presence or absence; while values 0, 1 and 2 represent low, medium, and high. This research gathered the raw data on each condition and outcome, determined the threshold values on each condition and outcome and assigned a threshold value on each condition and the outcome of the nine cases studied. The threshold value assigned to each condition and outcome was agreed by the interviewees, and was also supported by the data found from the existing literature and the case knowledge (Rihoux & Ragin, 2009, p. 42).

Condition Minimization

In this research, a minimal combination of conditions was identified, which lead to an outcome. The research used Boolean logic to find the minimal condition(s) leading to an outcome. The minimal condition(s) were the condition(s), which were common in all the cases, resulting in an outcome.

Validity Test

Validity is tested by ensuring that the following criteria are met (Rihoux & Ragin, 2009, p. 29).

- The study includes a sufficient number of cases with both ‘positive,’ and ‘negative’ conditions, leading to the ‘positive,’ and ‘negative’ outcomes.
- The conditions vary between the cases.
- The cases are diverse so that the conditions can be paired.

A visual test conducted on the cases studied revealed that it passes the validity test. The cases researched had sufficient diversity. The conditions and outcomes had both positive and negative values among the cases studied. It was possible to pair the conditions, which lead to an outcome.

Reliability Test

The reliability is ensured if other researchers using the same set of data, and choosing the same option would arrive at the same results (Rihoux & Ragin, 2009, p. 14). The reliability was tested in this research by ensuring the replicability. The threshold assigned to the conditions and outcomes was replicated by interviewing multiple participants. The threshold values were verified by multiple interviewees and multiple sources of data. A consensus was finally reached between the participants in each case on the threshold, which ensured reliability. The same case study protocol was repeated for all the cases. All the interviewees were asked the same set of questions and a similar set of data were gathered for all the cases.

The threshold value assigned did not vary on the conditions of the size of the university, the number of ITG committees, planned and the actual duration of the project, the number of vendors, number of procurement choices, and the speed of the decision making. A few variations were found in the values assigned by the participants on the level of conflict, communication, and end user satisfaction. To guard against it, the researcher reviewed the frequency of team meetings and stakeholder communication, conflict report submitted, help desk data, the number of system outages, and user complaints. The biggest variation in assigning a threshold was found in the level of project management expertise. A few of the case study participants claimed to have an expert level of project management expertise, even though the participant lacked that expertise. The researcher asked the participant questions about the training taken, the number of projects managed in the past. Finally, the threshold was assigned based on case knowledge and by triangulating data from multiple sources.

Use of Software for QCA

Tosmana – Tool for Small-N Analysis, software version 1.3.1.2 by Lasse Cronqvist was used in this research for QCA. This software supports multi-value QCA. The raw data on conditions and outcomes were coded to a threshold value using this software. The software was used to analyze how various conditions lead to the outcome. This software was used to analyze the minimal conditions.

Developing Interview Questions

The interview questions were designed based on the researcher's literature review. The interview questions were used to answer three main areas of this research in the following areas.

1. ITG structure and IT project selection processes in the centralized and decentralized nonprofit university.
2. The IT project management methodology and its maturity in the nonprofit university.
3. IT project performance in the nonprofit university.

This section elaborates the development of the interview questions using the existing literature.

ITG Committee Structure

Table 3.7 ITG committee structure

Existing Knowledge	**Source**
The universities form IT committees to oversee teaching, research, administrative, and core IT needs.	University of Texas, Austin ITG, 2014, UMD ITG, 2014, University of North Carolina, Charlotte ITG, 2015
The universities depend on the IT committees to make the strategic IT decisions.	Bowen, Cheung & Rohde, 2007
ITG in the university is formed of multiple committees.	McCredie, 2006, Romero, 2012

- What is the ITG committee structure of your university?
- Who are included in the ITG committees?

Roles and Responsibilities of ITG Committee Members

Table 3.8 ITG roles and responsibilities

Existing knowledge	**Source**
University's ITG can draw different responses from different committee members as if five blind men explaining an elephant in five different ways.	Gayle, Tewarie & White, 2003
The committee members have a varied understanding of ITG.	Kvavik, 2004
The IT decision rights, roles, and responsibilities of the IT committee members need to be clearly defined.	Grembergen & De Haes, 2004
The input and decision rights, such as who makes the decision, who provides the input to the decision, who settles the disputes need to be clearly defined under the ITG structure.	ITGI, 2003, Weill & Ross, 2004b, p. 10

- As an ITG committee member, do you know your roles and responsibilities?
- Are the roles and responsibilities clearly defined?

IT Project Selection in Centralized and Decentralized IT

Table 3.9 IT project selection in centralized and decentralized IT

Existing Knowledge	**Source**
The centralized IT gives the decision rights to a central organization while the decentralized IT gives the decision rights to the individual business units.	Olson & Chervany, 1980, Tavokolian, 1989, Sambamurthy & Zmud, 1999, Xue et al., 2008
The large, research universities give a higher authority to the decentralized colleges.	Santosus, 1997, Kvavik, 2004, McGinn & Roth, 1999
The shared IT services are provided by the centralized IT, and the unique IT projects are executed by different colleges.	Salle, 2004, McCredie, 2006, Jaafar & Jordan, 2011
The centralized IT and decentralized IT worked within a silo at The University of Cincinnati.	Albrecht & Pirani, 2004
It was difficult to decide on the IT projects in the university, as the project objectives, and benefits differ.	Weir, 2004, Clark, 2005, Gosenheimer, 2012

- How are the decisions made in the shared IT needs across in your university?

- How are the decisions made on the IT needs of the individual colleges and business units?
- Is there any IT project prioritization process in place?
- What are the conflicts faced in selecting the IT projects?
- How long does it take to select the IT projects?

<u>IT Fund Constraint</u>

Table 3.10 IT fund constraint

Existing Knowledge	**Source**
The university's IT budget was not sufficient to meet the IT requests. The demand for the IT products and services in the university is increasing, while the IT funding is not.	Weir, 2004, Hilton, 2009, Gosenheimer, 2012
An IT budget cut of USD 24 million kept the student email and HR function IT projects on hold.	Hettinger, 2015, University of Illinois
Funding the IT continues to be one of the top ten issues in the university.	Dewey & DeBlois, 2006

- Is the existing level of IT fund adequate to meet the IT needs?
- In the recent years, how many IT projects were kept on hold because of fund limitation?

Resource Constraint

Table 3.11 Resource constraint

Existing Knowledge	**Source**
The university's IT resources are not adequate to meet the IT demands.	Hilton, 2009, Titthasiri, 2000, Weir., 2004, Grand Rapids Community College, 2015
The economies of scope can be realized through resource sharing.	Sambamurthy & Zmud, 1999
The ITG purpose is to effectively manage the IT resources.	ITGI, 2003, Weill & Ross, 2004b, Grembergen & De Haes, 2004

- Is the IT resource adequate to meet the IT needs of the university?
- In the recent years, how many IT projects were kept on hold because of resource unavailability?

University-Wide IT Awareness

Table 3.12 Awareness of university-wide IT priority

Existing Knowledge	**Source**
Many senior leaders in the university are not aware of the IT opportunities and risks, and the university-wide IT needs.	Weir, 2004
At The University of Minnesota, it was difficult to build a consensus on campus-wide IT priority, as university leaders had a varied understanding of university-wide IT need.	Kvavik, 2004
At Indiana University, the enterprise goals of the university were unclear, and leadership lacked interest in IT.	Golden, Holland & Yanosky, 2007
ITG in university gets a negative implication, as formed by the individuals who lack knowledge of the university's IT needs.	Romero, 2012

- What is your level of awareness of the university-wide IT needs?

IT Domain Consideration in Decision Making

Table 3.13 Consideration of IT domains

Existing Knowledge	Source
Under the ITG framework, the IT decisions are made on the IT domains of business need, IT infrastructure, and IT architecture.	Weill & Ross, 2004b, p. 10-11

- To what extent the business need, IT infrastructure, and IT architecture are considered in selecting the IT projects in your university?

Stakeholder Management

Table 3.14 Stakeholder management

Existing Knowledge	Source
The university's IT projects have different groups of stakeholders, such as student, staff, and faculty. The IT needs and priorities of these stakeholders vary. The expectations of these end users need to be managed and met.	Gayle, Tewarie & White, 2003, McElheran, 2012, Denna, 2014, ECAR, 2008
The IT decisions need to obtain a strong support and sponsorship from the key stakeholders and senior leaders of the university.	Kvavik, 2004, Yanosky & Caruso, 2008, Utah State University, 2014

- How are the IT stakeholders identified?
- How is the expectation of the IT stakeholders managed?

Communication

Table 3.15 ITG communication

Existing Knowledge	**Source**
"The more management communicated formally about the existence of IT governance mechanisms, the more effective their governance."	Weill & Ross, 2004a
The frequency of IT communication, communication policies, guidelines, and practices need to be set.	Huang et al., 2010, Borousan et., 2011
Over 100 CIOs of the universities in the USA noted that improving communication between the IT committee members is a top priority.	Creasey, 2008
The University of Cincinnati found that the university's decentralized business units have a limited communication with the central IT.	Albrecht & Pirani, 2004
University of California, Santa Cruz used the IT communication plan to provide clear consistent, accurate and relevant message to the university's ITG committees and the IT end-users.	Bono, 2010

- How are the IT decisions communicated to the stakeholders?
- What is the frequency of communication?
- Who are included in the communication?

Project Management Experience

Table 3.16 Project management experience

Existing Knowledge	**Source**
PMO offers project management training, coaching, and mentoring.	PMBOK®, 2013, p. 38
Training and employee development is a part of personnel administration.	PMBOK®, 2013, p. 75
The business partners provide a specialized expertise or fill a role.	PMBOK®, 2013, p. 36
Project management has a methodology.	PMBOK®, 2013
There is a shortage of the skilled IT managers and employees at the university.	Titthasiri, 2000
Providing the IT training should be one of the top priorities in the university.	Dewey & DeBlois, 2006

- What type of project management training and experience do you have?
- What role does the PMO play in your university?
- What project management methodologies, tools, and techniques are used in the IT projects in your university?

Project Performance

Table 3.17 IT project performance criteria

Project Performance Criteria	**Source**
Align IT with the organizational objective, manage risk, realize the value and meet the performance criteria.	Weill & Ross 2004b, ITGI, 2003
Strategic alignment, value delivery and risk management.	Grembergen & De Haes, 2005
IT technical performance and IT-related business value-add.	Spremic, Žmirak & Kraljevic, 2008
Cost-effective use of IT to enhance the strategic objectives of the university, which are teaching, research and administration.	ECAR, 2008
A survey of over 100 CIOs of the universities in the USA noted that aligning IT with university's strategic objectives, and prioritizing the IT funding are the key performance criteria of ITG.	Creasey, 2008

- What are the IT project success criteria?
- How is the IT project success measured?

End User Satisfaction

Table 3.18 End user satisfaction

End User Satisfaction Criteria	Source
To meet the informational requirements of the users, attain the targeted levels.	Ives, Olson & Baroudi, 1983, Borousan et al., 2011
Content, accuracy, format, ease of use.	Doll & Torkzadeh, 1988
The attractiveness of user interfaces of the IT systems.	Hiltz & Johnson, 1990
IT system being error free.	Gelderman, 2002, Zviran et al., 2006
IT system designed with input from the end users has a direct relationship with the user satisfaction.	Guimares et al., 1992, McKeen et al., 1994
End user training has a positive association with the user satisfaction.	Nelson & Cheney, 1987, Guimares et al., 1992, Mahmood et al., 2000

- What input was obtained from the users while designing the IT system?
- Did the IT system include the expected features and functions?
- Did the IT system have unexpected system errors?
- What training was provided to the end users?

Data Collection

This section elaborates the collection and coding of the case data.

University Profile

Four nonprofit universities were studied in this research, two are large, and two are small.

University 1 (U1)

U1 is a large, nonprofit public research university in the USA with around 30,000 students. The colleges and business units in the university are decentralized. These decentralized units use their own funds to execute the IT projects. These decentralized units do not often take the IT project requests to the ITG committees for selection and prioritization. The IT project decisions are often made by the decentralized units.

University 2 (U2)

U2 is large, nonprofit public research university in the USA with around 30,000 students. This university exhibits the decentralized behavior, similar to U1.

University 3 (U3)

U3 is a small, nonprofit public university in the USA with around 10,000 students. This university is centralized. The colleges and business units typically take the IT project requests to the ITG committee. The ITG committees typically select and prioritize the IT project requests and make the funds and resources available from the central IT.

University 4 (U4)

U4 is a small, private, nonprofit university in the USA with around 5,000 students. This university exhibits the centralized behavior, similar to U3.

IT Projects Studied

Nine IT projects were studied in this research, six of which were from one university (U1), and the remaining three were from the three other universities. The cases C1, C2, C3, C4, C5, C6 were from the university U1, the case C7 was from the university U2, the case C8 was from the university U4, and the case C9 was from the university U4.

University 1, Case1 (U1C1): Email Unification

The university had many disparate email systems. The university wanted to have a single, unified email system for the entire university community. The new email system was expected to have the advanced features, scheduling features, and mobile support. The CIO of the university made the project a priority. The sponsoring business unit funded the project.

University 1, Case2 (U1C2): Hosting of Enterprise Learning Management System (ELMS)

The current vendor chose to discontinue the support of the ELMS hosted on-site. The vendor decided to support the ELMS hosted in the cloud computing environment using the shared processing model. The university had a choice to move ELMS to the cloud and stay with the current vendor, or to find a different vendor with on-site support. The university chose to stay with the existing vendor and moved the ELMS system to the cloud. The sponsoring business unit funded the project.

University 1, Case 3 (U1C3): Synchronous Learning Management System (SLMS)

The existing vendor purchased a new SLMS product and decided to discontinue the support for the current SLMS product, which was used by the university. The university had a choice to migrate to the new SLMS product of the vendor, or to find a different SLMS product. The university chose to stay with the current vendor and migrated to the vendor's new SLMS product offering. The sponsoring business unit funded the project.

University 1, Case 4 (U1C4): Payment Card Industry Data Security Standard (PCI-DSS)

The university lacked compliance with the industry's security standards for the payment card services. The university was at risk of exposing the confidential data. The university conducted business with around 120 merchants using the credit cards. The project scope was to achieve PCI-DSS compliance for all the payment card transactions. The sponsoring business unit funded the project.

University 1, Case 5 (U1C5): Research Portal

The university did not have the support to store, track, and manage research documents electronically in an efficient, and secure fashion. As a result, researchers were not able to effectively collaborate. The university did not have a system to archive the research documents for the duration of the research, and beyond. The university researchers lost some of the research documents in the past and two research grants could not be submitted on time. Manual billing of the invoices for the research projects was error prone and the invoices were lost on a few occasions. The scope of the project was to find an IT solution to securely store research documents and tie the invoices into the university's billing system. The sponsoring business unit funded the project.

University 1, Case 6 (U1C6): Online Purchase Portal

The university's staff, student and faculty members make online purchases from 120 merchants. Every merchant had a different purchase portal. The user experience differed from one merchant to another. The project scope was to bring all the merchants under a single online purchase portal, standardize the user experience, and automate the billing. The sponsoring business unit funded the project.

University 2, Case 7 (U2C7): High-Performance Computing (HPC) system

The university did not have the support for HPC computing on campus. The researchers were using the outside services, which fell short of the customized research support for the university's researchers. The university's health science department was awarded two research projects, which would require data-intensive computations. The scope of the HPC project was to establish the HPC research support within the university, make it a custom fit to meet the unique need of the university researchers, and secure the research data for the regulatory compliance. This project was funded by multiple colleges.

University 3, Case 8 (U3C8): Hosting Enterprise Administration System (EAS)

The university was hosting EAS on-site. The on-site hosting was outdated, did not have adequate audit support and 24/7 technical support. The university compared the cost and benefit of hosting the EAS off-site versus on-site. The university chose an off-site cloud vendor to achieve a higher level of support. The data security and access control concerns were addressed by the vendor. There was no significant difference in cost between the on-site and the off-site solution. The central IT of the university made the resources and fund available for the project.

University 4, Case 9 (U4C9): Degree Plan

The university did not have an automated way to track the courses taken by the students. The student counseling for the degree planning purpose was error prone. Any change made to the course requirements and the graduation policy was not readily reflected in the degree plan. A few students complained that they could not graduate on time, as they were not informed of the changes in the degree plan. The university's student counselors complained to the administrative unit head that they do not have the necessary tools to effectively counsel the students on the degree plan. The university felt the need to find an IT system that effectively tracks the degree plan and updates the records in a timely manner. The university chose a degree plan IT product from a vendor with which it was doing business. The central IT of the university made the fund and resources available.

Participants and Documents

For a single case, four or more participants were interviewed. The roles of the participants were that of IT committee member, IT project manager, IT staff, and end user. The interviews were conducted on-site and on the phone. The cases in this research are coded as C1 to C9. The participants were coded in this research P1, P2, P3, P4 and P5. For example, for the case 1, and participant 1, the participant is coded as C1P1. For case 1 and participant 2, the participant is coded as C1P2. For case 2, and participant 1, the participant is coded as C2P1. The participants were provided interview questions ahead of time. They got a chance to review the interview questions before the interview was conducted. The participants signed a consent form. All the participants were asked the same set of questions. The interviews were conducted in a secure environment. The researcher and the participant were the only ones who participated in the interview. Data were also collected from the university's project archives and the publicly available records. The information on the university's ITG structure, project details, and help desk calls were gathered. All the universities were asked to furnish the same set of documents.

Coding Scheme

The case data were collected on the conditions and outcomes of the ITG committee structure, IT decision making, IT project management, and IT project performance. The case data were coded to a threshold value based on the QCA research methodology. This section elaborates upon the QCA data coding.

Coding ITG Committee Structure

The conditions and outcomes of ITG structure of four universities were studied in this research. As the number of universities was only four, the raw data on the conditions and outcome were coded to dichotomous values 0, or 1. The choice of dichotomous values for a small number of cases is supported by the existing literature (Herrman & Cronqvist, 2006, Vink & Vliet, 2007, Rihoux & Ragin, 2009, Wagemann & Schneider, 2010).

The cases studied found the following conditions in the ITG committee structure.

- Size of university (small, or large)
- IT council committee (presence, or absence)
- Research focus (presence, or absence)

The cases studied found the following outcomes in the ITG committee structure.

- Centralized (presence, or absence)
- Research committee (presence, or absence)
- Administrative committee (presence, or absence)
- Core IT committee (presence, or absence)
- University-wide IT awareness (low, or high)

Condition of Size

Four universities were studied, two with over 30,000 students, and two with 10,000 students, or less. Based on that, the threshold in size was set to 1 on U1, and U2; and 0 on U3 and U4.

Table 3.19 Coding university size

Size				
University	U1	U2	U3	U4
Number of students	~30,000	~30,000	~10,000	~5,000
QCA coded value	1	1	0	0

Condition of IT Council

U1 did not have the presence of the IT council in the ITG committee structure. U2, U3, and U4 had the presence of the IT council in the ITG committee structure. IT council is a cross-functional committee, which reviews all the IT requests from all the colleges, and the business units. Based on that, the threshold on the IT council is set to 0 on U1; and 1 on U1, U2, and U3.

Table 3.20 Coding presence of IT council committee

IT Council				
University	U1	U2	U3	U4
Presence of IT council committee	No	Yes	Yes	Yes
QCA coded value	0	1	1	1

Condition of Research Focus

U1 and U2 were research focused university while U3 and U4 had more focus on teaching than research. Based on that, the threshold on research focus is set to 1 on U1, and U2; and 0 on U3, and U4.

Table 3.21 Coding research focus

Research Focus				
University	U1	U2	U3	U4
Research focused	Yes	Yes	No	No
QCA coded value	1	1	0	0

Outcome of Centralized

The university U1 exhibited the decentralized behavior. In U1, the decentralized business units were the project sponsors, and executed the IT projects within a silo, without bringing the IT project requests to the attention of the ITG committees. These requests were not selected, nor prioritized by the ITG committees. The university U3 and U4 exhibited the centralized behavior. In these two universities, the business units and colleges brought the IT requests to the ITG committees. The ITG committees in turn selected and prioritized these requests. The university U2 was historically a decentralized university. For the HPC project, it exhibited centralized behavior. The HPC project request was brought to the attention of the ITG committees for approval and prioritization. Based on that, the threshold on centralized is set to 0 on U1; and 1 on U2, U3, and U4.

Table 3.22 Coding centralized behavior

Centralized				
University	U1	U2	U3	U4
Exhibited centralized behavior	No	Yes	Yes	Yes
QCA coded value	0	1	1	1

Outcome of Research Committee

The university U1 and U2 were the research focused universities and a distinct research committee was found in the ITG committee structure. The university U3 and U4 were primarily teaching universities and a distinct research committee was not found in the ITG committee structure. Based on that, the threshold on research committee is set to 1 on U1, and U2; and 0 on U3, and U4.

Table 3.23 Coding presence of research committee

Research Committee				
University	U1	U2	U3	U4
Presence of research committee	Yes	Yes	No	No
QCA coded value	1	1	0	0

Outcome of Core IT Committee

All the four universities formed the core IT committee, and the threshold on the core IT committee is set to 1 for all the universities. The Core IT committee is the most technical committee and provides recommendations and advice on the IT matters to the other committees.

Table 3.24 Coding presence of core IT committee

Core IT Committee				
University	U1	U2	U3	U4
Presence of core IT committee	Yes	Yes	Yes	Yes
QCA coded value	1	1	1	1

Outcome of University-Wide IT Awareness

In U1, IT the projects were executed by decentralized business units. These project requests were not brought to the attention of the ITG committees, and the ITG committees were not aware of university-wide IT needs. In U3 and U4, the colleges and business units brought the IT project requests to ITG committees. The ITG committees reviewed the university-wide by IT requests. For the HPC project in U2, all the ITG committees reviewed the project request and were aware of the HPC project need. Based on that, the threshold on the IT awareness is set to 0 on U1; and 1 on U2, U3, and U4.

Table 3.25 Coding university-wide IT awareness

University-wide IT awareness				
University	U1	U2	U3	U4
Level of IT awareness	Low	High	High	High
QCA coded value	0	1	1	1

<u>Coding IT Project Selection</u>

The conditions and outcomes of the IT decision making about nine cases were studied. As the number of cases is intermediate, the raw data on conditions were coded as either dichotomous (0, or 1), or three values (0, 1, 2); and outcome were coded as dichotomous (0, and 1), as supported by the existing literature (Herrman & Cronqvist, 2006, Vink & Vliet, 2007, Rihoux & Ragin, 2009, Wagemann & Schneider, 2010).

The cases studied found the following conditions in the IT decision making.

- Planned budget (low, medium, or high)
- Planned duration (low, medium, or high)
- Number of product choices (low, medium, or high)
- Level of urgency for the project (low, or high)
- Fund readily available (yes, or no)
- Resource readily available (yes, or no)
- Centralized (presence, or absence)

The cases studied found the following outcomes in the IT decision making:

- Level of conflict in decision making (low, or high)
- Time taken in selecting the project (low, or high)

Condition of Planned Budget

Planned budget is what the project was planned to cost. In C1, C2 and C3, the planned budget was not disclosed. The interviews revealed that these were low budget projects. Based on that, the researcher coded them as low. The university's IT project budget is not always created by including the cost of all the university staff, working on the project. The budget typically includes the cost of procured product, vendor's professional services, and the cost to purchase new hardware, software, and network devices. The cases with a budget higher than $1.3 million were coded as 2 (high), $750,000 was coded as 1 (medium), and $255,000 or lower were coded as 0 (low).

Table 3.26 Coding planned budget

Planned budget									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Raw data (USD)	Low	Low	Low	1.3 million	255,000	750,000	2.5 million	32,000	182,000
QCA coded value	0	0	0	2	0	1	2	0	0

Condition of Planned Duration

The planned duration is an estimation of the time to be taken to complete the project. The cases with a lower planned duration of four months or less were coded as 0 (low), nine to eighteen months were coded as 1 (medium), and as high as forty-eight months were coded as 2 (high).

Table 3.27 Coding planned duration

Planned duration									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Raw data (month)	18	3	9	48	14	12	3	9	4
QCA coded value	1	0	1	2	1	1	0	1	0

Condition of Number of Choices

Each project had one or more IT products or IT solutions to choose from. The cases with a number of choices two or less were coded as 0 (low), three choices as 1 (medium), and as high as five choices as 2 (high). In C1, there were three email product choices. In C2, there were two choices, which were either on-site solution, or off-site solution. In C3, five IT products were evaluated. In C4, one consulting services was chosen from three choices. In C5, there were two choices, which were to find a vendor product or build in-house. In C6, the only option considered was to build the system in-house. In C7, three product choices were evaluated. In C8, there were two choices, which were either on-site solution, or off-site solution. In C9, only one vendor-product was considered. The IT products and solutions were analyzed by the university's selection team in the categories of technical and business fit. That is why, a more granular threshold of 0, 1 and 2 were set on the number of IT choices.

Table 3.28 Coding number of choices

Choices									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Number of choices	3	2	5	3	2	1	3	2	1
QCA coded value	1	0	2	1	0	0	1	0	0

Condition of Level of Urgency for the Project

The cases with a lower urgency were coded as 0 (low), and the ones with a higher urgency were coded as 1 (high). The case C2, C3, and C8 were coded as 1 as they had a higher urgency, as the product support was expiring. The case C4 was coded as 1, as the system was out of compliance, and the university was at a risk of a security breach. The cases C1, C5, C6, C7, and C9 had a lower urgency because, the university had an alternate way of performing the operation, and the project could wait. The alternative was not the most preferred way of performing those operations.

Table 3.29 Coding project urgency

Project urgency									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Level of urgency	Low	High	High	High	Low	Low	Low	High	Low
QCA coded value	0	1	1	1	0	0	0	1	0

Condition of Fund Readiness

The cases where the fund was readily available were coded as 1, and the rest as 0. In C4, the university had to wait till it generated an additional revenue from the payment card surcharge. In C7, the university had to wait till the other colleges agreed to provide an additional fund for the project. In C9, the university did not have the fund to purchase the product. The project was finally initiated because, the university generated an additional revenue because of an increase in the student enrollment, and the vendor agreed to give a discount on the IT product.

Table 3.30 Coding fund availability

Fund availability									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Fund readily available	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No
QCA coded value	1	1	1	0	1	1	0	1	0

Condition of Resource Readiness

The university's IT resources were not readily available to work on the IT new projects. In C6 and C9, the project had to wait till the resources were made available. These resources needed to be freed up from their existing responsibilities to be able to work on the new project. The cases, where resources were readily available, were coded as 1, and the rest as 0.

Table 3.29 Coding resource readiness

Resource readiness									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Resource readily available	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
QCA coded value	1	1	1	1	1	0	1	1	0

Outcome of Speed of IT Decision Making

The speed of selecting an IT product or an IT solution is analyzed in this research. The universities conducted a comparative analysis of vendor products, Request for Information (RFI), Request For Proposal (RFP), and proof of concept. In C1, multiple email products were compared based on features. In C2, the university conducted pros and cons analysis of hosting the system on-site, versus off-site. The case C3 took longer time because it had a high number of choices to compare. In C7, the fund had to be made available before the project could be initiated, and it took a longer time to decide how to obtain project fund. The case C6 took a shorter time, as the management promptly decided to build the system in-house. The case C9 took a shorter time because the management considered only one vendor. The cases with lower selection time of six months or less were coded as 0 (low), and as high as twelve months as 1 (high).

Table 3.30 Coding speed of IT decision-making

Speed of decision-making									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Selection time (months)	6	2	12	6	5	1	12	2	1
QCA coded value	0	0	1	0	0	0	1	0	0

Outcome of Level of Conflict in IT Decision-Making

The conflicts were faced with deciding which IT project to fund, especially when the sponsor was not able to fully fund the project. In C4, the office of Controller did not have the necessary funding for the project and used up the IT fund of the administrative unit. The other offices under the administrative wing showed dissatisfaction, as they wanted to use this common fund for different services. In C7, conflicts were found among the colleges in deciding which colleges should fund the project, and for what amount. In C9, the university did not agree to fund the project for the last two years, even with the repeated requests from the university's administrative staff. Finally, the administrative unit took the matter into its own hand and aggressively negotiated a price break with the vendor. The cases with a lower level of conflict were coded as 0, and high as 1.

Table 3.31 Coding level of conflict

Conflict									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Level of conflict	Low	Low	Low	High	Low	Low	High	Low	High
QCA coded value	0	0	0	1	0	0	1	0	1

<u>Coding IT Project Performance</u>

Nine cases are studied on project management conditions, project outcome, and end user satisfaction. As the number of cases is intermediate, the raw data on conditions is coded as dichotomous (0, and 1), or three values (0, 1, 2), and outcome is coded as dichotomous (0, and 1), as supported by the existing literature (Herrman & Cronqvist, 2006, Vink & Vliet, 2007, Rihoux & Ragin, 2009, Wagemann & Schneider, 2010).

The cases studied found the following conditions on the IT project management.

- PMO (presence, or absence)
- Project management experience (low, or high)
- Level of project communication (low, or high)
- Product purchased (yes, or no)
- Level of stakeholder management (low, or high)
- Level of validation by end user (low, or high)
- Level of end user training (low, or high)

The cases studied found the following outcomes for the project.

- Project delay compared to planned duration (low, or high)

- Project delay as a percentage of planned duration (low, or high)
- Number of requirements missed by the IT system (low, or high)
- Number of system errors in IT system (low, or high)
- Number of errors made by the user in using the system (low, or high)

Condition of PMO

In C8, the project obtained guidance from the PMO and thus the PMO condition in C8 was coded as 1. The projects in U1, U2 and U3 did not receive any guidance from the PMO, and the PMO condition in those cases was coded as 0.

Table 3.32 Coding PMO presence

PMO									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
PMO influenced project	No	No	No	No	No	No	No	Yes	No
QCA coded value	0	0	0	0	0	0	0	1	0

Condition of Expertise in Project Management

The project manager assigned to C4, C7, C8 and C9 managed more IT projects and had between two to five years of project management experience. The role of the project manager was full time. On the other hand, the project manager assigned to C1, C2, C3, C5 and C6 was either the business lead, or the technical lead from the decentralized business unit, who lacked the project management experience and training, and the role of the project manager was part-time. Thus, the cases C4, C7, C8, and C9 were coded as 1, and the rest as 0 on the project management expertise.

Table 3.33 Coding project management expertise

Project management									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Project management expertise	Low	Low	Low	High	Low	Low	High	High	High
QCA coded value	0	0	0	1	0	0	1	1	1

Condition of Communication

No significant difference was found in the level of communication within the project team between the projects studied. The frequency of communication with the end users and the stakeholders varied between the projects. The communication between the end users and stakeholders were in the form of meeting, memos, and bulletin board posts. Some of the IT projects had a higher level of communication with the end users during the requirements gathering, validation and testing. The cases with the number of user meetings less than four were coded as 0, and four or higher as 1.

Table 3.34 Coding project communication

Project communication									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
# of communication with end users/month	1	8	4	1	1	1	4	4	4
QCA coded value	0	1	1	0	0	0	1	1	1

Condition of Build versus Buy

In C1, C2, C3, C7, C8, and C8 the IT product were procured from a vendor, and these cases were coded as 1. In C4, C5, C7 the IT system was built in-house and were coded as 0.

Table 3.35 Coding product procured

Project procurement									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Product procured	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
QCA coded value	1	1	1	0	0	0	1	1	1

Condition of Number of Stakeholder Groups

The number of stakeholder groups in C4 was significantly high. Around 120 merchants needed to be managed in that project. These merchants needed to become PCI-DSS compliant. For the other projects, after a vendor was selected, that was the only external stakeholder that needed to be managed. In C5, C6, and C7, the IT system was built in-house, and there was no need to manage any external vendor. However. The IT projects had to manage the expectations of the university's internal stakeholder groups such as student, faculty, and the administrative staff. The level of stakeholder management in C4 was considerably higher than the other projects, and was coded as 1, and the rest as 0.

Table 3.36 Coding project stakeholder management

Project stakeholder management									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Number of vendors	1	1	1	120	0	0	0	1	1
Student affected	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Faculty affected	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Administrative staff affected	Yes	No	No	Yes	No	Yes	No	Yes	Yes
QCA coded value	0	0	0	1	0	0	0	0	0

Condition of Validation by End User

The end users are the users of the IT system. In C2, C3, C7, C8, and C9 the level of user engagement were higher and were coded as 1. In these projects, the end users validated the IT system during the user acceptance testing. In the remaining cases, The IT system was not validated by end users and was coded as 0.

Table 3.39 Coding IT system validation

IT system validation									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Level of end user validation	Low	High	High	Low	Low	Low	High	High	High
QCA coded value	0	1	1	0	0	0	1	1	1

Condition of End User Training

The universities put emphasis in training the end users on the new IT systems. The level of end user training varied in the projects studied. The end users were trained by instructor-led sessions and by self-paced training tutorial. In C1, the end user training was not provided, as the project lead concluded that the majority of the university users were already using the chosen email system for personal use. In C4, C5 and C6, and C7, the training did not include the university's broad base of users. These projects were coded as 0. In C2, C34, C8, and C9, the users were required to get the training, before starting to use the IT system. These cases were coded as 1.

Table 3.37 Coding end user training

End User training									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Level of end user training	Low	High	High	Low	Low	Low	Low	High	High
QCA coded value	0	1	1	0	0	0	0	1	1

Outcome of Schedule Slip

All the projects that were studied in research were found to miss the deadline. The cases with a longer delay of five months or more were coded as 1 and a delay less than five months as 0. The percentage of schedule slip, delay/planned duration was calculated. The cases with a percentage slip of less than 50% were coded as 0. The cases with a percentage slip of 50%, or more, were coded as 1.

Table 3.38 Coding project delay

Project schedule delay									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Planned duration (month)	18	3	9	48	14	12	3	9	4
QCA coded valued on duration	1	0	1	2	1	1	0	1	0
Actual duration (month)	24	5	15	57	19	18	6	12	5
Project delay (month)	6	2	6	9	5	6	3	3	1
QCA coded value on project delay	1	0	1	1	1	1	0	0	0
% delay (delay/planned duration)	33	66	66	18	35	50	100	33	25
QCA coded value on % delay	0	1	1	0	0	1	1	0	0

Outcome of Requirements Missed

The end users expected certain features, functions, and workflow in the IT system. The IT system released missed some of the expected requirements. A higher number of missed requirements were reported by the end users for C4, C5, and C6 and these cases were coded as 0, and the remaining cases as 1.

Table 3.39 Coding requirements missed

Requirements missed									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Number of requirements missed	1	1	1	4	5	4	2	1	1
QCA coded value	0	0	0	1	1	1	0	0	0

Outcome of IT System Error

After the production release, the IT system exhibited unplanned system outages, system exception, unhandled error, and incorrect result. These IT system errors were reported by the end users. The cases C4, C5, and C6 reported a higher number of system errors, and they were coded as 1, and the remaining cases as 0.

Table 3.40 Coding IT system error

IT system error									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Number of system error	1	0	1	3	4	4	1	1	1
QCA coded value	0	0	0	1	1	1	0	0	0

Outcome of User Error

The users of IT system called the IT help desk as they did not fully know how to work with the new system. These calls were categorized under the user error. These help desk calls were received because of the lack of knowledge of the users of the new IT systems. An approximate number of help desk calls in this category were identified. The cases C4, C5, C6, and C7 received a higher number of help desk calls in this category and were coded as 1, and the rest as 0.

Table 3.41 Coding user error

User error									
Case	C1	C2	C3	C4	C5	C6	C7	C8	C9
Number of user error	~10	~15	~15	~40	~25	~30	~25	~15	~15
QCA coded value	0	0	0	1	1	1	1	0	0

Summary and Conclusion

Case study research methodology was chosen in this research to study the ITG structure, IT decision making, IT project management, project performance and the end user satisfaction in the nonprofit universities. The case study research was found to be a good fit for this exploratory and contemporary type of research. The case study methodology was followed to study nine cases from four nonprofit universities in the USA. The interview questions were designed from the existing literature to support research hypotheses. Multiple participants were interviewed in each case, such as ITG committee members, IT managers, IT workers, and end-users. Additional data were gathered from the university archives and help desk logs. The data were coded using

QCA. This research followed the IRB protocol that was approved by the researcher's university and the universities participating in this research.

Chapter 4 : Findings: IT Project Selection in Centralized and Decentralized University

Introduction

This chapter is a knowledge contribution to the IT project selection in the universities. This chapter provides the support for the first hypothesis, H1 on whether the IT project selection process varies between the small, centralized university and the large, decentralized university. The literature review reveals that the large universities often make the IT decisions in a decentralized manner, while the small universities often make the IT decisions in a centralized manner (Santosus, 1997, McGinn & Roth, 1999, Kvavik, 2004, Salle, 2004, McCredie, 2006, Jaafar & Jordan, 2011). While it is well known that the universities exhibit centralized and decentralized IT, it is not well known how the ITG processes in the university aid in the IT decision making. This chapter studies the IT project selection in two large, decentralized universities and two small, centralized universities. The unique findings and variances are analyzed and explained. *"Emotions often run high when making these kinds of decisions, a structured and objective approach can be helpful in achieving consensus and balancing the needs of the department and its customers and stakeholders"* (Gosenheimer, 2012).

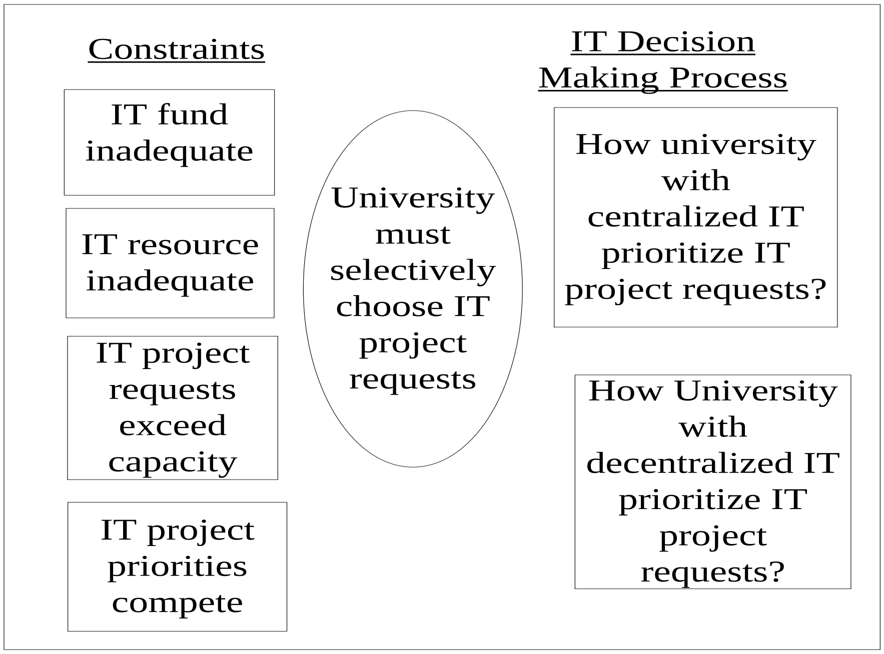

Figure 4.1 Study IT project decision in centralized and decentralized university

Difference in ITG Committee Structure between Four Universities

The four universities studied in this research have formed ITG to aid in the IT decision-making process. The ITG committee structure in the four universities is studied in this section.

ITG Drivers

The four universities studied have formed the ITG structure in less than a decade. The ITG was formed in these universities with certain objectives in mind.

Table 4.1 ITG drivers

University	Drivers to Form ITG
U1	Achieve transparency in decision making, collaborate with university stakeholders, align IT with university's strategic objectives, and meet customer needs, data reliability, and IT security.
U2	Develop policies and standards to approve and prioritize IT work, improve collaboration between university units, resolve disagreements, effectively allocate resources and fund on IT projects, improve accountability, communication, save time, and money.
U3	Ensure that the IT projects in the university align with the policies, standards, priorities and strategic objectives of the university.
U4	Make intelligent decisions on the university's IT needs, and effectively, and efficiently use the limited IT funds, and resources.

The large universities U1 and U2 faced more challenges in establishing the ITG policies and procedures because of a large number of stakeholders, who were influential and had diverse interests. In a large university, it was not easy to standardize the ITG policies, as different stakeholders liked different ways of doing things (U1C1, P2). The CIO was the driving force in forming ITG in all the universities studied. The CIO partnered with the university's senior leaders to form ITG. Forming ITG required a strong support from the university's senior leaders. The primary driver to form ITG in all these four universities was to aid in the IT decision making.

ITG Committee Structure

The ITG structure in the four universities studied comprised of various ITG committees. These committees were formed to make the IT decisions on the university's teaching, research, administrative and core IT needs. The universities typically form a teaching committee, research committee, administrative committee, and core IT committee to make the IT decisions in the respective areas. A few variations in the committee structure were found between the universities studied. The university U2, U3, and U4 formed the IT council committee, which was formed of the members of different colleges and business units.

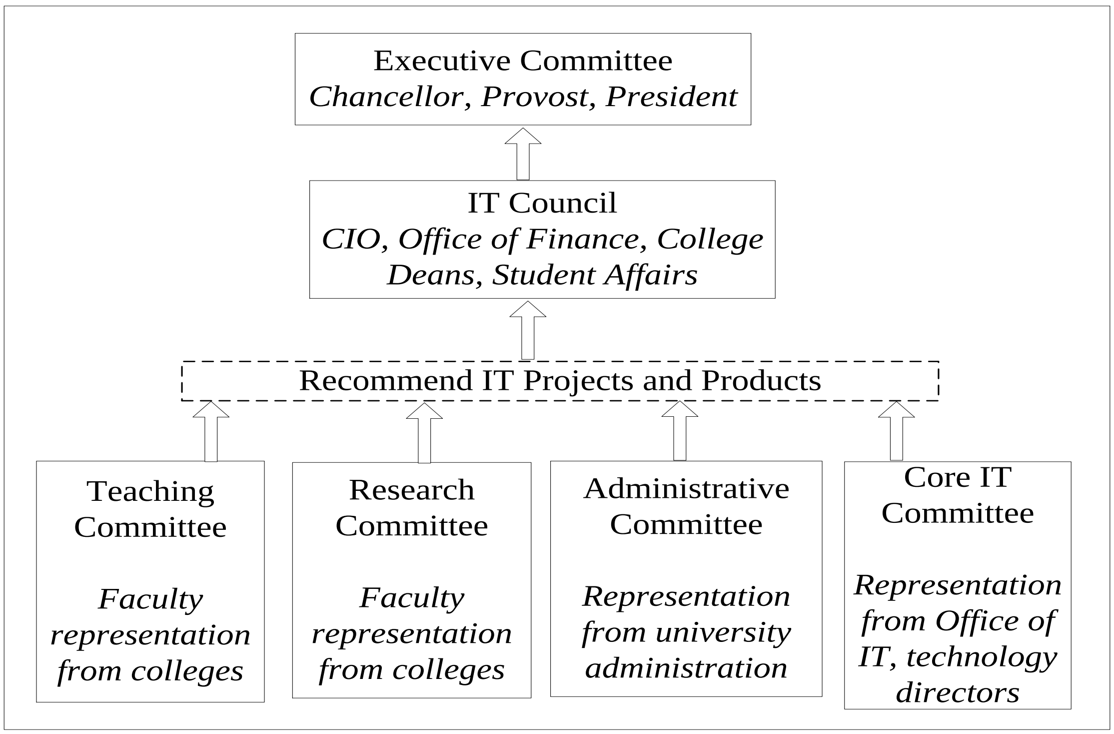

Figure 4.2 Typical ITG committee structure in university

Teaching Committee

The universities studied formed the teaching committee to make the decisions on the university's IT needs to support teaching. The teaching committee recommended the IT projects to advance on-site classroom technology and online learning. It advised on the university's learning management system, websites used for the university's course design, collaborative IT tools for learning, and the use of mobile devices to deliver courses, conferences, audio and video files (U2C3). The teaching committee aimed to improve the teaching and learning methods and the online programs (U4P1). The committee was formed by the faculty representatives from all the colleges. This committee was given different names by different universities.

Table 4.2 Teaching committee

University	Committee Name	Participants in Committee	Makes Teaching Decision	Makes Research Decision	Makes Administrative Decision	Decision Responsibility
U1	Academic committee	All colleges	Yes	No	No	Classroom technology, online learning
U2	Education committee	All colleges	Yes	No	No	Classroom technology, online learning
U3	Academic advisory committee	All colleges	Yes	Yes	No	Classroom technology, online learning, research
U4	Academic and administrative committee	All colleges and administrative units	Yes	Yes	Yes	Projects under USD 25,000 for classroom technology, research, administration

In research based universities U1 and U2, the teaching and research committees were distinct because of the distinct focus on teaching and research. On the other hand, in the teaching based university U3 and U4, the teaching and research committee were the same. In a smaller university U4, the same committee makes the IT decisions on the teaching, research, and administrative needs of the IT projects with a lower budget. In a small university U3, *"the same faculty members are involved in both teaching and research. We do not get many requests specifically to support research. Most of our IT need is around improving teaching and learning"* (U3C8, P3). In a small university U4, the committee was cross-functional and make the IT decisions in many areas. "*We are a small university, and we work closely with all the committee representatives. We oversee many areas of the IT"* (U4C9, P1).

Research Committee

The research focused university U1 and U2 formed the research committee to make decisions on the university's IT needs to support, and enhance research. The research committee was not formed in teaching-focused university U3 and U4.

Table 4.3 Research committee

University	**Committee Name**	**Participants in Committee**	**Decision Responsibility**
U1, U2	Research committee	Faculty representation from all the colleges	IT need to support and enhance research

The research-based university U1 and U2 put a higher emphasis on the IT needs to sustain research, and formed the research committee. In these two universities, the research committee was formed separately from the teaching committee. In U2, the "r*esearch committee makes IT decisions on the use of technology to support current and future research needs, the use of computer servers, instruments, and research data analytics"* (C7P3). The research committee in

U1 and U2 was formed by the faculty representatives from all the colleges. The IT needs to support new research grants were brought to the attention of the research committee in U2.

Administrative Committee

The four universities studied formed the administrative committee to make decisions on the university's IT needs to support, and enhance administrative services. No significant variation in the committee structure was found between the administrative committees between the four universities. This committee was formed of the representatives from the university's office of human resource, controller, registration, and general administration. This committee made the decisions on the university's IT need on administrative functions, such as student registration, grade book and degree, purchasing, record keeping, accounting, finance, payroll, online purchasing and securing university data. The university U1, U2, and U3 have formed a separate administrative committee, but an even smaller university U4 has combined the administrative committee with teaching committee.

Core IT Committee

The four universities studied formed the core IT committee to make the decisions on the university's IT needs. This committee was named differently by different universities.

Table 4.4 Core IT committee

University	Committee Name	Participants in Committee	Decision Responsibility
U1	Core IT	Representatives from office of IT	University-wide support for data center, identity management, network, telecom, internet service, technical support, infrastructure efficiency, security, legal, compliance.
U2	Infrastructure and security committee	Technology directors, and specialists	University-wide support for IT computing and communication, cloud computing, shared IT services, IT outsourcing, and telecommunication, tech support.
U3	Infrastructure Technology committee	Technology directors and specialists	Application, data, hardware, and technology support.
U4	Central IT	CIO, technology directors	Executes smaller IT projects to upgrade the hardware, software, network, and security patches. It collaborates with the business units on the larger projects.

The core IT committee was found to be the most technical committee. It comprised of the members of the office of IT, IT directors and IT specialists with IT domain expertise. This committee was responsible for making the decisions on the university's IT needs to support infrastructure, network, telecom, data, application, IT asset security, cloud and internet based services. This committee served as a consultant to the other IT committees by providing IT domain specific input. The university's help desk and technical support were represented on this committee. The training need for the IT end users and the help desk staff was discussed among the core IT committee members.

IT Council Committee

The IT council committee founded in the small, centralized university U3 and U4, and in large university U2. It was not found in the other large university, U1. For the projects studied in U2, U3, and U4, the IT council committee reviewed the university-wide IT requests, after they were reviewed by the teaching, research and administrative committees. The IT council committee was founded to be a cross-functional committee, represented by multiple colleges and business units. There was some overlap in membership between the members of IT council committee and the other ITG committees.

Table 4.5 IT council committee

University	Committee Name	Participants in Committee	Decision Responsibility
U1	Not found	Not applicable	Not applicable
U2, U3, U4	IT council	CIO, CFO, deans, heads, business units	Gathered input from all the colleges on their IT needs, reviewed the university-wide IT project requests, prioritized the project request, resolved conflicts, and allocated the IT fund.

Executive Committee

The four universities formed a final decision-making body to provide the final approval of the university's IT requests.

Table 4.6 Executive committee

University	Committee Name	Participants in Committee	Decision Responsibility
U1	IT leadership	CFO, provost, president	Funding decision on the large IT projects
U2	IT leadership	Chancellor, provost	Final sign-off
U3	Executive council	President, provost, chancellor	Final sign-off
U4	No name	President	The president worked with the office of Controller and gives the final approval.

The university's top officials of the rank of president, chancellor and provost had the highest authority to make the final IT decisions in the four universities. If the project sponsor had the necessary fund, the IT project was mostly not vetoed by the executive committee.

Data Coding and Analysis: Difference in ITG Committee Structure

This section analyzes how the various conditions affected the ITG committee structure in the four universities.

Conditions Analyzed:

Size{1}: Large university, Size{0}: Small university

ITCouncil{1}: IT council is present, ITCouncil{0}: IT council is not present

ResearchFocus{1}: Higher research focus, ResearchFocus{0}: Lower research focus

Outcomes Analyzed:

AdminCommittee{1}: Presence of administrative committee

AdminCommittee{0}: Absence of administrative committee

CoreIT{1}: Presence of Core IT committee

CoreIT{0}: Absence of Core IT committee

ResearchCommittee{1}: Presence of research committee

ResearchCommittee{0}: Absence of research committee

IT Council Committee

The IT council committee was not founded on the ITG committee structure of the large university U1, but it was found in the other large university U2. The IT council committee was founded in the small university U3 and U4.

Size{1} => ITCouncil {0} (U1)

Size{1} => ITCouncil {1} (U2)

Size{0} => ITCouncil{1} (U3, U4)

IT council was found in both large, and small university.

The later part of the chapter analyzes the influence of the IT council committee in the IT decision-making process.

Research Committee

The size of the university and its focus were found to affect the formation of the research committee. The university U1 and U2 were large research universities with a research focus and they formed the research committee in the ITG committee structure. The university U3 and U4 were small universities with primarily teaching focus. They have not formed the research committee.

Size{1} * ResearchFocus{1} => ResearchCommittee{1} (U1, U2)

Size{0} * ResearchFocus{0} => ResearchCommittee{0} (U3, U4)

The large university with a research focus was found to form the research committee. The university U1 executed Research Portal project, and the university U2 executed the HPC project to support the research initiatives. On the other hand, the majority of the IT projects executed in the small teaching focus university U3 and U4 were to support teaching, administration and the core IT.

Administrative Committee

The four universities studied formed the administrative committee. The university's administrative services received the due attention, and the administrative needs were voiced by this committee. The universities studied, executed the IT projects to support and enhance the administrative functions, as they were essential to support the university's registration, payroll, and human resources.

Size{0} => AdminCommittee{1} (U1, U2)

Size{1} => AdminCommittee{1} (U3, U4)

Both large and small universities were found to form the administrative committee. In U1, the email project, PCI-DSS, and Online Purchase Portal were executed to support the university administration. The university U3 executed Enterprise Registration system to upgrade the Enterprise Resource Planning (ERP) registration system. The university U4 executed Degree Plan project to improve the quality of the student counseling, conducted by the administrative staff.

Core IT Committee

The four universities studied formed the core IT committee.

Size{0} => CoreIT{1} (U1, U2)

Size{1} => CoreIT{1} (U3, U4)

Both large and small universities were found to form the core IT committee. This committee provided the technical guidance, and recommendation on the IT product selection.

IT Project Selection in Four Universities

The large, decentralized university U1 and U2 lacked a formal process to determine the university-wide project priorities. In the large university U1, *"there had not been a pressing situation that warranted a change in the IT decision-making process"* (U1C1, P2). Unifying to a single intake process for all the IT projects in the large university U1 would *"unsettle many influential university stakeholders"* (C1P2). The senior IT leaders in U1 were not yet ready to stir the *"hornet's nest"* and initiate any change in the IT project prioritization processes (C1P2). The attitude in U1 was, "*do not break it"* (C1P2). In university U1, often the *"squeaky wheel* *and the It sponsor with fund have it in their way"* (C1P1). The campus politics and the influence of the sponsors stood in the way to formalize the project prioritization process in U1.

The prioritization of the IT projects was not an easy task in the four universities. This was because, the "*priorities of teaching, research and administration are so different, that it is not possible to rank the projects"* (C7P2). As the value adds of the projects differed, it was not easy to rank their priorities. *"The influence of the sponsor and the fund availability decide which project will be executed"* (C1P3). The urgent projects were selected in the universities studied. The level of urgency was driven by the loss of support and out of compliance of the IT systems. The cases C2, C3, C8 were at a risk of loss of support, and the case C4 had a risk of being out of compliance. These projects were selected for execution.

In the large university U1, the decentralized business units and colleges made their own IT decisions and used their own IT fund to invest in the projects. "*A lot of IT work is going on by decentralized units in different colleges"* (C1P1). The decentralized units in U1 lacked the knowledge of the university-wide IT resources and product availability. This type of decentralization limited collaboration, resource sharing and standardization of the IT projects across the university. In the centralized university U3 and U4, all the IT project requests were brought to the attention of ITG, and the university has a higher awareness of university-wide IT needs.

The presence of the PMO and the IT council committee was found instrumental in prioritizing the IT projects in the university U3. The university U3 had a formal project prioritization process in place, which was established by the PMO. The IT council committee in U3 considered the following criteria in prioritizing the IT project requests (C8P4).

- Alignment with university's strategic objectives.
- Meets audit, accreditation, regulations, legal and compliance requirements.
- The number colleges the project would affect.
- The level of urgency of the project request.
- The cost to execute the project and its benefit.
- The risks of not executing the project.
- The availability of funds and resources.

Table 4.7 IT project decision-making

Case	**Project Sponsor**	**Sponsor had Fund**	**PMO Presence**	**Priority Assigned**	**ITG Involvement**	**University Character**
C1 C2 C3	Office of IT	Yes	No	No	Bypassed ITG	Decentralized
C4 C5 C6	Controller	Yes	No	No	Bypassed ITG	Decentralized
C7	College of medicine	No	No	Not formally	Sponsor brought the request to ITG	Decentralized behaved centralized
C8	Office of IT	No	Yes	Yes, assigns score	IT council prioritized request	Centralized
C9	Administrative unit	No	No	Not formally	IT council prioritized request	Centralized

The decentralized business units in U1 had the project fund and bypassed the ITG committees. These projects in U1 were not brought to the attention of ITG for selection and prioritization. A few variations were observed in the university U2, U3, and U4.

- C7: In the large, decentralized university U2, the HPC project was started as a decentralized IT effort by the college of medicine. The college did not have the fund to execute the project. That is why it was brought to the attention of the university's ITG committees. The IT council committee negotiated with the college of science and engineering to fund a part of this project. This project started in a decentralized fashion but exhibited the centralized characteristics.
- C8, C9: The sponsors of the project in the university U3 and U4 did not have the fund to execute the project. These projects were brought to the attention of the ITG committees. The ITG committees prioritized the It request and made the funds and resources available.

Even though decentralized business units in U1 bypassed the ITG committees, they sought the support of the office of IT. The same behavior was exhibited in the centralized university. The office of IT played an important role in providing the technical consultation and advice to the project sponsors in both centralized and decentralized university.

- C1: The office of IT provided a technical recommendation to on the email product choices.
- C2, C3: The office of IT provided a technical recommendation on ELMS and SLMS product choices.

- C4, C5, C6: The office of IT set the technical standards.
- C7: The Office of IT provided a technical recommendation on the HPC product choices.
- C8: The office of IT provided a technical recommendation on integration and security need to host the EAS system off site.
- C9: The office of IT set the technical integration standards.

It was found that the IT projects executed by decentralized units in U1 benefited not only the sponsoring unit but also the larger groups of the university stakeholders.

- C1: Even though the office of IT was the sponsor, the email project benefited the entire university community. It enhanced the teaching, learning and administrative functions.
- C2, C3: Even though the office of IT was the sponsor, it benefited the teaching function.
- C8: Even though the office of IT was the sponsor, it benefited the administrative function.

Competing Project Priorities

Table 4.8 IT demand exceeds

University	**Example**
U1, U2	*"The classroom technology improvement was on hold, as the university already committed to the other projects"* (U1, C1P1). *"Three projects approved by the research committee were kept on hold because of the lack of fund"* (U2, C7C1).
U3, U4	*"We get more project requests than we can handle. At any given time, we have 40-50 active project requests, and can only do half of it"* (U3, C8P1). *"Degree plan project was on hold for two years because of the fund limitation"* (U4, C9P1).

The four universities studied indicated that they receive more IT requests than they can support. In the large, decentralized university U1, a split was also found *"between the IT priorities of departments, and IT priorities of the central IT"* (C1P3). This split was more pronounced in the large, decentralized universities, which made the project prioritization decisions even more difficult in the larger, decentralized university.

Table 4.9 Competing priorities of IT requests

University	**Example**
U1, U2	*"ELMS project supported teaching and learning while the purchase portal supported the administrative functions"* (U1, C1P2). *"The medical and engineering college wanted the high-performance computing while the college of arts wanted the video and audio classroom support"* (U2, C7P2).
U3, U4	*"We had a need to improve Blackboard technology and student registration system. Blackboard supports teaching while the registration system supports administrative functions"* (U3, C8P2). Two separate requests, one for a wireless upgrade, and another for server upgrade was brought to the attention of the IT strategic committee in U4. The committee decided to wait on the server upgrade, as the servers were still under warranty. The committee decided to invest on the wireless project, as it would allow the students to do the online coursework from anywhere in the campus (U4, U9P2).

IT Awareness

Table 4.10 IT awareness

University	**Awareness of University-Wide IT Priorities**
U1, U2	*"Business units want the projects that would benefit them, and if they have the fund, the ITG committees do not hear about them"* (U1, C2P1). *"If a college has funds, then they do not need the blessings of the ITG committees"* (U2, C7P2).
U3, U4	All the IT project requests from all the colleges and business units submit to the ITG committees, who evaluate the priority.

The centralized university U3 and U4 exhibited a higher awareness of the university-wide IT priorities. In these two universities, the university-wide IT project requests were submitted to the ITG committees, who review the requests. In the decentralized university U1, the individual business units did not bring the project request to ITG committees, and the committee members had a limited awareness of the university-wide IT needs.

Consideration of IT Domains

The ITG framework of Weill & Ross (2004b, pp. 1-55) defined that the IT decisions should consider the IT domains of IT architecture, infrastructure, the business application need and IT principles. This section studies how these IT domains were considered for the nine IT projects.

Table 4.11 Consideration of IT domains

Case	IT Principle	IT Business Need	IT Architecture	IT Infrastructure
C1	Unified email system, support standardized	Communicate with all the university users, rich features	Mobile support	Storage of 50 megabytes per user, infrastructure support for the new email
C2	High level of IT support	Business continuity	Integration with existing IT system	Security and access control of in the cloud
C3	High level of IT support	Business continuity	Multi-language support, video chat	The existing infrastructure was adequate
C4	PCI-DSS compliance	Compliance, reduce risk for data breach	Meets university's security standard	Secure network, establish access control, monitoring
C5	Storage and retrieval of research data	24/7 access, billing integration, secure storage of data	Custom fit for university's research	Hardware support to store research data, access control, and retention
C6	Standardize online purchase	Reduce invoice error, efficiency	Extend existing software application	Access control and security of data
C7	Advance research	On-site support, allow new research	Integrates with supporting IT system	1 petabyte storage
C8	Uniformity of technology	Improve support and disaster recovery	Integrates with dependent application of Tuition Payment	Address connectivity between hosted site and university
C9	Better student counseling	Counseling was error prone	Add-on module to student registration	Reuse hardware, database, matched technology stack

The IT domains, integration, and customization needs were considered in selecting an IT product or IT solution in the four universities. The IT products were procured after considering whether they fit the university's existing architecture, infrastructure and support capabilities. Determinations were made on whether the IT system should be hosted on-site, or in the cloud, whether the system should be built on-site, or procured. The security, access control, and support were taken into consideration while making the It decisions. Some of the low-level details on the IT architecture and infrastructure were unveiled later, as the project progressed.

ITG Communication

The level of communication between the ITG committees is studied in this section. The frequency of the ITG committee meetings varied between once a month, to two times a year among the universities studied.

Table 4.12 ITG communication

University	**ITG Meeting**	**Communication Coordinator**	**Example**
U1	Two times a year	None	The ITG committee membership is a revolving chair, and a new member has to get up to speed (C1P3). The strategic discussions are not followed through (C1P3).
U2	Once a quarter	One part-time employee	The IT council received project requests from teaching, research and administrative committees. "*Agenda was often created on the fly"* (C7P1).
U3	Once a month	One full-time employee	A formal process was established to make the IT project request. Each committee reviewed the IT project requests in the respective area. The committee chair scheduled additional meetings. The ITG meeting dates and agendas were announced weekly in the IT bulletin and the SharePoint site The ITG meetings were open to the campus community.
U4	Once a month	One part-time employee	The meeting agenda and minutes were distributed to the committee members, but not to the broader community.

The level of ITG communication was found lower in the large, decentralized university U1 and U2, and higher in the small, centralized university U3 and U4.

Conflict in Decision Making

"The level of conflict is a proxy of stakeholder satisfaction. ITG in university is successful when university's senior leaders are not complaining" (U4C9, P2).

Table 4.13 Conflict in IT decision-making

University	**Resolves**	**Example**
U1	CIO	Each ITG committee comprised of the subject-matter experts (SMEs) from the respective areas. Conflicts were not common within a committee but arose between the committees. "The d*ecision made by the academic committee may not match up with the decision made by the administration committee. The CIO has to step in to resolve the conflict"* (C1P2). The IT projects funded by the decentralized units were not always brought to ITG and conflicts were not found in those cases. In C4, for the PCI-DSS project, the conflict was faced within the administrative unit itself on the fund allocation.
U2	IT Council	The colleges were not willing to share the project cost for HPC. The IT council intervened and convinced colleges to fund the project.
U3	IT Council	Each committee made the IT decision in the respective area. A quorum of 33% of members had to be present, and votes are cast. The IT council had the authority to change the priority.
U4	CIO, CFO, Provost, President	Conflicts arose on the fund allocation decisions. IT strategic committee consisting of senior leaders resolved the conflict.

The four universities studied reported that they would prefer a consensus in the IT decision-making, if possible. The selection of the IT product and IT solution choices was unanimous in the projects studied. Conflicts were not found within the same committee. The conflicts arose in determining the fund allocation between the project requests. A support from the university's senior leaders was found critical in resolving the conflict and for obtaining the approval for the fund and the project.

Data Coding and Analysis: Difference in IT Project Selection Process

This research analyzed how the IT conditions affected the IT decision-making processes in the nonprofit universities. Multiple conditions were combined to analyze the outcomes of the IT project selection, which are as follows.

- Centralized IT project selection
- Speed of IT decision-making
- Conflict in IT project selection

Centralized IT Project Selection

Various conditions affecting centralized and decentralized IT decision-making were analyzed in this research.

Conditions analyzed:

Size{1}: Large university, Size{0}: Small university

ITCouncil{1}: IT council is present, ITCouncil{0}: IT council is not present

Outcome analyzed:

Centralized{1}: Exhibits centralized behavior

Centralized{0}: Does not exhibit centralized behavior

The size of the university, and the presence, or absence of the IT council committee affected the way the IT projects were selected in the four universities studied. In the large university U1, the IT council committee was not present. The IT projects executed by the business units in U1 were not brought to the attention of the ITG committees. This university U1 exhibited the decentralized behavior in selecting the IT projects. These conditions and the outcome observed in U1 are coded as follows.

Size{1} * ITCouncil{0} => Centralized{0} (U1)

In the small university U3 and U4, the colleges and the business units brought the IT request to the IT council. These conditions and the outcome in U3 and U4 are coded as follows.

Size{0} * ITCouncil{1} => Centralized{1} (U3, U4)

During the research, it was observed that the large university U2 exhibited the centralized for the HPC project. In U2, the HPC project sponsor was a decentralized college. The college did not have the necessary fund. As such, it was brought to the attention of ITG committees. The IT council committee in U2 was formed of representatives from colleges and business units. The IT council committee bridged the communication gap between decentralized colleges and persuaded other colleges to share the project cost, as those colleges would also benefit from this project. These conditions and outcome in U2 are coded as follows.

Size{1} * ITCouncil{1} => Centralized{1} (U2)

Therefore, minimizing as, ITCouncil{1} => Centralized{1}

The university U2, U3, and U4 with the presence of the IT council committee exhibited the centralized decision making. The existing literature indicated that the large universities exhibit the decentralized structure (McElheran, 2012, Yanosky, 2010, McGinn & Roth, 1999, Santosus, 1997). This research found that a large university, which had been historically decentralized, could also exhibit the centralized behavior, under certain conditions.

The presence of the IT council committee in the centralized decision making resulted in a higher IT awareness in the university U2, U3, and U4.

ITCouncil{1} * Centralized{1} => ITAwareness{1} (U2, U3, U4)

The IT project request was brought to the attention of the ITG committees in U2, U3, and U4. The IT council committee in these universities reviewed the university-wide IT requests. The he IT council committee contributed to the centralized decision making and an increase in the university-wide IT awareness in U2, U3, and U4.

Speed of IT Decision Making

The conditions affecting the time taken to select the IT product, or an IT solution were analyzed. The coding scheme is shown below.

Conditions analyzed:

Budget{1}: High, Budget{1): Medium, Budget{0}: Low

Duration{2}: High, Duration{1}: Medium, Duration{0}: Low

Choice{2}: High, Choice{1}: Medium, Choice{0}: Low

Urgency{1}: High, Urgency{0}: Low

Fund{1}: Fund available, Fund{0}: Fund not available

Resource{1}: Resource available, Resource{0}: Resource not available

Outcome analyzed:

Speed{0}: Lower time in decision making, Speed{1}: Longer time in decision making

Planned Project Budget

The effect of the planned budget on the speed of the IT product, or solution selection was studied. In case 6, the planned project budget was $750,000, medium, and it took only a month to select the project and implementation choice. The choice was made to build the IT system in-house.

Budget{1} => Speed{0} (C6)

The cases with a lower budget have shown a contradiction. These projects have taken as long as twelve months in case 3, and as short as one month in selecting the IT product.

Budget{0} => Speed{1} (C3)

Budget{0} => Speed{0} (C1, C2, C5, C8, C9)

Budget condition by itself did not affect the speed of decision making.

Planned Project Duration

It was studied how the planned project duration affected the speed of IT decision making. The project with a high duration took less time in the decision making.

Duration{2} => Speed{0} (C4)

The project with a medium planned duration has shown a contradiction.

Duration{1} =>Speed{0} (C1)

Duration{1} =>Speed{1} (C3)

The project with a lower planned duration has shown a contradiction.

Duration{0} => Speed{0} (C2, C9)

Duration{0} => Speed{1} (C7)

As such, the planned duration condition by itself did not affect the speed of decision making.

Number of IT Product Choices

It was studied how the number of choices affected the speed of IT decision making.

Choice{0} => Speed{0} (C2, C5, C6, C8, C9)

A low number of IT choices have resulted in a faster decision making.

Project Urgency

It was studied how the urgency of the project affected the speed of IT decision making.

Urgency{1} => Speed{0} (C2, C4, C6, C8, with the exception of C3)

High urgency has resulted in a faster decision making. The case C3 was an exception. This case evaluated a high number of choices in the decision- making process and took a longer time in decision making.

Fund Availability

It was studied how the fund availability affected the speed of IT decision making.

Fund{1} => Speed{0} (C1, C2, C5, C6, C8, with the exception of C3)

If the project fund were available, the decision making was faster. The case C3 was an exception because of a higher number of choices it had to evaluate.

Resource Availability

It was studied how the resource availability affected the speed of the IT decision making. The speed of the decision making was faster in the cases where the resource was readily available.

Resource{1} => Speed{0} (C1, C2, C3, C4, C5, C7, C8)

The exception was found in case 3, where a high number of choices needed to be evaluated. The case 7 has also shown an exception, as the fund was not available to initiate the project.

At the same time, the lack of resource availability has also resulted in a faster decision making in the case C6 and C9.

Resource{0} => Speed{0} (C6, C9)

The resource availability was not considered when these products or solutions were selected in these two projects. The decision to select a project did not depend on the resource availability. These projects were kept on hold, till the resources were available.

Centralized IT

It was studied how the centralized structure affected the speed of the IT decision making. The decentralized university has exhibited a slower and a faster decision making. A slower decision making was observed in the case C1 through C6 and a faster decision making was observed in the case C3. In the same way, the centralized university has exhibited both slower and faster decision making. A slower decision making was observed in the cases C8 and C9 while a faster decision making was observed in the case C7. Contradictory results are found in this research. The centralized structure by itself was found not to affect the speed of decision making.

Multiple Conditions Combined

Multiple conditions were combined to see how they affected the speed of IT decision making. The following unique combinations were observed, which lead to a faster decision making.

Budget{0} * Duration{1} * Choice{1} * Urgency{0} * Fund{1} * Resource{1} * Centralized{0} (C1)

Budget{0} * Duration{0} * Choice{0} * Urgency{1} * Fund{1} * Resource{1} * Centralized{0} (C2)

Budget{2} * Duration{2} * Choice{1} * Urgency{1} * Fund{0} * Resource{1} * Centralized{0} (C4)

Budget{0} * Duration{1} * Choice{0} * Urgency{0} * Fund{1} * Resource{1} * Centralized{0} (C5)

Budget{1} * Duration{1} * Choice{0} * Urgency{1} * Fund{1} * Resource{0} * Centralized{0} (C6)

Budget{0} * Duration{1} * Choice{0} * Urgency{1} * Fund{1} * Resource{1} * Centralized{1} (C8)

Budget{0} * Duration{0} * Choice{0} * Urgency{0} * Fund{0} * Resource{0} * Centralized{1} (C9)

A lower number of choices, Choice{0} and Choice{1} have resulted in a faster decision making. On the other hand, the following conditions have resulted in a slower decision making.

Choice{2} * Urgency{1} * Fund{1} (C3)

Choice{1} * Urgency{0} * Fund{0} (C7)

The case C3 indicated that the decision making was slow, even with a higher urgency, as because the fund was not available. The case C7 indicated that even if the number of choices was medium, a lack of fund slowed down the decision-making process. The cases C2, C6, C8 exhibited the ideal conditions under which a fast decision was made.

Choice{0} * Urgency{1} * Fund{1} (C2, C6, C8)

The decision making was fasters in the case C2, C6, and C8, where the number of choices was low, the urgency was high, and the fund was available.

Conflict in IT Decision-Making

The conditions affecting the conflict in IT decision-making were analyzed. The coding scheme is shown below.

Conditions analyzed:

Budget{1}: High, Budget{1): Medium, Budget{0}: Low

Duration{2}: High, Duration{1}: Medium, Duration{0}: Low

Choice{2}: High, Choice{1}: Medium, Choice{0}: Low

Urgency{1}: High, Urgency{0}: Low

Fund{1}: Fund available, Fund{0}: Fund not available

Resource{1}: Resource available, Resource{0}: Resource not

Centralized{1}: Exhibits centralized, Centralized{0}: Does not exhibit centralized

Outcome analyzed:

Conflict{1}: Higher conflict found, Conflict{0}: Lower conflict found

Budget

It was studied how the planned budget affected the level of conflict in the IT decision making. A high budget has shown a high conflict in the case C4 and C7.

Budget{1} => Conflict{1} (C4, C7)

At the same time, a low budget has shown a high conflict in the case C9.

Budget{0} => Conflict{1} (C9)

At the same time, a low budget has shown a low conflict in the majority of the cases.

Budget{0} => Conflict{0} (C1, C2, C3, C5, C8)

A medium budget has shown a low conflict in the case 6.

Budget{1} => Conflict{0} (C6)

The project with a low or medium budget has shown a low conflict.

Duration

It was studied how the planned duration affects the level of conflict in IT decision making. The projects with a higher duration have resulted in a lower conflict.

Duration{1} => Conflict{0} (C1, C3, C5, C6, C8)

At the same time, the projects with a low duration have resulted in a low conflict in the case C2, and a high conflict in the case C7 and C9.

Duration{0} => Conflict{0} (C2)

Duration{0} => Conflict{1} (C7, C9)

The project with the highest duration has resulted in a high conflict in the case C4.

Duration{2} => Conflict{1} (C4)

The condition of duration by itself did not contribute to the conflict in decision making.

Choices

It was studied how the number of IT choices affected the level of conflict in IT decision making. Even with a high number of choices, a lower conflict was found in the case C3.

Choice{2} => Conflict{0} (C3)

The number of choices has not shown any effect on the level of conflict. Even with a higher number of IT product choices, a low conflict was faced in the decision making. The universities conducted a comparative analysis of the IT choices. Most of the time, the choices were unanimous.

Urgency

It was studied how the level of urgency of the project affected the level of conflict in the IT decision making. The projects with a low urgency have shown both low and high conflict.

Urgency{0} => Conflict{0} (C1, C5)

Urgency{0} => Conflict{1} (C7, C9)

The projects with a high urgency have shown both high and low conflict.

Urgency{1} => Conflict{0} (C2, C3, C6, C8)

Urgency{1} => Conflict{1} (C4)

The level of urgency by itself has not affected the level of conflict.

Fund

It was studied how the fund availability affected the level of conflict in the IT decision making. A shortage of funds has resulted in a high conflict in the case C4, C7, and C9. The projects for which the fund was readily available, have shown a low conflict. The projects for which the fund was not readily available, have shown a high conflict.

Fund{0} => Conflict{1} (C4, C7, C9)

Fund{1} => Conflict{0} (C1, C2, C3, C5, C6, C8)

Resource

It was studied how the resource availability affected the level of conflict in the IT decision making. The projects for which the resources were not readily available, have shown a high and a low conflict.

Resource{0} => Conflict{0} (C6)

Resource{0} => Conflict{1} (C9)

The projects for which the resources were available have shown a high and a low conflict.

Resource{1} => Conflict{0} (C1, C2, C3, C5, C8)

Resource{1} => Conflict{1} (C4, C7)

The resource availability condition by itself did not affect the level of conflict. The resource availability was not considered while selecting a project. If the resources were not available, the project was kept on hold.

Centralized IT

It was studied how the centralized decision making affected the level of conflict in the IT decision making. The decentralized unit has faced a high and low of conflict.

Centralized{0} => Conflict{0} (C1, C2, C3, C5, C6)

Centralized{0} => Conflict{1} (C4)

A high conflict was faced in the case 4 within the decentralized administrative unit for the fund allocation. The centralized university has also faced a high and low conflict.

Centralized{1} => Conflict{0} (C8)

Centralized{1} => Conflict{1} (C7, C9)

Multiple Conditions Combined

The conditions were combined to study how they affected the level of conflict. Following unique configurations have resulted in a low conflict.

Budget{0} * Duration{1} * Choice{1} * Urgency{0} * Fund{1} * Resource{1} * Centralized{0} (C1)

Budget{0} * Duration{0} * Choice{0} * Urgency{1} * Fund{1} * Resource{1} * Centralized{0} (C2)

Budget{0} * Duration{1} * Choice{2} * Urgency{1} * Fund{1} * Resource{1} * Centralized{0} (C3)

Budget{0} * Duration{1} * Choice{0} * Urgency{0} * Fund{1} * Resource{1} * Centralized{0} (C5)

Budget{1} * Duration{1} * Choice{0} * Urgency{1} * Fund{1} * Resource{0} * Centralized{0} (C6)

Budget{0} * Duration{1} * Choice{0} * Urgency{1} * Fund{1} * Resource{0} * Centralized{1} (C8)

A low conflict was found in the cases, where the fund was readily available. A high conflict was found in the case C4, C7, and C9, where the fund was not readily available.

Fund{1} => Conflict{0} (C1, C2, C3, C5, C6, C8)

Fund{0} => Conflict{1} (C4, C7, C9)

The case C4 had a higher level of urgency, but it still faced a high conflict, as the fund was not readily available.

Fund{0} * Urgency{1} => Conflict{1} (C4)

At the same time, the case 9 had a lower level of urgency, but it had a high conflict as the fund was not available.

Fund{0} * Urgency{0} => Conflict{1} (C9)

A shortage of funds and a low urgency contributed to a high conflict.

Observations and Discussion

This section covers the observations made on the IT project selection processes in the universities studied.

Decentralized University Exhibiting Centralized Behavior

A large university U2 has historically executed the IT projects in a decentralized fashion. The IT projects were executed by the decentralized business units and colleges in U2, without bringing them to the attention of ITG. For the HPC project, U2 exhibited the centralized behavior. The project sponsor, the college of medicine did not have USD 2.5 million to fund the project. The sponsor brought the project request to the ITG committees. This request was sent to the university's IT council committee, which was represented by the heads of multiple colleges, such as the college of science, and engineering. The IT council committee agreed that this project would not only benefit the college of medicine, but also the colleges of science and engineering. It was identified that the department of computer science, biology, and physics would be immediately benefited from this project. The university lacked the on-site support for the HPC. This project request would allow the on-site HPC research, which could be tailored to meet the unique needs of the university researchers. It would also help recruit new research faculty, who are interested in conducting HPC research. The only way for this project to be funded was by cost sharing by multiple colleges. The IT council committee played an important role in negotiating with the other colleges to acquire the project fund. The IT council committee members met twice a week for six months to agree upon a strategy to acquire project fund.

This project selection has shown the behavior of a centralized IT. The frequency of the ITG communication increased. The IT council committee played an important role in obtaining the project support from the university's senior leaders. A higher level of ITG communication, project prioritization, and fund allocation are the characteristics of a centralized IT. The large university U2 exhibited the centralized behavior in the HPC project. The presence of the IT council committee, shortage of fund, and a higher level of communication made U2 exhibit the centralized character in the HPC project.

Size{1}*ITCouncil{1}* Fund{0}*Communication{1}=>Centralized{1} (case 7)

Flaw in Scoring IT Project Request

This research finds that the university U3 scored the IT project request, and the scoring of the request could be flawed. In U3, the IT project requests were prioritized by assigning a score to each request. The university U3 set a weight in the categories of institutional impact, risk, outreach, and value. For each request, a score was assigned to each category. The value of the weight and score on each criterion was multiplied. Finally, these values were summed to find the composite score of priority of each project. A higher priority score was an indication of higher priority. A project with a higher score was ranked higher in priority.

Using the scoring model, the university U3 selected a community outreach project over an IT network refresh project. The objective of the community outreach project was to set up a website so that the alumni could make an online donation to the university. This project was scored high in the categories of institutional impact, outreach, and value. The network refresh project had a lower score than the community outreach project and the project was kept on hold.

This type of artificial scoring of nominal and ordinal values could be dangerous, flawed, and might not be appropriate. The weight and score on the criteria would change, if the university priority were to change. The forced scoring was assigned based on the judgment. It has a logical flaw, and could cause a practical problem, as the projects scored high are labeled as must do (Merkhofer, 2014). If scoring were used, a must have compliance project might earn a lower score; while a feel good type community outreach project could earn a higher score. The researcher argues that assigning a score to determine the project priority could be flawed.

Summary and Conclusions

This chapter supports the hypothesis H1 and found that the IT project selection process varies between the small, centralized university and large, decentralized university. The decentralized colleges and business units in the large university were fragmented and bypassed the ITG processes if the project sponsor had the necessary project funds. These projects missed out on the opportunity to share the resource and organizational knowledge. In the small, centralized university, the IT requests were brought to the attention of the ITG committees, and the committee selected the IT projects with the university-wide IT needs in mind. The campus politics of the decentralized colleges stood in the way of standardizing and enforcing the ITG guidelines. The ITG in the large, decentralized universities was found to be less authoritative than the small, centralized universities. The cross-functional IT council committee played a critical role in prioritizing the university-wide IT request. The strengths, weaknesses, opportunities, and threats (SWOT) of the IT project selection were analyzed.

Table 4.14 SWOT: IT project selection under ITG in university

Strengths	Weaknesses
• Forming ITG was a step in the right direction • Senior leaders of university acknowledged the importance of ITG • University's ITG aimed to align the IT with the university's core strategic priorities, which are teaching, research, and administration • ITG emphasized on transparency in decision making, communication with the stakeholders, and managing their expectations • Centralized IT had a higher awareness of university-wide IT needs	• ITG committee members had a lower awareness of the university-wide IT needs, particularly in the larger, decentralized university • The decentralized colleges in large university bypassed the ITG processes, and missed out on economies of scale, lessons learned, resource sharing, and standards • The ITG guidelines were not strongly enforced in the decentralized university • The universities did not always use a formal process to prioritize the IT project requests
Opportunities	**Threats**
• Clearly define the roles and responsibilities of the ITG committee members • Objectively prioritize the projects and allocate the funds and resources accordingly • Make informed decisions by involving the key decision-makers, stakeholders, and SMEs	• If ITG were unable to prioritize the projects, the IT fund and resources could be spent on less urgent projects • If ITG were unable to secure the funds and resources, the projects would be kept on hold • If ITG were unable to effectively communicate to the stakeholders, the clarity in the IT decision making would be lost

Chapter 5 : Findings: IT Project Management Maturity and Project Performance in Centralized and Decentralized University

Introduction

This chapter expands on the body of knowledge on the IT project management methodologies used in universities, the level of It project management maturity in university, and the relationship between the IT project management maturity and the IT project performance in university. This chapter provides support for the second hypothesis, H2 on whether the IT project management maturity varies between the universities. This chapter also provides support for the third hypothesis, H3 on whether there is any relationship between the IT project management maturity and the project performance in university. This chapter analyzes nine IT projects from four nonprofit universities in the ten project management knowledge areas of PMBOK® (2013, p. 63). Based on the findings, the project management maturity of university's IT projects was evaluated using the CMMI model. Finally, it was analyzed whether there is any relationship between the IT project management maturity and the project performance in university's IT projects. Evidence from the cases was triangulated to support the existing knowledge in the IT project management in universities. Unique findings were analyzed and explained.

Project Management Practices on Nine Projects

This section explores the project management practices followed in nine IT projects from four universities. Project management practices are studied on ten project management knowledge areas of PMBOK® (2013).

Project Integration Management

Project integration management includes the processes and activities to identify, define and coordinate the management of a project, and it contains project charter and project management plan (PMBOK® (2013, p. 63).

Project Charter

The project charter was not formally created in the IT projects studied. The business was used in most of the projects. The business case was often an oral communication and did not always quantify the project benefits. The universities did not use a standard template of the business case. *"We need to get better in quantifying the business value-add of IT projects. We need to include the projected increase in use, cost savings, the number of colleges benefiting in our business case. There is no standard template for the business case."* (C4P1). An exception was found in the project in the university U3. All the IT projects in the university U3 which used the project charter template, created by the PMO. In the university U3, *"the project charter was created using PMBOK® standards"* (C8P3).

Table 5.1 Business case in university projects

University	Example
U1	C1: The Formal business case was not created. The CIO asked the project team to recommend an email system. The CIO orally emphasized on the feature limitations and the support challenges with the disparate email systems and wanted to choose a single, unified modern email system. C2, C3: The formal business case was not created. The cost of ownership of the existing IT system and the proposed system was compared. C4, C5, C6: A business case was created by the office of the controller, who was the project sponsor. The controller's office considered the payback period, the potential increase in revenue and operational efficiency.
U2	C7: The formal business case was not created. The college of business orally emphasized on the potential loss of two imminent research grants.
U3	C8: Used formal project charter using the template provided by the PMO.
U4	C9: It was primarily an oral discussion between the ITG committee members.

The business cases were used to justify the business need. The IT project sponsors often lacked the expertise in creating the business cases. The business cases created by the office of the controller in the university U1 better articulated the business value-add.

PMO Role

The projects in the university U1 were executed bypassing the PMO. The university U2 and U4 have not formed the PMO. The PMO in the university U3 consisted of three members and was short-handed. The PMO in the university U3 supported the university's IT projects by providing project guidance and project templates. The same set of project templates was used by all the IT projects in the university.

Table 5.2 PMO role in university projects

University	PMO	Example
U1	Bypassed PMO	C1: *"Email system was a technical project and the office of IT led it. The technical lead was managing the project. We did not approach the PMO"* (C1P3). C2, C3: The office of IT used its resources and fund, did not seek the PMO help. C3, C4, C5, C6: The office of Controller made the funds available, the Office of IT made the resources available, did not seek PMO help.
U2	The PMO was not formed	*"University is working on forming PMO, and defining its roles and responsibilities"* (C7P2).
U3	PMO role supportive	PMO provided project templates and guidelines. *"We have only three members in the PMO, we can only do so much"* (C8P3).
U4	No PMO	*"We are too small to create PMO"* (C8P1).

The PMO role in the university U3 was found to be supportive, as the PMO was limited to providing the project guidelines and templates (PMBOK®, 2013). The universities are yet to form PMO and yet to realize the value of the PMO. Because of the lack of PMO support, the university's IT projects lacked standards.

<u>Project Scope Management</u>

Plan Scope

The project scope defines the high-level project deliverables, project inclusion, and exclusion criteria, and is created using the input obtained from the project stakeholders, and the SMEs (PMBOK®, 2013, p. 105).

Table 5.3 Plan scope

University	Example
U1	C1: The project scope was discussed informally among the project team members. The project lead had a general idea of the scope, but it was not validated by the users. C2, C3: Specifications of the existing IT system were used as the scope. C4: The project scope did not include the additional integration needed for special groups of merchants, who required more stringent authorization and access. C5, C6: A formal scope was not created, and the end users were not involved during project scoping.
U2	C7: The product specification from RFI was used as the scope. *"Users were not involved during requirements gathering"* (C7P2)
U3	C7: Project charter included the scope and exclusion criteria. *"In the past, users would call and request for changes. PMO created a change control plan"* (C7P1).
U4	C8: Formal scope was not defined. The scope was discussed orally with the vendor.

The university's IT projects did not always create the project scope. In the procurement projects, the product specifications were used as a scope. The end users were not always informed of the project scope. The accepted set of deliverables was not always verified by the end users. The scope creep was found commonly in those projects.

Collect Requirements

Requirement documents are created to define the needs of the stakeholders, requirements could be prioritized, tracked, and controlled by instituting a change control process (PMBOK®, 2013, p. 106).

Table 5.4 Collect requirements

University	Example
U1	C1: Project lead was under the impression that the system met the user needs. The released system did not include the expected chat features. C2, C3: The new system was a replacement of an old system, and the project team was aware of the requirements. Requirement document was not created. C4, C5, C6: Requirements were defined by the business units sponsoring the project, but they were not validated by the end users.
U2	C7: Requirements were created from the product specifications provided by the vendor. Requirements were validated by some of the end users.
U3	C8: Requirements were created with the assistance of the vendor. The new system was a replacement of the old system, and the users validated the requirements.
U4	C9: Requirements were defined by the vendor and were validated by the users.

University's IT projects were not always designed by collecting the requirements of the end users. While the IT systems met the technical specifications, they did not always meet the business need of the users. An exception was found in the university U3. The university U3 with the assistance of the PMO established a formal requirements collection process by involving the end users. Use Case modeling is commonly used in the IT projects for collecting the requirements. A use case defines a scenario and a sequence of actions to illustrate the behavior of the users. (Rumbaugh, Jacobson et al., 1999). Use Cases find heavy use in IT projects because it captures user interaction with the system. The IT projects studied did not use the use case for the requirements design.

Create WBS

WBS is a pictorial elaboration of all the tasks in the project, and the tasks are sufficiently decomposed at the work package level, where duration and resource need could be estimated

(PMBOK®, 2013, p. 126). Tasks included in WBS are the only ones, which are within the scope of the project.

Table 5.5 Create WBS

University	**Example**
U1	C1, C2, C3, C4, C5, C6: WBS was not created. Project document included a list of high-level tasks. Tasks were not decomposed. Duration and resource were not assigned to the tasks. *"We met on every week and discussed what is left, and who will work on them"* (U1C1, P1).
U2	C7: WBS was not created. Vendor listed the tasks to configure the product. Time and resource were not assigned to these tasks.
U3	C8: PMO provided WBS template. It was a top-down WBS and did not include the input from the project team. "*Project team members did not agree to the hours allocated to the tasks"* (U3C8, P2).
U4	C9: WBS was not created.

The IT projects studied did not always create the WBS. These projects did not have an adequate information on the tasks completed, tasks remaining and overall schedule. The cost and resources were not assigned to the tasks. These projects lacked information on the actual cost and resource utilization. The university U3 with PMO put importance on creating. The WBS created in a top-down fashion without the input of the project team members, lacked commitment from the project team. The tasks were not formally documented in the WBS dictionary, and the tasks were not traceable.

Project Time Management

Project time management includes the processes required to complete the project on time. It includes project schedules, project activities, activity sequences, resource estimate, and activity duration (PMBOK®, 2013, p. 141). The project schedule is developed by sequencing the WBS tasks with precedence, dependency, leads, lags, cost, duration, and resources (PMBOK®, 2013, p. 141). The schedule is used to identify critical path(s), which is the longest path in the schedule with the shortest duration. The critical path in a project requires monitoring and controlling.

Table 5.6 Time management

Case	Example
C1	CIO wanted the new email system in less than two years. The project schedule was not formally developed. Poor time management caused project delay.
C2	The technical complexity of university specific customization need was not in the scope. Poor scope management and poor management of technical risk caused the delay.
C3	The schedule was not planned. The technical complexity of cross-platform support was not included in the scope. Poor scope management and poor management of technical risk caused the delay.
C4	The schedule was developed by the project manager. Some of the merchants were not notified of time about the custom integration need. Poor communication with stakeholders caused the delay.
C5 C6	Requirements gathered were incomplete. The custom coding took longer than expected. Poor scope management caused the delay.
C7	The technical complexity of custom integration was not included in the scope. The project took longer than planned. Poor scope management and technical issues caused the delay.
C8	Project resource had to work on an emergency task during the project execution. The project manager could not find a replacement. Poor resource management caused the delay.
C9	CIO wanted to have the system available for the next five months. The schedule was not developed. The project took all the time, as it could possibly take. Poor time management caused the delay.

The time delay was found commonly in the university's IT project. These IT projects did not have additional resources and funds, which could have been allocated to bring the project back on the schedule. Multiple conditions affected the time delay in the university IT projects. These conditions were found to be interdependent. Poor time management was found to be the root cause of time delay. Poor management of scope, risk, communication and stakeholder affected the project delay. In the case C1, and C9, the projects exhibited student syndrome from the perspective of Theory of Constraints (Goldratt, 1999). These projects took the maximum allowed time. The university's IT projects did not compute nor manage the critical path of the project.

Project Cost Management

Project cost management includes planning, estimating, and controlling project cost so that the project could be completed within the approved budget (PMBOK®, 2013, p. 193). It uses various estimates, which are analogous, parametric, bottom up, top down, three points, vendor bid analysis, and group decision making (PMBOK®, 2013, p. 194).

Table 5.7 Cost management

University	**Example**
U1	C1: *"We did not account for the cost of university's IT staff"* (C1P3). The product was free and the university did not have to purchase any additional hardware and software. C2, C3: The cost of the product and the professional service were included in the budget. The cost of the university's IT staff was not included in the budget. C4: Merchants did not bill the university for the integration work. The cost of university's IT staff was not included in the project. The cost of consulting services, hardware and infrastructure upgrade was budgeted. C5, C6: The cost of university's IT staff was not included in the budget. The cost of new hardware, infrastructure upgrade, and software license were included.
U2	C7: The cost of the product and professional service were included in the budget. The cost of university staff was not included in the budget.
U3	C8: The cost of vendor contract and the university's IT project staff were included in the project cost estimate.
U34	C9: The cost of vendor product and professional service were budgeted. The cost of the university staff working on the project was not in the budget.

The cost of university staff working on the project was not always accounted for in the project cost estimate. The university staff working on the project was considered free resource. This made the project cost estimation inaccurate. The university U3 created more accurate project cost estimate with the assistance of the PMO. The projects did not use Earned Value Management (EVM). "*We do not have expertise in earned value"* (C1P2). The variance of actual time and planned time, actual cost and planned cost were not analyzed. The IT projects in the universities did not forecast the total cost at completion and did not control the project cost using EVM. The IT projects in the university lacked information on the projected completion date and the projected cost.

Project Quality Management

Project quality management includes the plan to manage the quality of the project deliverables, assuring product quality and customer satisfaction, and controlling quality to ensure the expected standards (PMBOK®, 2013, p. 227).

Table 5.8 Quality management

University	Example
U1	C1: Project did not use quality management plan. The IT system was tested by the project team, not by the end users. Test script was not created. C2, C3: Business analysts in the project team were more familiar with the system requirements and tested the system. The vendor tested the technical integrations. C4, C5, C6: Project team members tested the system. The system was not verified and tested by the end users.
U2	C7: The system capacity was not tested and the system ran out of storage within the first three months.
U3	C8: The project manager assigned a tester to test the IT system. The tester created test scripts and benchmarked performance. The IT system was piloted and validated by the end users.
U4	C9: The vendor tested the IT system installed.

The vendor was found to take an active part in testing the It product for the projects which procured a vendor product. The business analysts, technical members often conducted the system testing. The test scripts created to test the IT system did not tie back to the requirements traceability matrix. The test results were not always reviewed with the stakeholders to ensure that they met their level of expectation. That caused a mismatch in user expectation. The university U3 assigned a dedicated tester, piloted the system and had the IT system validated by the end users.

Project Resource Management

Human resource management includes the plan to identify and document the roles and skills, acquire project team, develop project team and manage project team (PMBOK®, 2013, p. 256).

Project Manager Role

The roles of project managers assigned to the university's IT projects were studied.

Table 5.9 Project manager role

University	**Role**	**Time Spent on Project Management**	**Control on Resource and Fund**	**Example**
U1	Project lead, project coordinator	Part-time on all projects, but full-time in C4	Limited	C1, C2, C3, C5, C6: Business and technical experts from the decentralized units were assigned to manage the project. "*I am a technical person but got assigned to do project management work for this project. I do not have any formal training"* (C1P3). C4: A project manager was from the controller's office as the project required coordination with 120 merchants. "*Communication and stakeholder management were important in this project"* (C4P1).
U2	Project coordinator	Full-time	Limited	C7: A project manager was assigned from the office of IT. The vendor provided assistance in creating the project requirements and tasks.
U3	Project coordinator	Full-time	Limited	C8: A project manager was assigned from the office of IT, who had prior experience in managing multiple projects. The project manager was trained on project management methodologies.
U4	Project coordinator	Full-time	Limited	C9: The vendor managed the project and had expertise in managing similar projects.

The decentralized business units and colleges in the university U1 assigned a technical or a business lead to manage the IT project. The project management 'halo' effect was noticeable. An excellence in the business, or in technology did not translate into an excellence in the discipline of project management. These business and technical leads assigned to manage the project lacked the project management training and expertise. The role of a project manager is that of a project coordinator under the matrixed environment in the universities studied. The project manager did not have enough control over the resources and budget. The project manager assigned in the university U3 with PMO had higher project management training and expertise. This project manager was Project management professional (PMP), certified by Project Management Institute (PMI).

Project Team Composition

The composition of technical members in the projects was studied.

Table 5.10 Project team composition

University	**Example**
U1	C1: The office of IT led the implementation. The help desk staff was trained to support the new email system. C2, C3: The project team consisted of vendor representatives and the members from the office of IT. The project team provided the future support. C4: The project team consisted of the merchants and the team members from the office of IT. C5, C6: The project team consisted of the team members from the office of IT.
U2	C7: The project team consisted of the vendor and the members from the office of IT.
U3	C8: The project team consisted of the vendor and the members from the office of IT. The functional users were a part of the test team.
U4	C9: The project team consisted of the vendors and the members from the office of IT. The project team was responsible for the post-project product support.

The organization structure of the universities studied was matrixed. The project team members were acquired from the functional manager. The project manager was at the discretion of the functional managers to make the resources available. The project team was used for future maintenance and support. The universities studied did not have a university-wide resource plan. The university's IT projects lacked information on the university-wide skill and resource availability.

Project Communication Management

Project communications management involves timely and appropriate planning, creation, distribution, storage, and control of project information (PMBOK®, 2013, p. 287).

Table 5.11 Communications management

University	**Example**
U1	C1 through C6: The meeting agenda was not published, discussions were ad-hoc.
U2	C7: The college heads received weekly project update.
U3	C8: The project manager used project dashboard to communicate the project status to the university's senior leaders and the end-users.
U4	C9: The project status was communicated to the university's senior leaders and the end users.

The weekly project team meeting between the project team members was found common in all the projects studied. The oral communication within the project team was often misinterpreted between project team members, resulting in a misinterpretation of the requirements. The communication with the vendor was done in person, and via phone calls and emails. These projects did not use a formal communication plan to communicate with the project stakeholders.

The level of communication in the university's IT project was found inadequate. The project stakeholders did not receive the timely information and the IT system was not designed with adequate input from the stakeholders. These universities did not have a collaborative environment to store and share the project documents. The email and shared network drive were used to store and share the documents instead of a collaborative software. This made the document search, retrieval, and collaboration challenging. A poor communication affected all the knowledge areas of project management, particularly, the stakeholder management. The university U3 has exhibited a have a higher level of communication with the end users.

Project Risk Management

Project risk management includes the qualitative risk analysis, risk prioritization, quantitative risk analysis, and risk response plan (PMBOK®, 2013, p. 309).

Table 5.12 Risk management

University	Example
U1	C1: The risk management plan was not created. University's senior leaders were opposed to hosting the email in the cloud because of data security concerns. The project ran into the risk of further delay, as some users wanted the additional features (C1P2). C2, C3: The risk management plan was not created. The project risk was discussed orally among the project team members. *"We were at risk of losing the support, as the vendor would no longer support the old product"* (C2P1). C4: The risk was the driver for this project, which was the non-compliance with PCI DSS and the risk of losing the confidential data. The project manager created a risk checklist, but these risks were not prioritized, nor quantified. C5, C6: The risk of losing the revenue and the invoices was analyzed by the office of the controller.
U2	C7: Without HPC, the university was at a risk of losing two imminent research grants.
U3	C8: University did not have 24/7 support, audit capability, and the existing system was obsolete. *"We were at risk of losing support if we did not move to a new system"* (C8P2).
U4	C9: The students were at risk of not graduating on time because of incorrect degree counseling.

The risk was the driver for all the projects. The project sponsor emphasized on the risk of not doing the project. The risk was not quantified, and nor compared with the risks of other IT project requests. The checklist was the primary form of risk management. The project risks were not prioritized. The risks were accepted in the university's IT projects. The warranty was purchased with the vendor product to transfer the risk. The project management practices of maintaining the risk response plan, identification of new risks, and residual risks were not followed.

Project Procurement Management

Project procurement management involves purchasing products or services from outside sources. It includes a procurement plan, vendor selection, awarding the contract, managing procurement relationships, making a change to the contract, and closing the procurement (PMBOK®, 2013, p. 356).

Table 5.13 Procurement management

University	Example
U1	C1: Multiple products were compared and an open source email system was selected. A vendor bid was not conducted. C2, C3: Multiple products were evaluated. The product selected was the new product offering of the current vendor. Vendor bid was not conducted. The university purchased professional services, warranty, and support from the vendor. C4: Multiple vendors were evaluated to select a security audit firm to provide the security consulting service. The most qualified vendor was chosen, although it was not the least expensive one. C5, C6: The university could not find a product which was a custom fit for the project need. As such, the decision was made to build an IT system in-house.
U2	C7: Multiple vendor products were evaluated. The product chosen met the quality standards, but it was not the least expensive product. The professional services were purchased from the vendor.
U3	C8: The university had a choice of hosting the system in the cloud, or to continue hosting it on premise. The cost of ownership of both the options was analyzed and the decision was made in favor of cloud hosting because of better support, audit, scalability.
U4	C9: The university chose the product from the vendor with which it was conducting business. This product was found as the right business and technical fit.

The university’s IT projects conducted RFI, Request For Proposal (RFP) and bidders conference in selecting a vendor. The business and technical experts from the university took part in product selection. The university’s purchasing division assisted with the bidder conference, contract negotiation, and the final contract award. Any change in the contract and payments needed the approval from the purchasing division. The purchasing division worked with the university's legal division on contracts and proposals. The contracts typically included the professional service, warranty, and post-project maintenance support. The procurement of a new product took as long as a month to a year. The university's IT projects conducted build or buy analysis. The university's IT projects did not settle for the lowest bid, but found the product that offered the best value. Product quality, maintenance, support, business and technical fit and the total cost of ownership were considered in selecting the IT product.

Project Stakeholder Management

Project stakeholder management includes the identification of the people, groups, and organizations that could impact, or be impacted by the project, analyzing their interests, effectively engaging them, communicating in a timely manner, and managing their expectations (PMBOK®, 2013, p. 391).

Table 5.14 Stakeholder management

University	Example
U1	C1: The project did not have a stakeholder management plan in place. The majority of the users came to know about the system by word of mouth. C2, C3: The system was not designed with adequate input from the end users. C4: Students, faculty, administration, and 120 merchants were the project stakeholders. The user interface was designed by a technical team without adequate input from the end users. The users expressed dissatisfaction with the system workflow. C5, C6: The user interface was designed by the technical team without adequate input from the end users.
U2	C7: The technical team configured the system without obtaining adequate input from the users on data volume. The system ran out of space within the first three months.
U3	C8: The project manager obtained input from the stakeholders on the expected response time and system uptime. The system was designed with input from the end users.
U4	C9: The system was designed by the vendor with stakeholder involvement.

The universities studied had multiple groups of internal stakeholders, such as faculty, student and administrative staff. The needs and expectations of these stakeholders differed, so do their priorities. A project that benefited one group of stakeholders did not always benefit another group. These universities had an additional burden to satisfy the external stakeholders, such as alumni, and the community. Larger university U1 and U2 had a larger number of stakeholders and faced a higher challenge in managing their expectations. The IT project managers did not always effectively communicate the IT changes, project scope, and benefits to the stakeholders. A stakeholder matrix was not created to document the power and interest of the stakeholders.

Project Performance Matrices and Evaluation on Nine Projects

This chapter is a knowledge contribution to the quality of decision on the IT projects in nonprofit universities under centralized and decentralized ITG structure. This chapter analyzes nine cases from four nonprofit universities. The quality of decision on nine IT projects was studied in the following areas.

- To what extent the IT strategy and project objectives were met.
- To what extent the end users were satisfied.

Study IT Project Performance

Meeting Objective

- Alignment with strategy
- Risk management
- Value delivery
- Performance outcome

Meeting End User Expectation

- Adoption of new IT system
- Requirements missed
- IT system error
- User error

Figure 5.1 Study IT project performance in university

Meeting Objective

The purpose of the IT projects is to align the IT with the organization's strategic objectives, manage risk, realize the expected value, and meet the performance criteria (Weill & Ross, 2004a, ITGI, 2003, Creasey, 2008). This section studies how the nine projects met these objectives.

Case C1, University U1

Meeting objective in C1. The project objective was met by being able to consolidate the disparate emails into a single email. The new email system allowed uniform user experience, additional storage space, rich features, and mobile support. The old email systems did not have these features. The researcher analyzed that the cost of ownership of the new email system would break even with the old system in three years. This project improved the university-wide communication and supported the university's strategic objective of teaching, research and administration.

Table 5.15 Meeting objective in C1

Objective	**Example**
Strategic alignment	Supported the teaching, research, and administration.
Risk management	Reduced the risk of not being able to effectively communicate with the university community and the potential of security breaches with outdated email.
Value delivery	Consolidated into a single email system, and provided the advanced features using a free product. The level of support needed did not go up.
Performance outcome	The email usage increased from 4.2 to 5.2 emails/day/user. More than 1,000 meetings were scheduled in the first quarter. The users obtained a higher storage quota of 50 megabytes.

Failure to meet the objective in C1. Some of the influential faculty members were more familiar with a different email system than what was selected. They wanted the email system of their preference. A disagreement report was published to document it. The decision-making process lacked transparency, as the CIO unanimously decided to select the project. The new email system did not enable some of the features that the users were expecting. This project was delayed because of poor project management.

Case C2, University U1

Meeting objective in C2. The project objective was met by being able to continue supporting the ELMS, without disrupting the user experience. The support for the mobile device, higher availability and scalability were the added benefits.

Table 5.16 Meeting objective in C2

Objective	**Example**
Strategic alignment	Supported teaching.
Risk management	Avoided the risk of the loss of support for ELMS.
Value delivery	Provided business continuity and improved the quality of support without any substantial increase in the maintenance and support cost.
Performance outcome	The user could not find any difference in quality.

Failure to meet the objective in C2. The project took longer than planned because of poor project management. Some of the college courses had to wait until the next semester, as they were not migrated to ELMS on time. The response time of the new system was slower from some of the college campuses because of the limitations in bandwidth. The technical team increased the network capacity to address it.

Case C3, University U1

Meeting objective in C3. The project objective was met by being able to continue with SLMS, without affecting the user experience.

Table 5.17 Meeting objective in C3

Objective	**Example**
Strategic alignment	Supported teaching.
Risk management	Avoided the risk of loss of support for SLMS.
Value delivery	Provided business continuity at no extra cost and support, achieved a high level of the American Disability Act (ADA) compliance.
Performance outcome	The user did not see any difference, the usage increased from a little over 100 synchronous schedules a month to over 130 a month.

Failure to meet the objective in C3. The video chat was not properly streamed from some of the classrooms because of network bandwidth limitation. The project took longer than planned because of poor project management.

Case C4, University U1

Meeting objective in C4. The project objective was met by making the payment transactions PCI-DSS compliant for around 120 merchants. The university passed the security audit.

Table 5.18 Meeting objective in C4

Objective	**Example**
Strategic alignment	Supported administration.
Risk management	Reduced the risk of non-compliance with PCI-DSS, the potential of a lawsuit, confidential data loss, and loss of business with the merchants.
Value delivery	The system was well adopted. The new system processed over USD 10 million in payment card transaction in a year. This accounted for USD 2 million increase in payment using the new system. The university did not face any breach of data and did not receive any security complaint.
Performance outcome	Over 120 merchants reached compliance. The system was designed so that the new merchants could be added easily using a repeatable business model.

Failure to meet the objective in C4. The project took longer than planned because of poor project management. Two merchants did not have internal resources to reach the compliance standards and discontinued the business with the university. These were low volume merchants, and the university found another merchant to substitute the product offerings.

Case C5, University U1

Meeting objective in C5. The project objective was met by delivering a solution which stored and retrieved the research documents and integrated with invoice and billing IT system of the university.

Table 5.19 Meeting objective in C5

Objective	**Example**
Strategic alignment	Supported research by providing an efficient document stored system. Supported administration by integrating the research invoice with the university's billing system.
Risk management	Reduced the risk of loss of research data, unauthorized access and loss of research payment invoice.
Value delivery	No complaints were received on losing research invoice.
Performance outcome	Around 7,500 users were registered and over 65,000 research projects were stored.

Failure to meet the objective in C5. Some of the research documents were not configured properly and could not be found by the researchers. The project team fixed the issue with the correct configuration. The project schedule slipped because of poor project management.

Case C6, University U1

Meeting objective in C6. The project objective was met by standardizing the user experience for online purchase, improving billing process, and achieving a price discount through merchant rebate.

Table 5.20 Meeting objective in C6

Objective	Example
Strategic alignment	Supported students, faculty and administrative staff, who were making purchases online using the university's online product catalog.
Risk management	Reduced the risk of loss of payment receipts, non-payments and delay in payment.
Value delivery	Provided uniform user experience for online purchase, standardized the payment systems of over 120 merchants, automated the tracking of purchase and invoice, reduced staff count by one, and negotiated a rebate of 6% on each transaction from the merchant.
Performance outcome	The new system registered 15,000 more transactions than the old system in its first year.

Failure to meet the objective in C6. Some of the merchant products could not be found in the new system as they were registered. The development team fixed the issue. The project took longer than planned because of poor project management.

Case C7, University U2

Meeting objective in C7. The project objective was met by delivering a system that allowed data intensive medical, biological, scientific and engineering research within the university premise and offered a custom support to the university's researchers.

Table 5.21 Meeting objective in C7

Objective	Example
Strategic alignment	Supported research.
Risk management	The university was at a risk of losing two imminent contract grants, and the future ones requiring high-performance computing.
Value delivery	Secured two new research grants, university attracted new research staff, the system was customized to meet unique needs of the university researchers, and the research could be conducted within the campus.
Performance outcome	The system found high usage by multiple colleges.

Failure to meet the objective in C7. The storage, capacity, and demand were not well planned. The system ran out of storage space within the first three months. The project took longer than it was planned because of poor project management.

Case C8, University U3

Meeting objective in C8. The project objective was met by successfully hosting the system off-site, without disrupting the user experience.

Table 5.22 Meeting objective in C8

Objective	Example
Strategic alignment	Supported administration.
Risk Management	Reduced the risk of lack of 24/7 support, failing the audit, and technological obsolescence of proprietary IT system.
Value delivery	Reduced the support staff count by one, standardized the technology, the cost of ownership was predictable, and the disaster recovery was improved.
Performance outcome	The new system was tuned to be as performant as the old system. The end users did not find any difference in performance and throughput.

Failure to meet the objective in C8. The project missed the delivery deadline because a project resource was not available during the project execution. The project manager could not find a replacement for the resource.

Case C9, University U4

Meeting project objective in C9. The project objective was met by delivering a system that allowed the students and counselors to correctly know the courses left to graduate. This allowed the students effectively plan their degrees.

Table 5.23 Meeting objective in C9

Objective	**Example**
Strategic alignment	Supported administration and students.
Risk management	Reduced the risk of students not graduating on time, because of incorrect counseling.
Value delivery	The system provided an accurate and updated information on the degree plan. The students received proactive notification.
Performance outcome	No complaints were received for missing the graduation date.

Failure to meet project objective in C9. The Project start date was delayed because the resources were not available. This delayed the projected completion time of the project.

It was found that an IT project in the university may not meet all the strategic objectives of teaching, research and administration. The IT projects were executed to reduce the risk of the loss of support and to reduce the risk of the lack of compliance. The value add of university's IT project could be measured by cost savings, user adoption, an increase in usage, the cost of ownership, staff savings, time savings, and operational efficiency. The performance of university's IT projects could be measured by improvement in response time, and meeting the functional and technical expectations.

Adoption of New IT System

The adoption rate of the new IT system is a proxy of the end user satisfaction. The rate of adoption of the nine IT systems was studied.

Table 5.24 Adoption of new IT system

Case	**Adoption Rate %**	**Reason for high adoption**
C1	~95	The new email system was the only way to schedule meetings with all university users. The new users were added to the system in phases.
C2 C3	100	The new system was the only way to perform classroom teaching and synchronous scheduling. All the courses were converted to the new system.
C4	~95	The new system was the only choice to do business with the university. A higher number of transactions were processed using the new system.
C5	~95	Some of the researchers did not participate, as the system was not configured to support certain operational flows.
C6	100	The new system registered 15,000 more transactions than the old system in its first year.
C7	~90	Some of the users could not be added, as the system ran out of storage space.
C8	100	The new system was the only way to perform certain administrative functions.
C9	100	The new system provided accurate information. The alternative was a paper trail, which was error prone.

The new IT systems had a high adoption rate. This was also because the new system was the only way to conduct business. The alternative was not the preferred one. Some of the users chose to not use the new system, as the system did not meet their needs and expectations.

Number of Requirements Missed

After the IT systems were released to production, the users complained that the systems did not include some of the expected requirements. The requirements missed in nine projects were studied.

Table 5.25 Requirements missed

Case	**Example**
C1	It did not include advanced chat and was not certified for all the platforms.
C2	The new system was a replacement of the old system but hosted in the cloud. After the system was installed, faculty members asked for an advanced grading option.
C3	The new system was a replacement of the old system. The system was not configured for certain video formats, which some of the faculty members asked for.
C4	Some of the user profiles were not set in the right group. The user interface navigation did not allow easy retrieval of vendor list. Transaction log did not include the required information.
C5	Certain types of documents had issues in setting up retention policy and were not found while searching. Some of the research grants had a delay in updating the invoice system.
C6	Some of the user profiles were not set for self-service. A few merchant products were not listed. The billing report did not include required customer information and had an unusual delay.
C7	The system was not configured to store some of the document types.
C8	Batch reporting was not implemented to avoid further delay in the project.
C9	A few users from the counseling service wanted additional types of alerts. The system was not flexible enough to accommodate that level of customization.

IT System Error

IT system error is an unexpected error in the IT system, which may arise because of incorrect software coding, defects, and incorrect system configuration. System errors could be of the type system crash, unexpected error, incorrect result, memory leak, and security threats.

Table 5.26 IT system error

Case	Example
C1	The email system chosen was a mature product, already in use by other peer universities and organizations worldwide (C1P1). The system was robust.
C2	*"Vendor ELMS product selected was the right technical fit"* (C2P3). The system was not tested from all network zones and had slower performance in certain zones.
C3	The vendor was instrumental in configuring the system (C3P3). The system had unexpected unavailability because of the defects found in the new software release.
C4, C5, C6	These projects required heavy custom coding to develop a new user interface and integration with university's IT systems. These systems have shown higher system errors as system crash, slower than expected performance, and incorrect result display.
C7	Vendor product chosen was the best value product and was used by peer universities.
C8	The system was found robust and met the response time criteria.
C9	*"Vendor has done more than ten similar installations and provided a high quality of professional service"* (C9P1). The system was found robust.

End User Training

The universities studied made an effort to train the end users, before installing the new IT system. *"We did not want our help desk calls to go up. We are not in a position to hire additional staff to manage help desk. When we add new IT products to our base services, we consider the effect on help desk calls"* (C4P1). *"Training the end users has helped us address many of their questions.. We are able to support the help desk calls with our existing staff"* (C8P2).

Table 5.27 End user training

Case	Example
C1	The users were not trained. Many users were already using the email for personal use.
C2 C3	Training tutorial was provided to the end users. Because of a schedule conflict, some of the users from the office of administration could not receive the training.
C4	Entire university staff, students, and faculty were the users. It was not possible to train all of them (C4P2). Online training material was available on the university website.
C5	Training was provided to the faculty members and student researchers. The training was not comprehensive and did not include the new features, which were added later.
C6	Entire university staff, students, and faculty were the users and an online training was made available.
C7	Because of the schedule conflict, some of the users could not receive the training.
C8	The entire administrative staff was trained on the new system.
C9	The vendor provided the training and support documents to the university staff.

The university's help desk received calls from the users who did not know how to properly use the new IT system. These calls could have been reduced by providing adequate training to the end users. Universities find it challenging to train all the users of the new IT system. The IT projects with a limited number of users have received an instructor lead training. To keep the training cost low, the universities have followed the train the trainer approach. An individual from a team was trained, who in turn trained the other users in the team. An effort was made to train the help desk support staff on the new IT systems before they were released to the production.

Project Management Maturity Evaluation of Four Universities

This section analyzes the findings to support the second hypothesis, H2 on university's IT project management maturity. CMMI defines five levels of project management maturity. The level of maturity on nine IT projects in four universities was assessed using CMMI.

Table 5.28 Level one - Initial level of project maturity

Table legend: Y (Yes), N (No)

Criteria for Level One	**U1**	**U2**	**U3**	**U4**	**Example**
Ad hoc processes	Y	Y	N	Y	Universities lacked project management standards and templates. The exception was U3, where the PMO standardized the project management processes and created project templates.
Success depends on heroics, not the process	Y	Y	Y	Y	The project team members were committed to the success of the project and worked extra hours. The team members volunteered for the new tasks and learned new technology.
Over schedule	Y	Y	Y	Y	All the projects exceeded the planned schedule.
Meet objective	Y	Y	Y	Y	All the projects met the project objective by delivering the new IT system.

Table 5.29 Level two - Managed level of project management maturity

Table legend: L (Low), M (Medium), Y (Yes)

Criteria	**U1**	**U2**	**U3**	**U4**	**Example**
Project is planned and managed according to the plan	L	L	M	L	U1: Tasks were defined at a high level and assigned ad-hoc. U2: Tasks were defined, and assigned to individuals. U3: WBS and project schedule were created, resources were assigned to the WBS and the tasks were adjusted as the project progressed. U4: Tasks were created at a high level.
Skill and resource are adequate	L	M	M	M	The IT resources were not adequate, and no back-up was available. The IT systems developed in-house in U1 particularly lacked skilled resources.
Expectation of project stakeholder is managed	L	L	M	M	U1: Technical team decided on the feature set without consulting the end users. U2: Did not consult with end-users on storage need. U3, U4: The end users provided the business requirements.
Manage by milestone	Y	Y	Y	Y	Milestones were set for projects. At the end of each milestone, the system was not validated by the end users.
Project status is reported	L	M	M	M	Weekly status meeting within the project team. U1: Project status was not reported outside the project team. U2, U3, U4: Monthly status was sent to upper management.

Table 5.30 Level three - Defined level of project maturity

Table legend: N (No), M (Medium)

Criteria	**U1**	**U2**	**U3**	**U4**	**Example**
Project processes are defined	N	N	M	N	U3: The PMO set the project guidelines and standards and provided the project templates which were used across all the projects in the university. The processes were improved using the lessons learned from the prior projects. The PMO role was supportive.

Table 5.31 Level four - Quantitatively managed level of project maturity

Table legend: N (No), M (Medium)

Criteria	**U1**	**U2**	**U3**	**U4**	**Example**
Quantifiable measurable goals	N	N	M	N	The university's IT projects did not set an upfront service level agreement on the expected response time and throughput. U1: Network speed and capacity requirements were not established. ELMS response time was slow. U2, U4: Did not consult with the users on the expected response time. U3: Old system was benchmarked, and the new system was expected to meet those quality benchmarks.

Table 5.32 Level five - Optimized level of project maturity

Table legend: N (No)

Criteria	**U1**	**U2**	**U3**	**U4**	**Example**
Continuous improvement	N	N	N	N	The university's IT project team did not have the expertise to quantitatively analyze the common causes of project variation. The lessons learned were not often documented and not shared with the other project teams. The IT systems were not often benchmarked.

The project management maturity differed between the IT projects executed by the decentralized business units and the centralized IT. The IT project management maturity was found lower in the IT projects executed by the decentralized business units in the university U1. The IT project management maturity was found to be level 1, initial in the IT projects in the university U1. In the IT projects in the university U1, the role of the project manager was part-time, the project manager was a business or technical expert, and lacked the skill and expertise in project management.

The IT project management maturity was found higher in the IT projects executed by the centralized IT in the university U2 and U4. The project management maturity was found to be level 2, managed. In these projects, the role of project manager was full-time and the project manager had a higher level of project management experience and expertise. The IT project management maturity was found the highest in the IT projects executed by the centralized IT with PMO support in the university U3. The project management maturity in the university U3 reached the level 3, as the project processes were defined with the help of the PMO. The IT project in the university U3 also exhibited the level 4, quantitatively managed, as the IT benchmarks were established and measured. The IT projects studied did not meet the criteria of the highest level of maturity, the optimized level.

Data Coding and Analysis: Project Performance

This section analyzes the IT project performance in the university. The following are the indicators, which were used to analyze the project performance.

- Project delay. Project delay is a deviation from the planned schedule. A delay in a project is an opportunity cost and the users have to wait for the system. A delay in the ELMS project affected the students and faculty, as they had to wait until the next semester for the system to be functional. A delay in PCI-DSS was putting the university at a higher risk of potential breach of confidential data. The delays in the IT projects were analyzed in this research.
- Missing requirements. Missing requirements are the requirements and the features that the users were expecting in the IT system, but were not included in the IT system released to production. The user satisfaction is positively associated with the extent the IT system meets the user requirements (Robey & Farrow, 1982, Ives, Olson & Baroudi, 1983, Day, 2007). The number of requirements missed in the IT projects was analyzed in this research.
- System errors. System errors are the unexpected errors in the IT systems, system downtime, inaccurate result and slowness in response. User satisfaction is positively associated with the IT system being error free (Gelderman 2002, Zviran, Glezer & Avni, 2006, Kulkarni et al., 2006). The number of system errors in the IT projects was analyzed in this research.
- User errors. User errors are the errors made by the end users, as they did not know well how to use the IT system. User satisfaction is reduced if the users do not know how to use the system and make inadvertent errors in using the system (Guimares, Igbaria & Lu, 1992, Berglunda & Ludwiga, 2009, Mahmood, Burn, Gemoets & Jacquez, 2000). The number of user errors in the IT projects was analyzed in this research.

Project Delay

All the IT projects studied had a delay. The delay is analyzed in this section in the following areas.

- Time delay. It is the delay in the number of months. It is the difference in the number of months between the actual duration and the planned duration.
- Percentage delay. It is the delay as a percentage of planned duration.

  Percentage delay = ((Actual duration – Planned duration)/Planned duration)) x 100

The coding scheme on the conditions and outcome is shown below.

Conditions analyzed:

PMO{1}: PMO assisted with project, PMO{0}: No PMO assistance

ProjManagement{0}: Low project management maturity

ProjManagement{1}: High project management maturity

Communication{1}: High communication between project stakeholders

Communication{0}: Low communication between project stakeholders

Duration{2}: High planned duration

Duration{1}: Medium planned duration

Duration{0}: Low planned duration

Buy{1}: IT product procured, Buy{0}: IT system built in-house

Stakeholders{1}: High number of stakeholders

Stakeholders{0}: Low number of stakeholders

Validation{1}: High level of IT system validation

Validation{0}: Low level of IT system validation

Outcome analyzed:

Delay{1}: High delay in time, Delay{0}: Low delay in time

PercentDelay{1}: High percent delay, PercentDelay{0}: Low percent delay

ReqMissed{1}: High number of requirements missed

ReqMissed{0}: Low number of requirements missed

SystemError{1}: High number of system error

SystemError{0}: Low number of system error

UserError{1}: High number of user error

UserError{0}: Low number of user error

Time Delay

The following combinations have resulted in a higher time delay.

PMO{0} * ProjManagement {0} * Communication{0} * Duration{1} * Buy{1} * Stakeholders{0} (C1)

PMO{0} * ProjManagement {0} * Communication{1} * Duration{1} * Buy{1}* Stakeholders{0} (C3)

PMO{0} * ProjManagement {1} * Communication{0} * Duration{2} * Buy{0}* Stakeholders{1} (C4)

PMO{0} * ProjManagement {0} * Communication{0} * Duration{1}* Buy{0}* Stakeholders{0} (C5, C6)

Minimization of the above conditions has resulted in the following.

Communication{0} => Delay{1} (C1, C4, C5, C6)

Poor communication has resulted in a higher time delay. An exception was observed in the case C3, where even with a higher level of communication, there was a higher time delay. In the case C3, a resource was not available in the middle of the project. The project manager could not find a replacement.

Projects with a higher planned duration had a higher time delay.

Duration{1} + Duration{2} => Delay{1) (C1, C3, C4, C5, C6)

An exception was found in case 8, which had a higher planned duration, but had a lower time delay. This was because of a higher project management maturity in the case C8.

Percentage Delay

A poor project management has resulted in a higher percent of project delay in the case C2, C3 and C6.

ProjectManagement{0} * Duration{0}=> PercentDelay{1} (C2)

ProjectManagement{0} * Duration{1}=> PercentDelay{1} (C3, C6)

An exception was found in case C7, which had a higher project management expertise, but had a higher percent of delay.

ProjectManagement{1} * Duration{0}=> PercentDelay{1} (C7)

This could be attributed to the projects with a shorter planned duration. A higher percent delay was found in the projects with a shorter planned duration.

Duration{0} => PercentDelay{1} (C2, C7)

The planned duration in both C2 and C7 was three months. The case C3 took five months to complete and C7 took six months to complete. For all the projects studied, the shortest time a project took to complete was five months. The case C2 and C7 took as much time as it could possibly take, and exhibited the 'student syndrome'. For the case C2, *"the sponsor wanted to have the system by the end of the year, which gave us six months. The project ended up taking all the time it possibly could"* (U1C2, P3).

The case C4 with the longest planned duration did not result in a higher percent delay, as the project was better managed with the help of a full-time project manager.

ProjectManagement {1} * Duration {2} => PercentDelay{0} (C4)

Requirements Missed

The following configurations have resulted in a higher number of missed requirements.

PMO{0} * ProjManagement {1} * Communication{0} * Buy{0} * Validation{0} Stakeholders{1} (C4)

PMO{0} * ProjManagement {0} * Communication{0} * Buy{0} * Validation{0} * Stakeholders{0} (C5, C6)

Minimization of the above conditions has resulted in the following.

Communication{0} * Buy{0} * Validation{0}

In the case C4, C5, and C6, the software system was built in-house. The system was not designed with adequate input from the end users. The system was not comprehensively validated, and tested by the end users. The system delivered did not include all the features that the users expected. The project manager assigned to the case C4 had a full-time project management responsibility, but the project had a very large group of stakeholders, larger scope, and higher technical complexity. The case C4 received requirements from over 120 merchants. This project did not include all the requests from these groups. The IT systems not designed with adequate input from the end users had a higher number of missed requirements.

IT System Error

The following configurations have resulted in a higher number of IT system errors.

PMO{0} * ProjManagement {1} * Communication{0} * Buy{0} * Validation{0} Stakeholders{1} (C4)

PMO{0} * ProjManagement {0} * Communication{0} * Buy{0} * Validation{0} * Stakeholders{0} (C5, C6)

Minimization of the above conditions has resulted in the following.

Communication{0} * Buy{0} * Validation{0}

Poor communication and poor system validation have resulted in a higher number of system errors in the IT projects studied. The IT systems built in-house have exhibited a higher number of system errors. The IT systems built-in house in the case C4, C5 and C6 were not well tested. The IT products procured from the vendor were mature, tested and exhibited a lower number of system errors.

User Error

The following configurations have resulted in a higher number user error.

Communication{0} * Buy{0} * Training{0) (C4, C5, C6)

Communication{1} * Buy{1} * Training{0) (C7)

Minimization of conditions was done as the following.

Therefore, Training{0}

Poor user training has resulted in a higher number of user error. A higher number of help desk calls were received on the IT systems on which the users did not receive an adequate training.

Data Coding and Analysis: Project Management Maturity and Project Performance

The relationship between the IT project management maturity and project performance was studied in this section. This section supports the third hypothesis, H3 on whether there is any relationship between the IT project management maturity and IT project performance in university.

A higher level of project management maturity was found in following cases.

ProjManagement {1} (C4, C7, C8, C9)

The highest level of project management maturity was found in the case C8, which obtained the PMO assistance.

PMO{1} * ProjManagement {1} (C8)

A lower level of project management maturity was found in the following cases.

ProjManagement {0} (C1, C2, C4, C5, C6)

A higher time delay was found in the following cases.

ProjManagement{0} => Delay{1} (C1, C3, C5, C6}

A higher number of missed requirements and IT system errors were found in the following cases.

ProjManagement{0} => ReqMissed{1} (C5, C6}

ProjManagement{0} => SysError{1} (C5, C6}

The cases with low project management maturity have exhibited a higher time delay, a higher number of missed requirements missed, and a higher number of IT system errors. It was also found that the C5 and C6 had poor communication with the stakeholders, and they did not receive any support from the PMO. The lack of PMO support, poor project management maturity, and lack of communication resulted in poor project performance in the case C5 and C6.

PMO{0} * ProjManagement{0} * Communication{0}

=> Delay{1}, ReqMissed{1}, SysError{1} (C5, C6)

Project Management Maturity in U1 and Project Performance

The IT projects studied in the university U1 were executed by the decentralized business units. The project management maturity of these projects was found to be level 1, initial. The project management processes were ad-hoc. The project manager assigned was a business lead, or technical lead, not a project expert. The project management expertise and experience of the individual assigned to manage the project was as low as six months. The project management role was part-time. These projects did not seek any help from the PMO. These projects had a higher delay and a higher number of missed requirements and IT system error.

PMO{0}*ProjManagement {0} => Delay{1}, ReqMissed{1}, SysError{1} (C5, C6)

Project Management Maturity in U2, U4 and Project Performance

The IT project in U2 and U4 was executed by the central IT. The project management maturity was found higher for these projects. A full-time project manager was assigned. The project manager had a higher number of years of experience in project management. The vendor provided additional assistance in managing the project deliverables. These projects did not avail any support from the PMO. Basic project management standards were followed and the project management exhibited level 2, managed maturity. The IT project executed in U2 and U4 had a lower schedule slip, less number of requirement misses, a less number of system error.

PMO{0}* ProjManagement {1} => Delay{0}, ReqMissed{0}, SysError{0} (C7, C9)

Project Management Maturity in U3 and Project Performance

The IT project in U3 was executed by the central IT with PMO support. The level of project management maturity was the highest, level 3, defined and also exhibited level 4, quantitatively managed. A full-time project manager was assigned. The project manager had five years of project management expertise and a PMP certified by PMI. The project management processes were standardized by the PMO, the project processes were defined. The IT system was benchmarked by setting the Service Level Agreements (SLA) on the response the time, throughput rate and system downtimes.

PMO{1}* ProjManagement {1} => Delay{0}, ReqMissed{0}, SysError{0} (C8)

The case C8 had the lowest percentage of delay. This research found evidence to support the third hypothesis, H3. The IT project management maturity has a positive association with the IT project performance in university. A higher level of project management maturity leads to a lower schedule slip, better meets the user requirements and has a lower IT system error.

Observations and Discussion

This section covers the observations made in the IT project management on nine projects during the case study.

Higher Institutional Support for Enterprise IT Project

This research found that a higher level of institutional support was obtained for the IT projects that affected the university's enterprise IT system. The IT project studied in the university U3 required hosting the university's Enterprise Resource Planning (ERP) system in the cloud using a shared processing model. If the system were not properly configured, it would have affected the university's day to day business. This project obtained a higher level of support and attention from the university's IT division and the senior leaders.

The university U3 used the ERP system for student registration, and administrative record keeping. This system was used to store the data on the admission, registration, and payroll. The system was hosted on outdated servers, which lacked the necessary support, performance, and capacity. The university had a limited IT skill to upgrade and maintain these servers. The university hired consultants to support this system, and their billing rate was four times higher than the median hourly rate of university's IT employee (U3P4). These proprietary servers were reaching the end of life. The university had to make a decision on whether to upgrade the on-site servers and renew the contract with the existing vendor or to outsource the upgrade and support (P4). The university decided to outsource the ongoing upgrade and support. The new vendor hosted the system in the cloud, as the cloud solution offered a higher level of support and disaster recovery and higher capability to meet the increase in demand (U3P2).

This IT project obtained a higher level of support from the ITG committee members and the stakeholders. University's ITG established a high priority for this project, which helped in obtaining the necessary IT resources needed for the project (U3P1). A full-time project manager was assigned from the central IT. The PMO provided support with the project management documents and templates. The project team included an analyst from the university's administration, who provided the business requirements. The users of the existing on-site system were assigned to validate the IT system hosted in the cloud. University's office of IT provided a resource for data migration, software customization, network upgrade and remote access. The vendor provided support with the specialized server, network and software configuration. The project budget and time were allocated to train the end users. All the users were required to be trained on the new IT system.

Higher Urgency for Operational Project than Strategic Project

The IT projects studied could be broadly categorized into operational, and strategic. The operational projects have found higher urgency than the strategic projects. The characteristics of these two categories are as follows.

- Operational. The IT projects that are operational in nature keep the university running by providing the essential IT services.
- Strategic. The IT projects that are strategic in nature align the university with its long-term goals, provide a competitive advantage and position the university for the future.

Table 5.33 Category of IT projects

Case	Category	Explanation of Categorization
C1	Strategic	Bring all the university users under a single email system.
C2	Operational	Affects university operations on online and on-site teaching and learning.
C3	Operational	Affects university operations on synchronous teaching and learning.
C4	Operational	The university's daily operation was at risk because of the lack of compliance with payment card transactions.
C5	Strategic	Position the university to support advanced research.
C6	Strategic	Bring all vendors under a single payment portal.
C7	Strategic	Position the university to support advanced research.
C8	Operational	The loss of support for daily operations on administrative functions.
C9	Strategic	Position the university to provide better counseling to students.

This research found that the universities assigned a higher level of urgency on the operational projects than on strategic projects. The case C2, C3, C4, and C8 were operational in nature and they were executed without any further delay. The project budget for the case C4 was USD 1.3 million. This project got started with a phased approach, even though the full fund was not yet available. The strategic projects were kept on hold till it was made a priority by a key university leader. The email unification project, in the case C1, was attempted twice before, but it finally got approved as the CIO made it a priority. The case C9 was attempted twice before, but each time it was assigned a lower priority. The vendor finally provided a discount and the university agreed to execute the project.

Better IT Support with Cloud Hosting

Out of the projects studied, two IT systems were hosted in off-site in the cloud, and the rest was hosted on-site. The cloud hosting environment offered the universities a shareable resource pool, without incurring upfront cost of setting up an equivalent high-end IT infrastructure on-site.

Table 5.34 Hosting of IT system

Case	Hosting	Example
C1	On-site	The university chose to host the email system on-site because of better security access control of the email data. *"Some of our senior university leaders were not comfortable to host it in the cloud"* (C1P1).
C2	Cloud	The university chose the off-site solution, as the vendor was stopping the support for the on-site version of the product. The off-site solution lacked some of the requested features and needed additional customization.
C3 C4 C5 C6	On-site	These new IT systems were an add-on to the existing IT product stack, which was hosted on-site. "U*niversity already had the support and infrastructure in place, and there was no need to look for an off-site solution"* (C3P2).
C7	On-site	The on-site solution provided a better custom fit. "*Researchers had a concern about security and data access for the off-site solution"* (U2C7, P1)
C8	Cloud	The off-site solution provided better support and audit. "*We tested and tuned the system to make sure that the user experience and response time of the off-site system is equivalent to the current on-site offering"* (C8P3).
C9	On-site	The new system was an add-on to the existing IT system, which was hosted on-site. As such, there was no reason to look for an off-site solution.

Table 5.35 Comparison of on-site and off-site hosting of IT system

Criteria	On-Site Hosting	Off-Site Cloud Hosting
Increase in demand	Unable to match the increase in demand. The server capacity was limited because of the budget. In C7, the on-site server exceeded its capacity in three months.	Designed to handle the increase in demand, without degrading the service quality. In C8, the off-site solution was as performant as the prior on-site system.
Data security	Greater control and security of data were the primary reasons to host the email system on-site (U1C1, P2).	The university was subject to the security standards set by the off-site hosting system.
Custom fit and support	Higher custom fit. In C7, the HPC was customized to fit the unique need for the university researchers. University's help desk support team was trained on the product to provide custom support.	Lower custom fit. In C2, the generic off-site version of ELMS did not fit university need, and it needed to be customized. Hosting company provided generic help desk support, without intimate knowledge of the university's unique IT environment.
Disaster recovery	Lower support for disaster recovery, as the university could not purchase additional servers for back-up, and recovery (U2C7, P2).	Higher support for disaster recovery and redundancy (U1C2, U3C8).
Cost	Part of the yearly operational cost.	The cost was comparable, but allowed the discount opportunity based on usage.

The universities studied showed a preference in hosting the system on-site if they had a choice. The security of data, better access control, and custom user experience favored hosting the system on-site. The existing hardware and facility were repurposed to host the system on-site. The off-site hosting solution was chosen when the university had a limited choice to continue hosting the IT system on-site. A known cost model of ownership, better support with an increase in demand, and disaster recovery were the advantages of hosting an IT system off-site. The users of the IT system did not know the difference on whether the system was hosted on-site, or off-site. The universities studied made it imperative that the business continuity and user experience were seamless, irrespective of the hosting location.

Better IT Quality with Procured Product

The IT projects studied have shown a preference towards building an IT system in-house, if the resource and skill were available. A comparable procured IT product could cost university considerably more, without considering the yearly license cost (U1C4, P1). The IT systems in the case C4, C5, and C6 were built in-house. The rest of the cases procured an IT product from a vendor.

Table 5.36 Comparison of build versus buy

Criteria	**Build**	**Buy**
Custom fit	The user interface and workflow were a custom fit to the university's need in C4. C5, and C6.	Low custom fit, same IT product was used by multiple clients. The procured SLMS did not have certain features.
Technical fit	The technical fit was high, as the system was built using the technology available to the university.	The technical fit was high, as the university procured the IT products that fit the university's technical architecture and infrastructure. The procured products in SLMS, HPC, and Degree Plan project were found a technical fit.
Time to develop	Development time needed to be considered.	The product was readily available but required custom integration. The time to procure needed to be considered.
Quality	The quality of the built system was found to be lower. The IT systems built reported a higher number of system errors and requirement misses.	Reported a lower number of system errors and requirement misses. *"The product demo helped us ensure that the procured product included meets our requirements"* (U2C7, P2).

The procured IT product has shown better IT quality than the IT system built in-house. Procured products have resulted in less system error. This is because the product has gone through the university's evaluation process and was found to be the right business and technical fit. In many cases, the procured IT product was already in use by other organizations, and the majority of the defects had been fixed. Vendor provided professional service and assistance to ensure the expected quality of the procured product. The IT systems requiring custom software development have shown higher system errors. Poor project management, limited IT skills, and poor quality control has affected the quality of the IT system built in-house.

Summary and Conclusions

This chapter analyzes the findings to support the second hypothesis, H2, and the third hypothesis, H3. The IT project management maturity varied between the IT projects studied. The IT projects executed by the decentralized units by a part-time project manager with a lower project management expertise have shown a lower project management maturity, as low as level 1, initial. The IT projects executed by the centralized IT with a full-time project manager with higher project management expertise have exhibited a higher management maturity of level 2, defined. IT project executed by the centralized IT with PMO assistance has exhibited the highest project management maturity of level 3, defined and to some extent level 4, quantitatively managed. This research found that the IT project in the university with a higher project management maturity exhibits a better project performance. The IT projects in the university with a higher project management maturity exhibited less project delay and a better IT quality. These IT systems had less number of requirements misses and the IT system errors.

Table 5.37 SWOT: University’s IT project management

<table>
<tr>
<td>Strengths
Increased awareness of project management
The project had a sponsor
Best value model for procurement
Alternative analysis
Well written contracts
Vendor skill was utilized
Employees were engaged, eager to learn and accept new challenges
User training and help desk staff training were considered
Post-project maintenance was planned</td>
<td>Weaknesses
Project management was a part-time responsibility
PMO presence was weak to non-existent
Lack training and expertise in project management
Time slips were common
The cost of internal resources was not tracked, the budget was inaccurate
Scope creep, requirements were not met
Stakeholders were uninformed, not engaged, and showed dissatisfaction with the IT system
Project management maturity was low</td>
</tr>
<tr>
<td>Opportunities
Implement PMO to standardize project management practices
Train employees on project management
Engage stakeholders
Improve internal and external communication
Quantify project benefits, measure project success and continually improve</td>
<td>Threats
An IT system designed without input from end users fell short of meeting the user needs
The university had different groups of stakeholders, whose priorities varied
End user satisfaction was not surveyed
Project performance was not benchmarked</td>
</tr>
</table>

Chapter 6 : Conclusion

The existing literature does not have a sufficient coverage of the IT project selection in the nonprofit universities, IT project management, and the project performance. This research studied nine IT projects from four nonprofit universities in the USA. The objectives of this research were met by exploring the ITG structure in nonprofit university, the IT project selection process, the IT project management maturity, and the project performance. The research findings were discussed in chapter four and five of this dissertation. The research findings were interpreted by coding the raw data into coded value using QCA. These findings were supported by the artifacts gathered from the interviews and the project documents.

Major Findings

The major findings from this research are discussed in this section.

Improving IT Decision Making in University

This research found that the quality of IT decision in nonprofit university could be improved if the IT decisions were made in a centralized manner by involving the key project stakeholders, and the university leaders. The IT decisions made in a centralized manner were more informed ones. These decisions considered university-wide IT needs, not just the IT need for a single business unit, or a college. These IT project requests tended to align better with the university's strategic need. The IT council committee in a centralized university played a critical role in obtaining the support and fund for an IT project. The centralized decision making exhibited a higher authority in decision making. The roles of responsibilities of the IT committee members were better defined. The IT committee members meet more frequently and the committee members had a higher awareness of the university-wide IT needs. Under the centralized decision making, the business units and colleges brought the IT requests to the ITG committees, which prioritized the IT requests, allocated funds, and resources. ITG was found to be less authoritative in a large, decentralized university. The decentralized units in a large university were influential and they executed the IT projects using their own funds and resources, without bringing the IT request to the attention of ITG. These IT projects meet the project objective but did not always take university-wide IT needs into consideration.

The university U3 and U4 exhibited centralized IT decision making. The ITG committees in these two universities reviewed the university-wide IT project requests and prioritized them based on the university-wide IT need. The key stakeholders were involved in decision making and the project had their buy-in. On the other hand, the ITG committee members in the university U1 lacked information on the IT projects executed by the decentralized business units.

Improving IT Project Management Maturity in University

This research found that the IT project management maturity in the university could be improved by following project management methodology, assigning a full-time project manager with project management expertise and by setting project management standards with the assistance of the PMO. The IT projects with a higher project management maturity have shown a better project performance, lower schedule slips, less number of requirements missed, and less IT system errors. This research found that training the IT project manager in project management methodology would increase university's IT project management maturity. The IT project, which had the highest level of project management maturity was managed by a project manager who was PMP certified. "*When more than one-third of their project managers is PMP-certified, organizations complete more of their projects on time, on budget and meeting original goals.*" (PMI, 2015)

The IT projects executed by the centralized IT have exhibited a higher project management maturity and a better project performance. The IT projects studied were executed in a matrixed environment and the project manager had a limited control over the budget and resources. A project schedule slip is common. The IT projects executed by the centralized IT with a higher project management maturity have exhibited a shorter schedule slip. The university's IT project that sought the help of the PMO used the standardized project templates and guidelines.

The IT project in U3 was managed by central IT with the assistance of the PMO assistance. In this university, the IT project management practices were standardized by the PMO. The project manager had a higher expertise in project management and was a certified project management professional. This project exhibited a higher level of maturity and had a better project performance, compared to the other IT projects studied.

Stakeholder Management Need

This research found that stakeholder management was of high importance in reaching a consensus in the IT decision making and in meeting the expectations of the stakeholders. This research found that centralized university better managed the expectations of the university's IT stakeholders. IT projects executed by the centralized IT obtained a higher support from the broader university community. The centralized decision making involved the key stakeholders in the IT decision making. In the centralized university, the IT decision-making roles and responsibilities were enforced, and the decisions are made in an informed manner with higher clarity by obtaining necessary input from the SMEs from the business and technology domains. The IT projects executed by the centralized IT have shown a higher level of engagement of the end users. These IT systems were designed with a higher level of input from the end users, and the IT system was validated by the end users, before releasing it to production. These IT systems, which were designed with necessary input from the stakeholders have shown a fewer requirement misses and less IT system errors.

The universities studied faced challenges in managing its IT stakeholders. The universities had to manage a diverse group of IT stakeholders, such as faculty, student, and administration. The IT needs and priorities, the influence and impact of these stakeholders varied. The influential stakeholders who affected the IT decision might not be the active users of the IT system. The users of IT system who had the highest impact might not have had the highest influence. University's IT stakeholders needed to be kept satisfied, managed, informed and monitored.

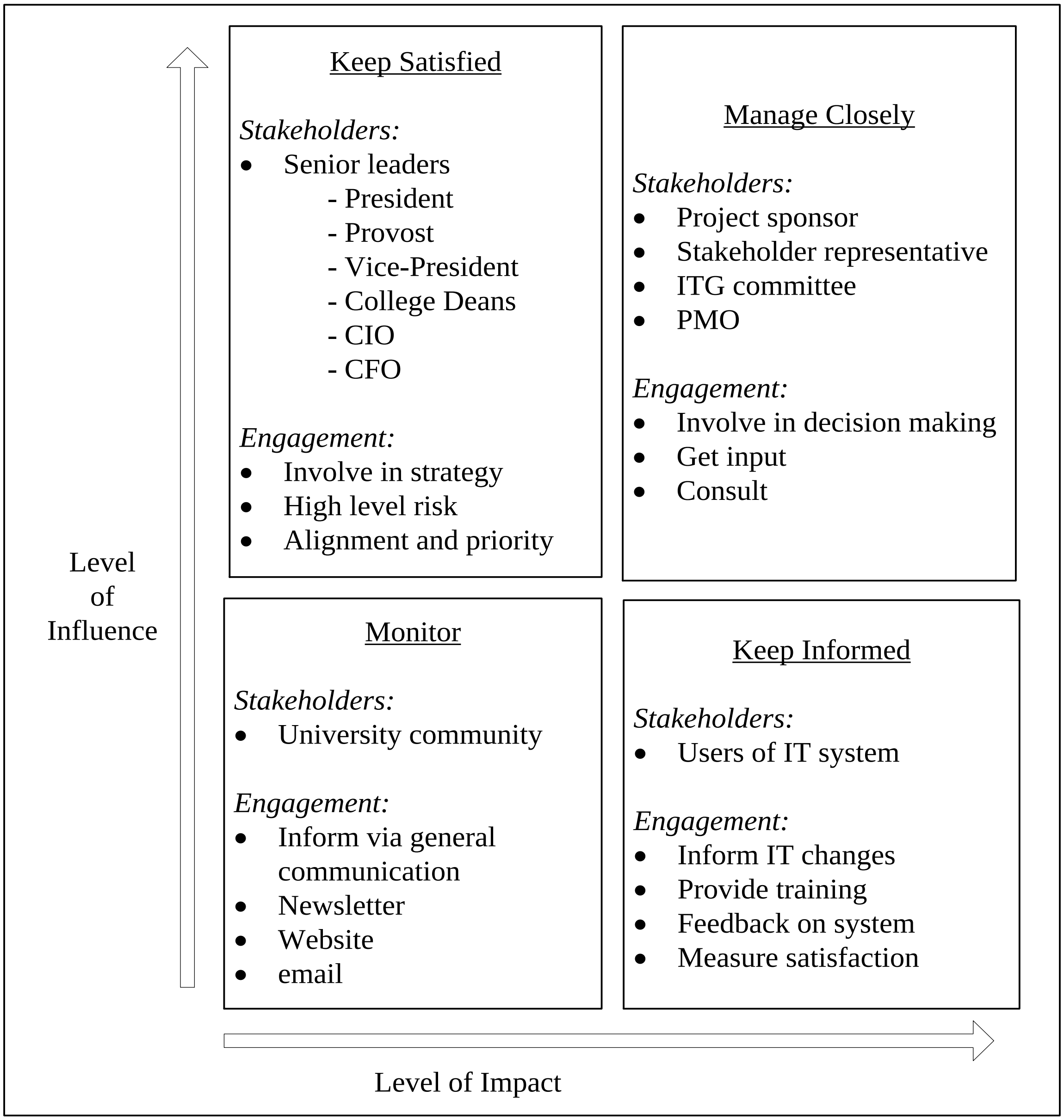

Figure 6.1 IT stakeholder management need in university

The IT projects studied faced a challenge in managing the change requests from the stakeholders. These IT projects did not use a formal process to manage the change requests from the users. The change requests were informal, often a word of the mouth. These requests were not always prioritized. The inclusion of the ad hoc requests has resulted in a scope creep and project delay. The success of the IT system depended on the quality of business analysis, and the comprehensiveness of the requirements gathered from the end users. Engagement of the stakeholders during requirements gathering and project lifecycle through verification and testing were found to improve the project performance. The university's IT projects designed with input from the end users have better met the user need in case C8. In the case C8, the requirements were gathered from the end users and were prioritized because *"it is not possible to give the users everything they asked for within the project deadline"* (C8P1). In the case C8, the IT system was validated by the end users, before it was released to the production.

Communication Need

This research found that communicating is of high importance in IT decision making and IT project management in the university. This research found that the centralized university had a higher level of communication between the ITG committee members. The communication protocol was established and the frequency of ITG communication was higher in the centralized university. In the centralized university, the university leaders and the ITG committee members received information on the project progress, issues and risks; meeting agenda, meeting minutes and IT decisions were better communicated to the ITG members and interested parties, and meeting information was made available via project dashboard and university newsletter. A voting was conducted on the IT decision to enforce accountability in the centralized university U3. The IT end users in the centralized university were better informed on the project scope and set their expectations accordingly. A Higher level of IT communication increased the clarity in IT decision making in the centralized university.

It was found that the IT project communication in the university needed to address the varying communication needs of the university’s IT stakeholders. The university’s IT projects required upward communication to the ITG committees, CIOs, PMO through the use of dashboard and high-level project progress. The IT project issues and risks were brought to the attention of the university leaders in this upward communication. The downward communication was provided to the IT end users on the project scope and expectations. The need for user acceptance testing and training were communicated to the user users. The lateral communication happened within the project team members and the IT vendors. The lateral communication was the weekly team meetings, emails, phone calls and personal interactions.

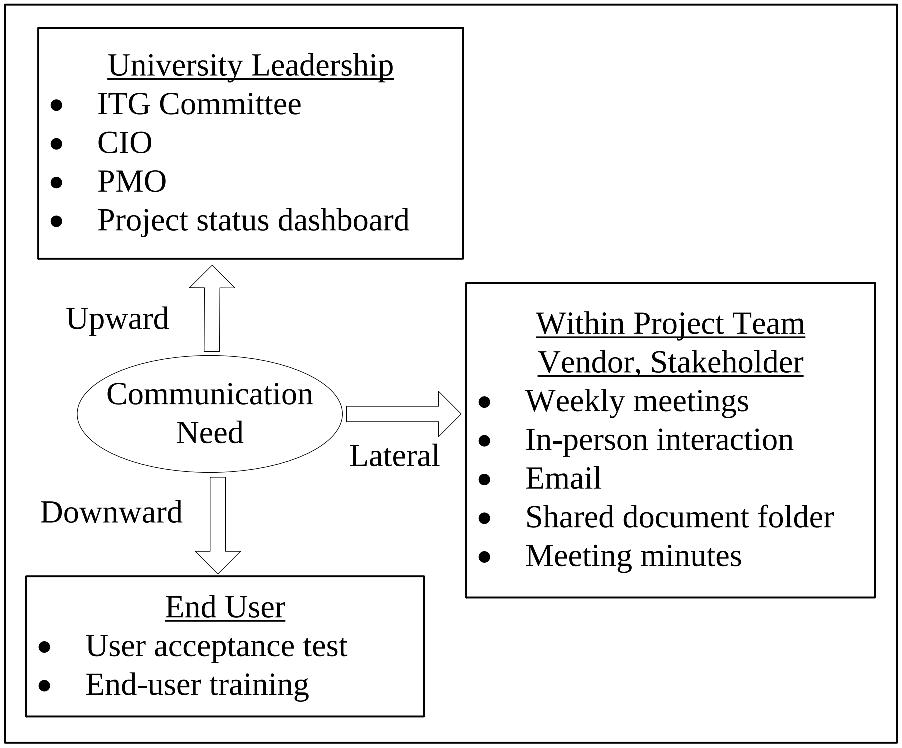

Figure 6.2 IT communication need in university

Managerial Implications

The findings from this research could help the university leaders make strategic IT decisions, and IT project decisions. This research has managerial contributions in the three broad areas.

- ITG structure. Findings from this research could help the university leaders make decisions on how to structure ITG committees, how to centralize IT decision making, and how to set stakeholder management and communication standards. The ITG committee structure could comprise of the teaching committee, research committee, administrative committee and the core IT committee with some variations, depending on whether the university has a teaching or a research focus. The cross-sectional committee, IT council, formed of the representatives from all the colleges and the business units was found instrumental in obtaining a buy-in in the IT decision making.

- IT decision making. Findings from this research could help the university leaders in making decisions on how to select and prioritize the IT project requests objectively, how to make an informed IT decision, and how to engage the key stakeholders in IT decision making. The university-wide IT project requests could be brought to the attention of the ITG committees, instead of making the IT decisions within a silo, in a decentralized manner. That would increase the awareness of university-wide IT needs. IT projects could be prioritized based on the strategic need of the university, not that of a single decentralized unit.

- IT project management and project performance. Findings from this research could help the university's project managers improve the IT project management maturity. By following the project management standards, establishing the PMO, and by training the project managers on the project management methodology could increase university's IT project management maturity. A higher IT project management maturity would help reduce the number of requirements missed, the number of IT system errors and the number of user errors, and will increase the IT end user satisfaction.

Findings from this research could help the university's CIO, senior leaders, IT managers and IT with the IT decision-making and the IT project management.

Limitations and Further Studies

Forty-seven nonprofit universities in the USA were contacted to participate in this research. Only four universities followed through and agreed to participate in this research. As such, the data available were limited. The data collected on the nine cases from the four universities were found adequate to support the research hypothesis. A theory saturation was reached from the nine cases to support the research hypotheses. The future cases studied replicated the findings from the previous research and augmented the theory. A theoretical sampling of four to eight cases could be sufficient to triangulate the evidence in the case study research (Eisenhardt, 1989, Harris & Sutton, 1986). A total of nine cases was studied in this research, using which theory saturation was reached. The nine cases studied had enough variations and were adequate for multi-value QCA (Rihoux & Ragin, 2009).

The case study participants were more interested in showcasing the success of the project. To safeguard against it, the data were collected from multiple sources of evidence by using multiple collection methods, documents, help desk calls, and by interviewing multiple participants in each case. This approach of data collection from multiple sources ensured the validity in case study research (Tellis, 1997), and allowed triangulation of evidence from multiple sources (Eisenhardt, 1989, Yin, 2009).

A future research could be conducted on how to apply the governance to the shared IT services between multiple universities under the state system. There are multiple state universities, under the same state system in the USA. The vision, strategic objective, the size and the IT needs of these universities vary, even though they are under the same state university system. It could be studied how the governance could be enforced between multiple universities to share the IT services, reduce the duplication of IT effort and cut IT cost across the university system. As the cloud services become more abundant, mature and secure, university's focus would also shift towards shared services (Yanosky, 2010).

A future research can be conducted on how to apply governance to the IT fund allocation between multiple universities in the state system. This research found that the IT challenges of the smaller universities are similar to that of the larger universities. The smaller universities faced similar challenges with classroom technology, administrative IT, security, data protection, network, server, software, and system integration. Even though the number of users in the small university was less than that of the larger universities, the smaller universities had to solve the similar technical challenge, as its larger counterpart. The technical solutions sought to address these challenges do not cost any less, as because the university was smaller. The IT fund in smaller university was less than that of the larger university. Future research could be conducted on how to apply the governance on IT fund allocation between different universities under the state system.

A future research could be conducted on how to apply the governance on distance education and Massive Online University (MOU). The MOU requires sharing academic and research resources and data among multiple locations and users. The information is retrieved using a variety of devices, including desktop computers and mobile devices. A future research could be conducted on how to apply the governance policy on data ownership and sharing. The IT director of Princeton University voiced this concern because the universities are now drowning in data and it would require the governance around the data, usage, privacy, and retention policies (Secodant and Montesquieu, 2008).

Appendix A. ITG Implementation in Nonprofit Universities in the USA

US State	University	Source on ITG (Accessed on September, 2014)
Alabama	University of Alabama, Tuscaloosa	http://oit.ua.edu/oit/about/it-governance/
Alaska	University of Alaska, Anchorage	http://www.uaa.alaska.edu/informationtechnologyservices/about/governance.cfm
Arizona	University of Arizona	http://cio.arizona.edu/it-project/it-governance
	Arizona State University	
Arkansas	University of Arkansas, Little Rock	http://ualr.edu/itservices/tag/governance/
California	University of California, Berkeley	http://technology.berkeley.edu/governance
	University of California, Santa Cruz	http://its.ucsc.edu/governance/
	University of California, Los Angeles	https://oit.ucla.edu/governance
Colorado	Colorado State University, Fort Collins	http://www.acns.colostate.edu/Policies/ITGovernance
	University of Colorado, Boulder	http://www.colorado.edu/avcit/governance
Connecticut	University of Connecticut, Storrs	http://itp.uconn.edu/
Florida	University of Florida, Gainesville	http://www.it.ufl.edu/governance/
	Florida State University, Tallahassee	http://its.fsu.edu/IT-Professionals/Governance
Georgia	University of Georgia, Athens	http://www.usg.edu/information_technology_handbook/section1/tech/1.2_governance_structure

Hawaii	University of Hawaii, Manoa	http://gbr.pepperdine.edu/2010/08/the-it-governance-road-map/
Illinois	University of Illinois, Urbana-Champaign	https://www.cio.illinois.edu/IT_governance
Indiana	Purdue University	http://www.purdue.edu/cio/sgc.html
Iowa	University of Iowa, Iowa City	
Kentucky	Northern Kentucky University, Highland Heights	http://oit.nku.edu/governance.html
Maine	University of Maine, Orono	http://umaine.edu/it/files/IT_Strategic_Plan_051012.pdf
Maryland	University of Maryland, College Park	http://www.it.umd.edu/ITstrategy/plan/9_IT_governance.html
Maryland	Loyola University	http://www.loyola.edu/department/cio/itgovernance
Massachusetts	University of Massachusetts, Amherst	https://polsci.umass.edu/research/research_cluster/information_technologies_politics_and_governance/
Michigan	University of Michigan, Ann Arbor	http://cio.umich.edu/governance
Michigan	Michigan State University, East Lansing	https://itservices.msu.edu/year-review/2014/governance/index.html
Minnesota	University of Minnesota, Minneapolis	https://it.umn.edu/community/resources-it-staff/itg
Mississippi	Mississippi State University	
	Delta State University, Cleveland	http://www.deltastate.edu/policies/policy/university-policies/technology/operation-and-responsibility/information-technology-governance-committee/
Missouri	University of Missouri	http://www.umsystem.edu/oei/ss_project_governance

Montana	University of Montana, Missoula	http://www.umt.edu/it/about/governance/default.php
Nebraska	University of Nebraska, Lincoln	http://www.unl.edu/chancellor/topadmin/vc_staff/maskren.shtml
Nevada	University of Nevada, Reno	http://www.unr.edu/it
New Hampshire	University of New Hampshire, Durham	http://www.it.unh.edu/index.cfm?id=3431FD9B-D87A-C0D0-9987880635E02873
New Jersey	New Jersey Institute of Technology, Newark	https://ist.njit.edu/about/
New Mexico	University of new Mexico, Albuquerque	http://cio.unm.edu/about-governance.html
New York	State University of New York, Albany	http://www.ctg.albany.edu/projects/itgov
North Carolina	University of North Carolina, Chapel Hill	http://its.unc.edu/office-of-the-cio/
North Carolina	University of North Charlotte	http://itservices.uncc.edu/home/it-governance
North Carolina	North Carolina State University, Raleigh	http://oit.ncsu.edu/it-governance-at-nc-state
North Carolina	Western Carolina University, Cullowhee	http://www.wcu.edu/academics/campus-academic-resources/it/aboutit/itgovprioritization/
North Dakota	University of North Dakota, Grand Forks	http://und.edu/cio/it-security/governance/isag.cfm
Ohio	Ohio State University, Columbus	https://net.educause.edu/ir/library/pdf/ERB0905.pdf

Ohio	Ohio University, Athens	https://www.ohio.edu/finance/bpa/upload/IT-Governance-Overview.pdf
Oklahoma	University of Oklahoma, Norman	http://www.ou.edu/ouit/help.html
Oregon	Oregon State University, Corvallis	http://oregonstate.edu/admin/itsc/original-it-governance-structure
Pennsylvania	Pennsylvania State University, State College	https://it.psu.edu/annualreport/itleadscollab.php
Rhode Island	University of Rhode Island, Kingston	http://web.uri.edu/amrc/information-technology-subcommittee-report/
South Carolina	University of South Carolina, Columbia	http://academicdepartments.musc.edu/ocio/
South Dakota	University of South Dakota, Vermillion	https://www.usd.edu/technology/
Tennessee	University of Tennessee, Knoxville	http://tennessee.edu/systemfacultycouncil/docs/reports/UT_IT_report_%20August_2007.pdf
Texas	University of Texas, Austin	http://www.utexas.edu/its/news/112013/evolution_of_it_governance.php
Utah	University of Utah, Salt Lake City	http://cio.utah.edu/it-governance/strategic.php
Vermont	University of Vermont, Burlington	http://www.uvm.edu/it/
Virginia	University of Virginia, Charlottesville	http://its.virginia.edu/home.php
Washington	University of Washington, Seattle	http://www.washington.edu/uwit/governance/
West Virginia	University of West Virginia, Morgantown	http://it.wvu.edu/governance

Wisconsin	University of Wisconsin, Madison	https://www.doit.wisc.edu/about/organization/advisory-groups/
Wyoming	University of Wyoming, Laramie	http://www.uwyo.edu/infotech/

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