THE IMPACT OF IT PROJECT MANAGEMENT TOOLS AND LEADERSHIP SELF-EFFICACY ON PROJECT SUCCESS

Sameh Subhi Shamroukh

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ABSTRACT

The present study is concerned with improving IT project outcomes, specifically in relation to the possible effects of Leadership Self-Efficacy (LSE) and the use of Information Technology Project Management (ITPM) tools. Though logically connected to effective project work and outcomes, the literature review on project management, leadership, LSE and tools did not uncover empirical studies raising the questions of the relationship of these factors with project outcomes or studies seeking to determine the direct effect of each of these two factors on project outcomes. The present study focuses on filling this gap in research by addressing these questions and presents a research model that has provided statistically reliable evidence of the positive impact of each of these two factors on the odds of project outcomes at the component level of the project dimension.

The study was designed based on an abbreviated version of an IT project, consisting of four project dimensions: communication management, requirements gathering, risk management, and project support transition, and two dimension-specific ITPM tools for each dimension. Data was collected using 1) a questionnaire to measure each participant’s level of LSE, 2) a survey of tool use and outcomes in the four dimensions for each of ten projects managed by each participant, and 3) recorded personal interviews with twenty-nine highly qualified and experienced IT project management professionals who have cumulatively handled 1,000+ projects in 400+ companies across four industries (high-tech, retail, automotive and logistics).

The data from the LSE questionnaire was used to assess each participant’s level of LSE. The LSE data and the data of each participant’s reports on ten projects was analysed using logistic regression. The results showed that 1) project managers’ possession of LSE and 2) the utilisation of dimension-specific ITPM tools each increased the odds of successful outcomes in each project dimension with statistically significant results with the exception of one tool.

The interview transcripts were analysed qualitatively for trends in these experts’ viewpoints regarding the practical reality of IT project management. With the aim of gleaning insights into the possible relationship of LSE and project managers’ perspectives on success and failure and on tool use, the interview transcripts were further analysed quantitatively with a word to vector text analysis
(a Natural Language Processing technique) for word associations regarding concepts of success, failure, ITPM tools, and related project manager activities. The results showed a notable difference in degree of cosine similarity for word associations of selected word pairs found in the transcripts of the group with higher LSE scores compared to those of the group with lower LSE scores, in almost all cases, providing more evidence that the factor of LSE is influential.

This study makes important contributions to the background literature on LSE and project management and offers a reproducible research design that yielded statistically reliable results that confirm the influences of LSE and tools on project dimension outcomes. Furthermore, this study applied a text analysis technique to explore the factor of LSE and word associations regarding IT project dimensions and tools. These contributions, along with insights from the literature review, can be applied to training and development for IT project managers. Besides its immediate applications, this study has taken a step toward empirically and statistically researching factors contributing to IT project outcomes and provides a base study and context for future research in this area.
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Key Words

A number of terms considered keywords in this study may sometimes be abbreviated in the text and figures; the terms and their abbreviations are as follows:

- (CSF) Critical Success Factors;
- (GDP) Gross Domestic Product;
- (GSE) General Self-Efficacy;
- (IT) Information Technology;
- (ITPM) Information Technology Project Management;
- (LSE) Leadership Self-Efficacy;
- (NLP) Natural Language Processing;
- (PM) Project Management;
- (PMBOK) Project Management Body of Knowledge;
- (PMI) Project Management Institute;
- (PMM) Project Management Methodologies;
- (PMO) Project Management Office;
- (PMP) Project Management Professionals;
- (PRINCE2) Projects in Controlled Environments;
- (RM) Risk Management;
- (RMP) Risk Management Process;
- (VIF) Variance Inflation Factor.
1 CHAPTER ONE: INTRODUCTION

1.1 Overview

This thesis concerns Information Technology (IT) Project Management (PM) and the challenges faced by IT project managers and, in particular, IT project outcomes. Though project management methodologies are available to guide project management, many projects still fail. The leadership skills and decision-making abilities of project managers seem to be a key element. So, this study considers the personal quality of Leadership Self-Efficacy (LSE) a factor related to the project manager’s effect in project outcomes. Using effective communication and ITPM tools are also essential in project management in order to minimise or avoid knowledge gaps regarding the project among team members and other stakeholders. The second focus of this research explores the effects of commonly used ITPM tools on project outcomes. The relationship between LSE and tool use is also of great interest.

While Leadership Self-Efficacy and its relation to management is addressed in the literature, very few studies concerning IT project management were found, and there were no statistical studies finding connections between the level of project manager Leadership Self-Efficacy and project success or of utilisation of ITPM tools and project success. The present study addresses this gap in the literature using an abbreviated version of an IT project consisting of the four project dimensions that together represent the core structure of IT most projects: communication management, requirements gathering, risk management, and project support transition. For each dimension, two dimension-specific IT project management tools are included. A mixed research methods approach is used; data was collected from twenty-nine experienced IT project management professionals, and statistical analyses yield statistically significant evidence of the positive influence of LSE and tools on the outcomes of each of the four dimensions.

This study has been motivated by over two decades of project management experience and a desire to improve the resources, training and development for experienced and new project managers. The findings of the study contribute to the body of academic knowledge, the body of professional knowledge, and also suggest applications that can be implemented in project management practice.
This chapter will introduce the aims and specific objectives of the study, the researcher’s background in project management and the elements that have motivated and influenced the design of the study, in particular the four project dimensions of the model are addressed. The method and scope of the research will be overviewed, and Chapters Two through Ten are briefly described.

1.2 Problem Definition, Research Aims and Objective

As it has been observed, both academically and practically, the goal of reaching higher rates of successful project outcomes involves a wide range of factors. The IT project manager is the key person responsible for the direction and outcome of a project; thus, their preparation, experience, ability to effectively use project management tools to guide team members working in all dimensions of a project, communicate with all other stakeholders, assess and prepare for possible risks and obstacles, and solutions to ensure project success are all essential for success. Even though there are various types of training for managers and IT Project Management Methodologies (PMM) for project managers to apply and tools for project managers to use, many projects still fail in some or all dimensions. The missing elements seem to involve project managers’ leadership abilities. Effective leadership involves self-awareness and confidence to make assessments, judgements and decisions as well as confidence allowing the manager to practice behaviours to effectively lead people. Furthermore, even though leadership and Leadership Self-Efficacy are known concepts, addressing and developing leadership qualities and behaviours has not been a main focus of IT project manager training or of ongoing support for project managers.

The aims of this research are to:

1. Investigate project managers’ Leadership Self-Efficacy and project outcomes;

2. Investigate the role of IT project management tools in project outcomes; and

3. Make recommendations enabling project managers to successfully contribute, in practice and research, to the project management (PM) profession.
The objective of this study is to provide additional insight into Leadership Self-Efficacy within project management as a factor in IT project outcomes by seeking data-based, statistical evidence of a relationship between project outcomes and the Leadership Self-Efficacy of project managers. As such, the study addresses deficiencies existing in PMM by synthesizing existing studies and by identifying the involvement of Leadership Self-Efficacy and ITPM tools, in the project dimensions of communication management, requirements gathering, risk management, and project support transition, as contributing factors to successful standardized ITPM practices.

1.3 Research Questions

The following three questions are the focus points of the present study.

Research Question One:
Is there a relationship between Leadership Self-Efficacy and success in particular dimensions of a project?

Research Question Two:
What is the impact of dimension-specific ITPM tools on project dimension success?

Research Question Three:
Is Leadership Self-Efficacy a factor in project managers’ perspectives on IT project management tools and their perspectives on ownership of project success/failure?

1.4 Research Significance

As a whole, research into IT project management and IT-based programs remain heavily reliant upon a functionalist, instrumental view of projects and organisations where the function of a project manager is understood to be the overseer of a finite piece of work in a specified period of time, within a certain budget, and to agreed specifications (Cicmil and Hodgson, 2006). To this point, IT project management research has focused on PMM at the structural and task level without an emphasis on leadership skills and its impact on the tools project managers need to manage projects across industries.
This research study was motivated by the desire to remedy these shortcomings and was built upon observations made in academic studies as well as in personal practical experience in the field of IT project management.

Despite the growing use of PMM, 70% of projects fail on a yearly basis (Chabursky, 2005; Finch, 2003; Hyvari, 2006). Because of this, frameworks that project managers can follow to improve their likelihood of project success should be created and implemented. One such framework, “leader leadership,” has been found to enhance interpersonal relationships, motivation, decision making, and emotional maturity among project team members (Kezar, 2001). Leadership Self-Efficacy represents a set of behaviours through which a leader assumes a supportive, service-orientated role among both his or her followers and the stakeholders of a project. A leader assumes this role by building the skills of his or her followers, removing obstacles hindering performance, encouraging innovation, and empowering creative problem solving.

Over the last two decades, research findings have demonstrated a consistent relationship between self-efficacy and work-related performance. A review and meta-analysis by Stajkovic and Luthans (1998a) found that 28% of performance improvements can be attributed to an employee’s task-specific confidence. In a companion article regarding the practical implications of self-efficacy theory for workplace performance, Stajkovic and Luthans (1998b, p.73) state:

Practicing managers can be confident that employees with high self-efficacy will perform well. The challenge for both research and practice will be to further build on this foundation and select and/or develop high self-efficacy in today’s and tomorrow’s human resources.

All major reviews of self-efficacy list self-confidence as an essential characteristic for effective leadership (see for examples Bass, 1990; Yukl and Van Fleet, 1992). Self-efficacy is also an especially prominent variable in transformational leadership theory, which was the paradigm that had captured most of the attention in leadership research some years ago (Judge and Bono, 2000; Mhatre and Riggio, 2014)).

Leadership is a necessary competency that project managers should possess in order to achieve successful project outcomes (Kerzner, 2009). In addition, Leadership Self-Efficacy enhances the human resource skills needed to
mobilize project teams (Schmid and Adams, 2008). Despite this, there is limited empirical research linking Leadership Self-Efficacy to project outcomes. The existence of such a disparity provided the impetus for the present study.

1.5 Research Gap

As a result of the literature review conducted in this study, it was found that little research is available on the relationship existing between project manager leadership self-efficacy, and critical success factors in IT project management. As one delves into the research available on the subjects of leadership, project management, and critical success factors, it becomes clear no unified treatment or understanding of the topic exists. In fact, Prabhakar (2008, p. 3) states, “the only agreement existing in this area involves the consensus of disagreement when attempting to determine “What is project success?” With such a varied array of ideologies, it is arguable that the overall success of a project may be hard to determine unless critical success factors are clearly determined at the onset of the project.”

Cleland (1999) suggests that research on project leadership was still limited though calls had been made for more project leadership research within the field of project management for more than a decade. Huemann et al. (2007) suggest the project is a social system and includes several areas focused on organizational behaviour, leadership, communication, team building, and human resource management.

1.6 Background of the Researcher, Research Motivation and Development of the Research Design

The author of the present study has been an IT project management professional for two decades, managing a variety of projects and experiencing failure and success. Working in the field over these years has allowed many opportunities to talk with many colleagues regarding their experiences with project management, their concerns, and ideas about resources, tools, and interventions that could help reduce problems, improve knowledge sharing and facilitate more successes in various project dimensions and thereby increase the probability of overall project success. Coming to this research with a background of practical
experience has influenced the objective to make academic contributions to the field of project management and also practical applications toward solving problems and facilitating success in real-life project management.

1.6.1 The Researcher’s Background

In February of 1994, immediately after completing my undergraduate degree in Industrial Engineering, I was hired by an oil field engineering company and began my first engineering position in their technology division. I was informed I would be going through a two-month training program at the company’s training centre in Texas. During this training, I was educated about the systems used by the company and the cultures of the countries in which they operated. Through this, I came to understand the company created a project management methodology derived from that of the Projects in Controlled Environments (PRINCE, the initial version of PRINCE2) and the Project Management Institute (PMI) processes. This was my first exposure to PMM, and I was impressed with both the project management documentation available and the attention paid to detail in its development.

Two weeks before the end of this training program, I was informed my first assignment would be in Turkey. I was asked to join a newly formed team assigned to a project designed to implement technology and software assisting in the exploration of underground oil characteristics. The team’s project manager spent hours discussing how we were going to execute the project. During the initial design of this undertaking, the project manager applied the PMM we studied during the training program. However, during the execution phase, I sensed his function was limited to communicating the status of the project and managing its scope (which had been defined by the project and sponsorship teams), schedule, and budget. He did not appear to have been given the leadership resources and tools needed to manage the various phases of the project on a holistic basis. The project manager did not know how and when to communicate internally with the project team. In addition, he could not evaluate and control scope changes to ensure new requirements did not negatively impact the project timeline.

The stakeholders often asked how the project was progressing, and the answers he provided were given in terms of schedule, budget, and scope. The project manager had only limited access to any project details; he had to consult
regularly with the project team regarding the current status of the project. He trusted communication from the project team was accurate because he did not have the resources necessary to verify the information he was given. I asked the project manager if he could find out the project status without asking and getting feedback from the project team or if, perhaps, there was a more concrete resource he could utilise to get closer to the true status. The answer was always the same we could apply PMM within the parameters of the schedule, budget, and scope of the project along with the feedback from the project team in order to obtain a closer understanding of the true status. The project manager was never able to ask the correct questions to be able to find out if the project team would be able to meet the planned timeline. In retrospect, I realize it seemed the project manager’s self-judgment and self-efficacy was not well enough developed for him to be able to raise the right alert at the right time. Further, the PMM also restricted him, as described next.

Two weeks before the “go-live” date — the period during which a project manager prepares to provide a “go” or “no-go” status to the stakeholders — my project manager was surprised to learn the team was behind schedule by four months. Needless to say, this was a stressful moment for him, not only because the project was proceeding much more slowly than anticipated, but also because he became aware of this fact at such a late date. At that moment, I recognized the PMM under which we had been operating provided high-level guidelines but lacked structures to make sure the project manager had the details he needed to effectively handle the project. The project manager was not provided with any leadership tools or resources allowing him to easily or readily determine the status of the project or notify him of issues that had arisen, compromising its success. This situation prompted me to become an IT project manager so I could work to provide solutions to this dilemma.

I left that company in August 1998 and began implementing IT solutions for multiple Fortune 500 companies. Working with these companies, I experienced the same challenges my previous project manager faced, and I found out the necessary leadership tools and resources were no more readily available for me than they had been for him. I was certified as a Project Management Professional (PMP), Scrum Master, and Scrum Product Owner, yet, I was not efficient as I could not always access the information an IT project manager needed to run a successful project.
For more than 20 years, other IT project managers and I have frequently discussed exactly which leadership tools would be most useful for empowering individuals to manage IT projects across various industries (such as, retail, high-tech, or automotive) and also how the impact of project manager leadership could affect the project outcome when utilising practical project management tools.

In 2013, I decided to investigate the impact of leadership, tools and resources in a more formalized, rigorous, and reviewed manner, with the aim of contributing research that could be widely used in the field of project management. After investigating numerous programs where I could carry out such research, I located one best suiting my background and building upon my long experience in IT project management.

1.6.2 Research Motivations

This section elaborates on the research motivations through the researcher’s observations made during his academic work and his practical experience in the IT project management field.

Academic Observations

Through the review of the literature for this research project, the following observations were made.

1. Focus on Project Management Methodology (PMM) Research

Through academic study, this author came to recognize the concept of PMM has been extensively researched and defined differently by numerous individuals and institutions. However, PMM still follows a traditional approach whereby projects are initiated with goals and activities clearly defined at the outset. Detailed project plans are also often established at this point which identify the tasks that must be accomplished to achieve the project’s goals in a streamlined, timely, and effective manner. The primary problem with this approach is that projects often do not fit the set of assumptions upon which traditional ITPM is based. In fact, Attarzadeh and Ow (2008, p. 4) maintain that traditional ITPM assumptions often negatively impact a project manager's ability to deliver value.
CHAPTER ONE: INTRODUCTION

2. **ITPM Leadership**

Having recognized the existence of these problems, it became clear that understanding more about the impact of IT project management leadership would help facilitate successful project results (i.e., projects completed on schedule, within budget, and meeting the desired outcome(s) and quality expectations set by their designers).

Academic study further reveals that the field of IT project management research lacks a comprehensive definition delineating the traits and skills comprising a “good” IT project manager. Bredillet et al., (2015) address this issue and conclude any discussion as to what constitutes a “competent” IT project manager must consider the ethical foundations of what being competent means, any consequences associated with the evaluation of competence, and the underlying views helping to determine requirements in this area.

Loufrani-Fedida and Missonier (2015) recommend both practitioners and current academic researchers stop looking for the “perfect” project manager who possesses every necessary critical competency and, instead, promote the principle that such competency could be shared across multiple individuals functioning as part of the same team.

With insights from the reviewed sources, the author of the current research believes that understanding Leadership Self-Efficacy may be of benefit in determining which qualities could increase the effectiveness of IT project managers. Due to changes in environmental factors in companies, competencies required of project managers will need to continually evolve. Mere technical or industry skills, project management methodology applications, and leadership abilities have largely been the focus of project management competencies required until now, but these will likely not suffice for the modern-day project manager. More and more, it seems that project managers, today, typically operate in increasingly stressful, hostile, and cut-throat corporate work environments. Recent factors, like the global recession, modern technology, and the internet, have changed the outlook of the modern organization and its expectations. Project managers now require deeper, intrinsic, and more personnel qualities to thrive in their role than what has been focused on in the past. Previous areas of focus were on industry or technical knowledge and project management methodology (management of the work of the project itself) as well as leadership and interpersonal skills (management of other people involved in the project). The next
generation of project managers must focus on their own self-efficacy for increased effectiveness (Jacobs and Kamohi, 2017). Hence, the ability of a project manager to understand self-efficacy, the impact it has on project management effectiveness, and nurturing and maintaining its growth in any particular project or situation will make the project manager more effective in contemporary organisations. Miles and Maurer (2012) state self-efficacy predicts performance and motivation across a wide variety of tasks in corporate environments. The more confidence one has in his or her ability to perform a particular task, the greater the likelihood one will participate in the activity, set higher goals than normal, persist through difficulties, and ultimately be successful. Locke (2009, p. 180) states:

Efficacy beliefs affect self-motivation and action through their impact on goals and aspirations. It is partly on the basis of efficacy beliefs that people choose what goal challenges to undertake, how much effort to invest in the endeavour, and how long to persevere in the face of difficulties. When faced with obstacles, setbacks and failures, those who doubt their capabilities slacken their efforts, give up prematurely, or settle for poorer solutions. Those who have a strong belief in their capabilities redouble their effort to master the challenges.

**Practical Experience Observations**

As mentioned, the personal experience motivating this study includes direct participation in over 60 IT projects across multiple industries, including automotive, consumer goods, logistics, and telecommunications, as well as the public sector. The value of these projects ranged from $100,000 to $70 million, with an average value of approximately $3 million. While the details of these projects cannot be disclosed, all of them were highly ambitious and carried a significant risk of failure. Based on this real-world experience, the following issues have been identified.

1. **There is a lack of both ITPM leadership and the utilisation of ITPM tools in the IT field.**

   Simply stated, the successful implementation of a project requires project management, and, because effective project management requires strong leadership, the leadership and self-efficacy of project managers themselves cannot be underestimated.

   Effective project managers are often described as having both a vision and the ability to articulate it. Visionaries thrive on change and the freedom to draw
new boundaries. Combining these two, visionary project managers enable the members of their teams to feel that they have a real stake in the projects on which they work. As such, team members are empowered to experience the overall vision of the project on a personal level.

Project managers accomplish this personal engagement by communicating the importance of updating tasks and projects on a daily basis to their team members. Through personal experience, the most successful projects are overseen by project managers who reinforce requests for team member updates by incorporating such a behaviour change in performance evaluations. If a project manager does not possess the leadership skills necessary to ensure these updates happen regularly, then any attempt to change behaviour through process changes will ultimately fail. Consider, for example, what could occur if a project’s client submitted a change request impacting the project’s timeline and/or budget. If the project manager did not have the leadership skills required to control the scope of the project within the parameters and requirements of the change request, this could very well lead to a failure to meet the scheduled timeline.

2. **Gaps exist in the area of communication management dimension.**

A common issue many projects face once they are fully underway relates to communication. Project communication is a pervasive problem and can occur between individuals and groups at all organisational levels, regardless of the communication method by which messages are communicated. To illustrate this point, consider the following example from personal experience:

During the implementation of a scheduling application for a major retailer in the United States, the development manager communicated through weekly status updates to the project manager that testing would be completed within two weeks. Based upon this information, the project manager adjusted the project plan, changed the quality assurance testing duration to two weeks, and communicated the accelerated schedule to all project stakeholders. Upon learning this, the development manager clarified his message to the project manager, informing him that the testing to which he referred was developmental testing rather than quality assurance testing. Because the project manager had not
initially been informed about the existence of a developmental testing phase, he never accounted for it in the project plan and assumed the development manager’s communication referred to the quality assurance testing. As a result, he communicated an incorrect expected delivery date of the project to the stakeholders.

In light of this example, it is evident communication plans are necessary tools to secure the flow of information throughout the lifespan of a project in such a way that project-related details originate and are gathered, appropriately labelled and distinguished where similarities exist and/or where confusion might occur, stored, and made accessible in a timely manner and in accordance with adopted quality standards.

Communication plans should define the guidelines and tools that project members are to apply when gathering and/or distributing information. At a minimum, they should include:

- The manner in which information should be reported;
- The standards concerning the means of information transmission (e.g., fax, e-mail, post);
- The procedures for circulation and storing information within the project structures; and
- The organisational structure of project meetings.

From personal observation, most problems related to project execution seem to occur due to a lack of communication between the project manager, his or her project team, and the project’s stakeholders. Ultimately, it is the responsibility of the project manager to utilise the appropriate project communication tools to facilitate communication between project teams.

3. **Gaps exist in the area of requirements gathering.**

Because project managers are generally not trained in utilising the most effective requirements-gathering tools, technical experts are charged with the responsibility of developing project requirements, then explaining the results of their work to the project’s clients and users.
In observing the practice of project management for many years, many project managers indicate they believe the requirements-gathering process is more efficiently conducted when it is performed by technical experts rather than by the project’s clients or users. The reasoning behind this belief is that clients and/or users do not understand the technology at the heart of the project in question, making it largely a waste of time to explain it to them. Alternatively, the author believes that during the requirements gathering phase, the client must form a team that represents all facets of their organisation, technical and business, to provide accurate and complete requirements for systems and software implementation.

4. Gaps exist in the area of risk management.
Even the most carefully structured project can experience unforeseen difficulties. Team members may be lost, because they get sick or because they quit, or resources a project needs may turn out to be unavailable, just to name two of many potential issues than can arise. To minimize the effects of such problems, project managers must apply the concept of risk management. Doing so will enable them to identify potential problems, estimate how likely they are to occur, proactively avoid risks, and minimize the consequences of unavoidable problems.

Project managers are often not provided with the needed resources and tools to mitigate project risks. For example, from personal experience, in instances where a critical project team member has quit during the project execution phase, projects suffer because of the knowledge lost with that team member’s departure. In those instances, had the project manager been given the tools to support their previously established plan to both identify and transition a replacement team member, and had the project manager maintained a transition check list to mitigate the risk of project failure, then the project could have been realigned and progressed as scheduled, with only minimal delay.

5. Gaps exist in the area of Project Support Transition.
The research in this area is grossly lacking. Tools required so the system and all of the associated support processes operate in a smooth and continuous manner need to be in place from the first day of production. The area of project support transition is critical in bringing a project to a successful finish because this phase is where the product is transitioned to the client and end users. Satisfaction
of the end user and acceptance of the product are important elements of successful project outcomes.

1.6.3 Thought Process and Steps Leading to the Research Model Design

The steps described explaining the thought processes that led to the research design, research questions, research instruments, and data analysis methods are illustrated in Figure 1-1 (see Appendix A1 for more details). More specific details of the research design, instruments, procedures, and the implementation of this study are described in Chapter Three.

![Figure 1-1 - Thought Process and Steps Leading to the Research Model Design](image)

1.7 Research Methodology

This study adopted a mixed research methods (qualitative and quantitative) approach. Participants representing key IT project management practitioners were recruited to allow an integrated image of the existing problems as experienced by all parties. The research procedure consists of questionnaires and interviews. The research approach involves collecting primary data from IT project managers during recorded personal interviews. One type of data is from interviewees answering a self-reported survey questionnaire regarding leadership qualities and leadership style. A second type of data is sourced from a survey of the use or not of the IT project management tools and successful or unsuccessful outcomes in each of the four project dimensions/knowledge sharing areas for each of ten projects, also based on self-reported information from the participants. A third type of data is the recording of the semi-guided interview. Data analysis will involve
examining the raw data for trends and simple cross analysis of some factors; then Logistic Regression and Natural Language Processing (NLP) will be used for further analysis. Furthermore, a triangulation method will also be used to consider results from different analyses that address the same points.

1.8 Research Focus and Boundaries

In IT project management, there are various dimensions that project managers need to monitor and manage in each project for which they are responsible. There are multiple schools of thought for project management, each with different views on the categorization of the key component dimensions sharing areas of a project. In each dimension of a project, ensuring knowledge sharing among all parties involved is essential. The number of dimensions/knowledge sharing areas varies by project. For the purpose of this research, an abbreviated structure of a project is used that includes the four areas. These four dimensions are basic and key dimensions of almost any project (see the Project Management Institute (PMI) Guide, 2013) and, thus, have been selected by this study to research influences on project outcomes at the dimension level. The following four knowledge areas will be evaluated: 1) Communication management, 2) Requirements gathering, 3) Risk management, and 4) Project support transition. This section explores examples of problems that can occur when there is insufficient knowledge sharing in each of these four project dimensions.

![Figure 1-2 Project Life Cycle boundaries](image)

**Communication management**

Communication gaps can occur whenever people offer ideas, present information, introduce change, make recommendations, give or receive feedback, or simply converse—be it with customers, suppliers, co-workers, or teammates (Kashiwagi, 2011). That is to say, any time people share information with others involved in the project, there is the potential for errors in information, incomplete
information or a possibility that the information may not be understood the same way by all parties resulting in a communication gap. In the ITPM field, specifically, the vast majority of customer complaints revolve around communication glitches, omissions, and snafus (Kashiwagi et al., 2010).

In all four of the project dimensions selected for this study, the activity of knowledge sharing and interventions to avoid knowledge gaps all involve communication. And because communication is so essential, communication management is often considered a project dimension or knowledge sharing area, in itself, and for that reason is included as such in this study.

**Requirements gathering**

This type of knowledge gap occurs when there is a discrepancy between the user's requirements and what has been gathered in this regard; this type of knowledge gap is known as a requirements-gathering gap (Niu and Easterbrook, 2009). Effectively gathering user requirements is a critical first step of any project, as these requirements establish the desired outcomes of the project being undertaken. While clearly defined project requirements are instrumental to a project's success, it is perhaps, also, one of the most challenging IT project management skills, especially for new IT project managers. The soliciting and gathering of business requirements is a critical first step for every phase of any project. Creating a complete set of requirements up front enables better planning, more accurate cost estimates, shorter delivery cycles, improved customer satisfaction, and adoption of the final product. Another issue in requirements gathering is that various phases of the project, various members of the project team and various stakeholders may have requirements from their perspective that need to be integrated with technical realities of the project work, as well as coordinated with requirements of other stakeholders such as end users. Additionally, the requirements need to be understandable by all stakeholders, including project team members. Bridging the gap between business and technical requirements is one of the responsibilities of IT project managers. They must understand the business needs within the given context, align these needs with the business objectives, and properly communicate the needs to both the stakeholders and the development team. For that, they need to ensure requirements are written in a language comprehensible by both groups. In their position as client advocates, IT project managers need to make their way through
ambiguous and sometimes conflicting stakeholder views to arrive at a clear picture of what needs to be accomplished.

**Risk management**

A third type of knowledge gap occurring in ITPM relates to risk management. Managing risk in IT projects remains a key challenge for many organizations (Chapman and Ward, 2004). Furthermore, the disparity between research and practice is strikingly evident in the area of IT project risk management. For example, in theory, the IT project manager should design a risk identification and mitigation plan; however, in practice, risk is usually unforeseen and hard to identify. Thus, the IT project manager needs to utilise effective ITPM tools to help identify risk.

**Project support transition**

The fourth knowledge gap addressed in the study regards project support transition. This gap develops in the time between the completion of a project by the project team and its delivery to the designated support team. This window of time allows for errors and/or misunderstandings to enter into a project’s development and release. During this window, the project team and the support team usually have different interests. The project team typically focuses on closing the project to begin a new assignment; however, the support team’s focus is on understanding how to maintain the current implementation/solution in production. Some authors maintain that complications in this regard can cause team demoralization (Legrisa et al., 2003). Utilisation of proper practical ITPM tools designed to assist IT project managers during this transition would greatly increase project success as it would allow them to ensure misunderstandings do not affect the project at this stage. This is not to say that tools for project support transition do not exist; however, many project managers are unaware of tool options and/or do not know how to use them effectively. And, in practice, adequate attention is not always given to this phase of projects.

In the knowledge sharing areas discussed above, the need for the use of ITPM tools has been stressed. The possible need for better or additional tools has also been implied. Various effective tools do exist and are specifically useful in particular dimensions; utilising them is an important behaviour of project managers.
1.9 Academic and Practical Contributions to the Field of IT Project Management

The present study was designed to determine the influence of two factors on four IT project dimension outcomes: factor 1) IT project managers’ Leadership Self-Efficacy and factor 2) the use of ITPM tools. Specifically, the study investigates the influence of each factor on the odds of project success in the four selected IT project dimensions, using logistic regression.

The study investigates data from the interview transcripts with a Natural Language Processing technique involving word frequencies and associations between words in the text data of the interview transcripts of the group of participants who have high LSE scores and in the interview transcripts of participants who have lower LSE scores (based on the LSE scores assessed from the LSE survey mentioned above). The words selected for the NLP analysis represented concepts related to success, failure and the project manager, ITPM tools and IT project manager behaviours related to each of the project dimensions. This text analysis technique was chosen to explore the transcripts of the interviews and uncover insights regarding the relationship between IT project managers LSE and IT project management tool usage and regarding viewpoints concerning accountability and ownership of both successful and unsuccessful project outcomes.

This study does not apply traditional definitions of success which tend to concern overall project success in terms of budget, time frames, and end user satisfaction, but, rather, considers the component level of IT projects and gives a focus to the use of dimension-specific ITPM tools and perceptions of success or failure in four key dimensions of IT projects where effective tool use for knowledge sharing is critical. This study builds on and supports previous research and expands further with statistical analysis and new perspectives.

The results of this study be of particular benefit to IT project management practitioners as it will provide them with specific constructs that they can apply to improve their project management leadership skills. The concrete recommendations will enhance present training, feedback, support of IT project management, and, possibly, project team member leadership training, including the development of self-efficacy and Leadership Self-Efficacy.
The results and conclusions of the present study will also lead to further research and further improvement of training and support of IT project managers and their team members, facilitating increased successful project outcomes from enhanced self-aware awareness, confidence, job satisfaction, and effective project involvement of essential people.

1.10 Thesis Structure

The thesis is divided into ten chapters.

Chapter 1 - discusses the nature of the research and introduces the aims and objectives. Additionally, a description of intended work to be carried out is provided.

Chapter 2 - presents a review of the literature related to project management, leadership, and Leadership Self-Efficacy.

Chapter 3 - explains the research method. The participants, data types and collection, and data analysis methods are outlined in detail.

Chapter 4 - presents and discusses the qualitative analysis of the data gathered from the semi-guided recorded interviews with the 29 participants.

Chapter 5 - presents an examination of the collected survey data, and some cross analysis of selected items from the questionnaire regarding leadership qualities and behaviours and self-reported leadership style. An overview of the survey data and observations regarding trends are discussed. A discussion of the main points of the interviews data is also included.

Chapter 6 - addresses Research Questions One and Two and concerns data analysis using Logistic Regression. The process is explained in detail, and the results show the influence of IT project managers’ possession of Leadership Self-Efficacy on the odds of successful outcomes in each of the four project dimensions under study. The results also show the influence of the utilisation of each of the eight IT project management tools on the odds of success in the related dimension.

Chapter 7 - addresses Research Question Three. The chapter shows a word to vector text analysis of the transcripts of the recorded interviews. The analysis involves word frequencies and word associations. The results for IT project managers who possess higher degrees of Leadership Self-Efficacy are compared.
with the results of those who possess lower degrees of LSE and impact of IT project management tools utilisation.

**Chapter 8** - shows the triangulation process of comparing the results from qualitative and quantitative data analyses, and interpreting contextual support, similarities or complementation.

**Chapter 9** - discussions of the results of the study and the interpretations and possible applications of the results as seen in Chapters Four, Five, Six, Seven and Eight.

**Chapter 10** - provides a brief review of the highlights of this work, the results, academic and practical contribution and recommendations for possible applications of the same in training interventions, and support resources for IT project managers and team members. It also outlines the limitations experienced during this research, and recommendations for further research regarding Leadership Self-Efficacy, leadership and management, and their relevance to IT project management and to project management in general.

### 1.11 Conclusion

This chapter has provided a background of the research problem, elaborated on the factors affecting IT project success and failure, and the role of and practical challenges IT project managers face. The IT project manager is the key figure in project management and the processes involved in advancing projects; thus, the IT project manager may be the key to increasing successful project outcomes, so leadership and leadership self-efficacy as well as ITPM tools are the focus topics explored.

The long IT project management experience of the researcher has been introduced, and the practical and academic observations that have led to the motivation of the study have been put forth.

With the above in mind, the aims, approach and design of the present study have been introduced. In the early part of this chapter, details have been given regarding what the study does and does not address. The rationale for the model used and approach have been explained. Finally, Chapters Two through Ten have been given a brief introduction.

The study makes contributions to the body of knowledge concerning both Leadership Self-Efficacy and the practical field of IT project management. The
study fills a gap in the literature as few data-based studies were found that made a statistical connection between Leadership Self-Efficacy and successful outcomes of projects. The present research identifies such a relationship and the influence of a managers’ Leadership Self-Efficacy on the odds of success in four dimensions of IT projects: communication management, requirements gathering, risk management and project support transition. Also, this study found statistically reliable evidence of the impact of ITPM tool utilisation on the odds of success in these four project dimensions. As this is a first study, the reproducible design of this research is available to serve as a base model for future research in this area.

The findings of this study facilitate determining elements and directions that project manager training could incorporate to provide project managers with additional or enhanced skills and tools that would in turn facilitate successful project outcomes in specific dimensions, which in turn increases the probability of overall project success.

Next, Chapter Two explores the literature concerning project management, management and leadership, Leadership Self-Efficacy, IT project management tools, perspectives on success and failure, and perspectives and research working towards a deeper understanding of leadership in management and Leadership Self-Efficacy. This will provide a deeper and more detailed context for this study.
2 CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Project management as the set of knowledge, skills, and techniques is used to fulfill requirements and expectations, establish measurable scopes, make realistic timetables, and define roles and responsibilities (Tinnirello, 2000; Schwalbe, 2004). Indeed, project management standards are inadequate for developing and assessing project managers and more empirical-based research is needed in order to create models of project managers’ effectiveness (Crawford, 2005).

Effective project managers are those who have productive, committed, and satisfied team members with high project performance, and who communicate with project stakeholders, manage conflict, and train, develop, and motivate team members (Luthans, 1988). They can manage changes, possess high quality managerial skills, and inspire their team members to show a high level of contribution and recognition (Thamhain, 2004). Indeed, they can carry out any of the leading and managing functions (Kent, 2005).

Organisations have tried using a number of newly developed project management instruments attempting to increase project success. Unfortunately, many of these are directed primarily toward noting symptoms and calculating a “score” (Williams, 2004). Although various opinions exist regarding ITPM, it is evident that gaps in knowledge sharing frequently exist with regard to communication management, requirements gathering, risk management, and project support transition. Continued research is necessary to shed more light on ITPM leadership resources and tools and the impact their effective use has on project success. The present study seeks to make advances in this area.

The following literature review provides a foundation for the proposed study by providing an outline of the model of Leadership Self-Efficacy, Impact of Leadership Self-Efficacy on individual performance and IT project manager Leadership Self-Efficacy trait as a success factor. The review begins with an examination, analysis, and criticism of the available Project Management Methodologies (PMM).
The review of literature was conducted to explore perspectives and previous studies in areas of project management and leadership that provide background and context for the boundaries of the proposed research:

- Project Management Methodology;
- A Critique of most commonly utilised PM methodologies and Frameworks;
- Resources and Tools for Project Managers and their impact on project success;
- Leadership and Self-efficacy as project success factors;
- Impact of Leadership and Leadership Self-Efficacy on project success;
- Impact of project manager’s Leadership and Leadership Self-Efficacy on selected project management dimensions.

The boundaries of the present study are elaborated below.

### 2.2 Research boundaries

The literature review begins by looking at Project Management Methodologies (PMM) and their impact on project success. PMMs provide strategic frameworks for IT project managers to follow as a roadmap to reach success. PMMs are heterogeneous in composition, and their elements play a role in supporting the project team throughout the project life cycle to achieve the projects’ goals. PMMs were developed specifically to address low success rates using project-related knowledge (The Standish Group, 2013), as projects not using project methodologies have high failure rates (Wells, 2012). This underscores the importance of selecting the right project methodology, tool(s), and techniques as well as the appropriate project management experience. Several researchers (Fortune and White, 2006) show more than just selecting a project methodology leads to project success; it is the experience of using a project methodology, project manager skills and traits, and the ability to tailor to the context of a project that drives project success. Many organisations respond to low project success rates by requesting the project management associations to develop benchmarks and new models to improve project management success rates. This PMMs literature review uncovers the shortcomings of PMMs leading to project management research in resources and tools to support project success.
Next, IT project success factors are important to define in the planning phase of the project. Leadership, resources and tools, on the other hand, are key to supporting IT project success factors. Communication management, requirements gathering, risk management, and project support transition are the four dimensions selected to be studied in this research with the goal of determining the impact of the implementation of IT project manager Leadership Self-Efficacy and IT project management resources and tools on IT project success.

An IT project manager will spend nearly 90% of his or her time acquiring and communicating information (Rajkumar, 2010; Deguire, 2007; Whitten, 1999). The project manager is responsible for ensuring effective communication amongst the team and ensuring real, two-way communication between the project team and the customer. A project's requirements define what is needed to change from the current state to some future state. A problem in the requirements can directly impact project success. 70% of project failures are attributed to requirements gathering (Stieglitz, 2012). According to Taylor (2008), More than one-half of errors in a project originate with the requirements and analysis activities done prior to product design. Most projects fail as a result of incomplete requirements, poorly written requirements, or misinterpreted requirements. Effective requirement gathering tools and resources will make big impacts on the quality of requirements gathered. Effective risk management strategies allow an IT project manager to identify project strengths, weaknesses, opportunities, and threats (Altahtooh and Emsley, 2015). By planning for unexpected events, a manager can be ready to respond if the unexpected arises. To ensure a project's success, IT managers should define how potential risks will be handled so problems can be identified, mitigated or avoided all together (Altahtooh and Emsley, 2015). Successful project managers recognize risk management is important because achieving a project's goals depends on planning, preparation, results and evaluation which contribute to achieving strategic goals (Altahtooh and Emsley, 2015). Operational effectiveness is measured by the application availability to end-users and the extent of convenient usage of the application to perform their business functions. Operations efficiency can be affected by the transition process of projects from the delivery to the operations phase. According to Chemuturi and Cagley (2010), project closure is the most neglected project management practice. Often, minimum information is received by the operations team, as their involvement and communication with the project team in many instances is almost non-existent.
According to Baysal (2012), an information model is required for robust information exchange processes to exist. The absence of such a model results in a situation where the expectations of the operations team are not clear to the project delivery team. Consequently, the deliverables on which project teams are working are not known until the time of delivery, often resulting in surprises. IT project management resources and tools are key to supporting successful project transitions to ongoing application support.

2.3 Project Management Methodology

What, specifically, constitutes a project and what project management methodology comprises effective IT project management are subjects open to a great amount of discussion in the literature available on these topics.

Some theorists maintain that a project is essentially a group of people dedicated to achieving a specific purpose or objective (Ress, 1993). Others view projects in a far more complex light, maintaining they are generally large, expensive, complex, and high-risk undertakings which must be completed according to specific standards — namely, by a particular date, within a specific budget, and according to its ability to deliver the expected quality and outcomes for which it is designed (Pinto and Slevin, 1989; Morgan and Soden, 1979; Morris and Hough, 1993; Atkinson, 1999).

With regard to project management methodology, Turner (2009) provides a useful definition, describing this term as “a structured approach for delivering a project, [which] consists of a set of processes, with each process having clearly defined resources and activities (p. 20).” Chin and Spowage (2012) provide another definition, describing project management methodology as “a comprehensive set of best practices, tools, and techniques that are dynamic, flexible, adaptive, and customizable to suit different projects within a specific environment (p. 123).” These definitions reflect varying perspectives on the basic concept of this term, suggesting it is a difficult concept to encapsulate.

Various definitions of PMM have been proposed. The Project Management Body of Knowledge (PMBOK) — recognized as the governing body of PM knowledge (PMBOK PMI Guide, 2013, published by Project Management Institute (PMI))—provides generally accepted “good practices” which apply to most projects, most of the time. This resource may be the foundation for good PMM,
but the PMBOK guide, alone, is not (A critique of the PMBOK is detailed in Section 2.4).

Defining PMM has proven to be difficult, thus making it a concept that is hard to standardize across industries. Because of this, researchers and practitioners have begun to develop their own definitions of this concept. Josler and Burger (2005), for example, define PMM as being: “[T]he standard methods and guidelines to ensure that projects are completed on time, within budget, and are conducted in a disciplined, well-managed, and consistent manner that serves to promote the delivery of quality results (p. 25).” Vaskimo (2011) further defines PMM as being:

[A] system of recognized project management processes and practices, target[ed] to enhance project effectiveness and increase chances of project success, applied in a coherent and coordinated way to obtain benefits not available from employing them individually. PMM may include logics, structures, resources, techniques, and methods outside the discrete processes in the methodology. (p. 42)

As businesses have become more dependent on technology, effective ITPM has been recognized as a necessity for leading and delivering quality software applications on time and within budget. One possible option to aid in the development of software projects is the use of PMM. Interestingly, despite the increased dependence on technology just mentioned, research on PMM is still lacking (Vaskimo, 2011). Many organisations, both small and large, are creating their PMM based on their business needs because they cannot find an established PMM fitting their own processes.

Wells (2012) investigates the benefits and supports provided by project management methodologies (PMMs) to project managers for the management and delivery of information technology/information system (IT/IS) projects. Qualitative data was collected, four case studies were examined spanning disciplines, project contexts, and types of PMM that provide anchorage into front-line management of IT/IS projects. Case 1 focused on PRINCE2, a widely used structured PMM. Case 2 concerned an in-house structured PMM. Case 3 employed a gate-phased PMM. Case 4 hosted a gate-phased PMM in the process of being phased out and replaced by an Agile approach. Data were collected through semi-structured interviews. Each interview lasted between 90 and 120 minutes. 48 practitioners were interviewed, each having different roles with
varying levels of accountability in the design, development, and management of projects. Some of these practitioners were key decision makers of PMM development and application. The findings revealed the presence of strong strategic direction governed by the organizations alongside very little involvement from their managers. Despite this unidirectional approach to the implementation of PMMs in the cases examined, there existed a general consensus across the cases that traditional, structured PMMs were beneficial for projects and organizations. However, the types of perceived benefit, to both project team and project managers, and contribution were different, depending on the individual, his or her level of involvement with the project, his or her accountability, and the organization. From the findings, the generalization can be drawn that the perception of PMM benefits to some extent relates to the levels of experience, authority, accountability, and overall responsibility of the individual. As a common occurrence in all four cases, the benefit of the PMM was subjected to personal perspectives, needs, and the level of experience. Well’s findings support the fact that PMM are not enough to support project success. There are other factors contributing to the implementation of PMM, including the individual contribution of the project manager, the experience of the project manager and the tools the project manager utilises to increase project success.

Without clear directions and structure, project teams will not be able to deliver the results expected of them. PMM are regularly employed with the aim of increasing project efficiency and effectiveness, and they have been popularized for use in various industry sectors for over thirty years (Johnston and Wierschem, 2005). A substantial amount of research has been conducted on PMM, reflecting its value; however, this research also suggests weaknesses within this area. The lack of information regarding the impact of Leadership Self-Efficacy may have on project performance is one example of this. The leadership skills required of project managers are essential to driving success. Despite this, organisations often focus on project management training without first considering the specific leadership-related traits project managers will need to handle the complexity of the projects they will oversee and to resolve any ambiguities they may encounter.

Prior research on PMM suggests the early development of strategies, philosophies, and project implementation methodologies are the most important factors in achieving success (Kumar, 1989). Over the years, however, increased
visibility has been given to claims centring on project and PM failures and upon stakeholder dissatisfaction with project performance and outcomes.

The findings of Budzier and Flyvbjerg (2012) show that the typical project in their study had no cost overruns but took, on average, 24% longer to complete than was initially expected. However, their data also illustrated that, on average, 18% of all general projects are outliers with cost overruns greater than 25%. Their research further showed the risk for outliers is higher than average for standard software projects (24%) as well as in certain project types—i.e., data management (41%), office management (23%), eGovernment (21%), and management information systems (20%). In addition, their analysis also demonstrated the duration of a project increases the risk associated with it; every additional year of a project’s duration increases the average cost risk by slightly over four percentage points.

Project managers can control cost and schedule related overruns if they also control the scope of the projects they oversee. In order to do this, however, project managers should possess specific leadership skills and traits that convince project stakeholders of the manager’s capabilities so that stakeholders agree to relegate such responsibility to them.

According to Ahlemann et al. (2013), for decades, researchers and practitioners, alike, have been searching for methodological solutions to practical PM problems, particularly in the areas of scheduling methods and risk management methodologies. Despite this long tradition of prescriptive research, however, PMMs suffer from a number of problems. For example, there is a lack of their acceptance in practice, they produce limited effectiveness, and they are often unclear with regard to application scenarios.

Despite the fact modern PMMs boast tighter project controls, improved approaches, and leverage increasing experience, many projects still fail (Delisle and Olson, 2004). A growing body of literature and empirical evidence, as well as the voices of numerous practitioners, indicate that even in cases of accepting and applying the “good practice” standards widely promoted with regard to project management, doing so neither eliminates the risk of project failure nor guarantees a project’s success (Williams, 2004).

Part of the reason ITPM has received such a high profile in recent years stems from the widely publicised instances of project management failure in public sector-related projects and in IT. Reports on these projects point to delays,
frequent cost overruns, and under-performance in terms of quality and user satisfaction. A personal example: in a small town where the researcher lives, an electronic billing system designed to connect clients with town services and utilities was delivered one year after its planned delivery date at a 27% cost overrun. A post-delivery analysis for this project showed the town project team had a pre-defined PMM and experienced no issues with the project planning. The problems it suffered stemmed from the type of relationship between the project manager and project team as well as the project manager’s style of managing the project in a holistic fashion. Such a finding underscores the entire purpose of the present research.

Literature on ITPM shows that despite the advancements made in ITPM processes and systems, project success has not significantly improved (Mir and Pinnington, 2014). Naturally, this raises questions about the value and effectiveness of PM and PM systems (Mir and Pinnington, 2014). While PMM are helpful for ITPM, research reflects they are not sufficient for successful project completion (Johnston and Wierschem, 2005). Detailed project management tools supported with core leadership skills will help increase the number of successfully completed projects, in the view of Krahn and Hartment (2006). They see the nature of projects changing—becoming larger, more complex, having heterogeneous teams and greater uncertainty—as they are becoming more prevalent. In this context, it is increasingly important to have a clear idea of the work involved to deliver projects successfully, and knowledge of the best combination of skills and competencies for the project manager to be most effective.

Take, for example, according to the Frankfort Times (McGee, 2016), the Volkswagen engineers who intentionally designed and installed a so-called “defeat device” into the engine’s control computer. This device — in actuality, a software program rather than a physical unit — was programmed to detect when the car was undergoing emissions testing. When official testing conditions were detected, the system would retune the engine to minimize emissions. Doing so sacrificed fuel economy, but also maintained adherence to the testing limits for clean-air standards. In real-world driving conditions, however, the system would revert to its normal mode, optimizing fuel efficiency at the expense of emissions. Reports indicate the technology required to comply with governmental regulations was available. Rather than utilise it, however, enterprise leadership decided the cost associated with these components was too high. Additionally, the project
manager did not use his position or influence to point out the concern that such a decision could ultimately cost the company far more if the recommended shortcut was discovered. Instead, to ensure long-term profit margins were protected, the “defeat device” was installed so the costlier emissions-cleaning components could be avoided in the short-term.

Competitive pressures, cost control, and profit margin are always going to be considerations in real-life projects. Rather than finding a creative — and legal — solution, Volkswagen opted to take a shortcut, ultimately costing the company far more than the savings it initially sought to capitalize upon. This example should serve to illustrate the value of PM and PM systems. Had a PM system and its predefined tools been adhered to, the required technology would have been utilised or another less costly alternative would have been designed because the risk management aspects of project management would have been communicated emphatically with a clear and convincing analysis of the pros verses the cons of such an important decision.

A number of professionals and professional bodies have developed a wide range of project management methods and techniques to aid in project management. McHugh and Hogan (2011) argue structured PMMs are more efficient than other, more basic project management methods. Other researchers elaborate on this concept further, stating that in order for structured project management methodologies to be successful, they should consist of a set of processes, templates, techniques, resources, and tools designed to assist the planning and management of a project throughout its entire life cycle (Chin and Spowage, 2012; Eskerod and Riis, 2009).

Implementing a project in an organisation involves designing the best possible processes, project management methods, techniques, resources, and tools; it also involves changing attitudes and applying organisational changes in a continuous exercise of improvement (Cobo et al., 2010). PMM can provide the theoretical foundation upon which PM occurs, but without practical tools, resources, and techniques, objectives are less likely to be met.

It is widely accepted that there is room for improvement in project delivery, including the development of new software, software upgrades, or software implementations. The studies conducted in this area highlight that while project management methodologies are valuable, they lack the ITPM leadership traits that project managers require to provide and utilise practical ITPM tools needed to
achieve the highest success rates. A well-defined profile of skills and traits of what ITPM leadership consists will provide a better answer for the question of how to achieve greater success within any project management methodology.

2.4 A Critique of most commonly utilised PM Methodologies and Frameworks

In the modern institutional setting, two factors have become increasingly commonplace: change and complexity. To survive in an ever-evolving workplace, an organisation or project team should be competitive, productive, customer-focused, and cost-effective. Business, itself, has also become extremely complicated. This complexity is related to the number of factors involved in business efforts, the sheer size of the endeavours being undertaken, and the global scope of markets. As a result, even small decisions often involve the interplay of hundreds of variables. With this in mind, PMM needs to integrate ongoing adaptability so project managers can be prepared and able to strategically adapt their management approach, possibly at various times during the life of a particular project.

There is a wide range of PMMs that are often applied to PM; the three most commonly utilised are PRINCE2, PMBOK, and Agile. Each of these provides project managers with a theoretical framework to conduct project management.

A. Projects in a Controlled Environment (PRINCE2)

The PRINCE2 methodology helps project managers oversee projects on behalf of an organisation’s senior management, asserting more functional and financial authority should be shared with senior management (Kruger and Rudman, 2013).

Positively, PRINCE2 provides a single-standard approach to the management of projects, which is why many government and global organisations prefer this option. It is also favoured because of its ease of use; it is considered easy to learn, even for those with limited experience (Kruger and Rudman, 2013).

Negatively, PRINCE2 needs a huge amount of time for planning and designing (Sommer et. al. 2015) and overlooks the importance of so-called “soft skills”, such as motivation and leadership, that should be one area of a project
manager’s focus (Cho, 2005). Hewagamage and Hewagamage (2011) note PRINCE2 does not offer the level of flexibility offered by some of the more modern PMMs. Additionally, PRINCE2 focuses on general practices, rather than on IT practices (Moe, 2013). Because the field of PM has grown so significantly, especially in the software industry, those who adhere to PRINCE2 may have difficulty meeting a number of modern PM needs.

B. Project Management Body of Knowledge (PMBOK)

Users of PMBOK find it has a more substantial framework for the management of contracts and scope than PRINCE2. They also maintain other aspects of PM are arguably more robust in this system than in PRINCE2 (Siegelaub, 2009).

Because PMBOK limits decision-making solely to project managers, this makes it difficult to delegate some aspects of management to other parties. Many users of this system also believe the project manager assumes too many roles, including primary decision maker, planner, problem solver, and human resource manager (Wideman, 2002). Although PMBOK provides clear definitions for some PM terms and describes the required components for the framework, it does not offer a specific approach to conduct IT projects, since PMBOK address all types of projects abstractly (Reed and Knight 2009).

C. AGILE Software

In the last few decades, the software industry has seen noticeable growth. This growth has led to an increasing demand for more specific IT-based PMM, which has, in turn, led to the development of new software development methodologies. The Agile software methodology is one example of such (Ghai and Kaur, 2012).

This project management methodology is rapidly growing in popularity. PM is a relatively new focus of Agile software development, which uses an iterative method of determining requirements meant to deliver projects in a highly flexible and interactive manner.

Positively, Agile is a more distinct methodology than PRINCE2 or PMBOK (Nerur et al., 2005). The Agile methodology is more flexible, better enabling it to produce deliverables without the need for substantial changes and reworking.
Tasks can also be broken down into smaller stages, which allows for substantial risk reduction through earlier assessment, testing, and analysis (Goyal, 2007).

The primary drawback of Agile is that if it is not fully grasped, the project management methodology can lead to unattainable expectations. Many people also believe the Agile approach does not scale well when used for large projects (Poppendieck, 2007). Agile has its own advantages and is really suitable for medium and small-scale IT projects which focus more on IT development activities. Daily scrum meeting and working on deliverables within a sprint are some advantages of Agile. It is understood that within a large project small sub-projects can be created which could focus on specific goals. In this regard, Agile can be used and better results can be obtained (Antill, 2016).

PMMs are, first and foremost, management philosophies. As such, they are ultimately concerned with managing human beings towards the accomplishment of tasks. Because of this, PMM will only be as effective as the people who use it. A primary way to increase the odds of successful implementation of PMM is to make sure that these people have the right leadership skills and set of resources and tools which can be utilised across multiple fields.

2.5 Resources and Tools for Project Managers

Effective PMMs are those which can be tailored to a specific environment and adapted to the dynamic nature of various projects and stakeholder demands. A project management methodology must, therefore, be flexible, but it should also provide guidelines leveraging both best practices and past experiences to ensure project goals are achieved. In addition, it should also help the project team clearly understand the scope of their work, what to accomplish, and how they have to accomplish it using the techniques available within the project management methodology, itself (Charvat, 2003).

Nakayama and Chen (2016) found that despite the increasing availability and variety of project management (PM) tools in recent years, projects continue to face challenges. Nakayama and Chen distributed a survey questionnaire to 200 randomly chosen registered Project Management Professionals (PMPs) from the list of the Project Management Institute (PMI) members in China. A final sample of 93 valid responses was obtained to test the proposed hypothesis that 1) the extent of project management tool use positively impacts the degree of
overall project benefits, and 2) the extent of project management tool use minimizes the deviation from project estimation (cost and time estimates). Their model was tested using structural equation modelling with partial least squares (PLS) analysis. They found that the use of PM tools is considered a means to counter project management challenges. However, in their study, the effectiveness of PM tools in specific project dimension and how it could impact specific project dimension success was not statistically demonstrated. A summary of hypothesis tests showed support for hypothesis # 1: project management tool use positively impacts the degree of overall project benefits with p < 0.01. The results for hypothesis # 2: the extent of project management tool use minimizes the deviation from project estimation (cost and time estimates) was not statically significant. The current research will prove Nakayama and Chen’s findings that project management tool use positively impacts the degree of overall project benefits by statically analysing the impact of project management tools on specific project dimensions and proving, by using statistical analysis and further testing the results for significance, the impact of project management tools on specific project dimension success.

Although Thamhain (2013) has emphasized the importance of using right tools, it is not clear how much their use can contribute to project success. Thamhain found through a four-year field study of 35 large projects in 17 high-technology companies that projects are complex and require management interventions that go beyond simple analytical approaches. Their data was collected via questionnaires of 14 items, and they were evaluated and summarized via standard statistical methods; content analysis was used to evaluate the predominately qualitative data collected via work process observation, participant observation, and in-depth retrospective interviewing. Thamhain’s results have emphasised the importance of using right tools, which lines up well with the second aim of this research: the impact of tools on project dimension success. With statically significant findings, this research will embrace Thamhain’s findings and provide quantitative results that show the impact of project management tools on the odds of successful outcomes in specific project dimensions.

Raz and Michael (2001) found a positive relationship between project tool use and project management performance (PMP) score. While there are a variety of PM tools, they should be selected and applied in the appropriate stage of a
project cycle. In the initial stage, project managers can utilise user stories (Cohn, 2004). It is imperative for project managers to know what tools to use under what project circumstances in order to estimate projects accurately as well as to achieve project success. Indeed, Fortune and White (2004) include the correct choice of and experience with PM tools as one of the critical success factors (CSFs) for projects.

It would be impractical to develop a new project management methodology for each new project an organisation undertakes. Consideration for adopting and implementing a project management methodology to tailor it to a specific set of processes should, therefore, allow for easy customisation to any project within a given environment (Charvat, 2003; Chemma and Shahid, 2005). This is not considered a new project management methodology, but it should consist of a set of processes, templates, techniques and tools designed to assist in planning and managing the project throughout its entire life cycle (Chin and Spowage, 2012).

Longman and Mullins (2004) note that the standardization of PM may increase the likelihood of success for any given project. In fact, several authors articulate the need to introduce alternative theoretical approaches to the study of project development and success, as well as the need to identify the potential implications of how projects are organised and managed (Koskela and Howell, 2002; Morris et al., 2000; Winch, 1996). In practice, project managers making use of such alternative, standardised approaches should include standard project management tools to aid in the practical implementation of a proposed theory. As already stated, developing new PMM would take a considerable amount of time and research, so a practical alternative to this would be to develop a standardised set of tools to supplement pre-existing project management methodologies.

Authors find IT project managers need and expect quality project management tools to help them do their jobs. Furthermore, they have determined it is not possible to produce their best work without them. For example, Aljaz (2010) believes processes need to work in harmony with one another and these processes should determine how tools need to be used. Project management tools vary in their level of sophistication and they can help the efficiency, level of consistency, and control only if they are appropriate for the task at hand and used properly. An individual cannot use a tool effectively unless the processes it guides are known and/or instructions for its usage are clear. In order to understand why or how to use a project management tool, an individual should first understand
processes and behaviours. Program and project managers, therefore, need to combine process familiarity, embodied through behaviours and actions, with the tools needed to carry out their work. Careful understanding of the processes should be first; the most appropriate resource to perform the process must, then, be made available (Alotaibi and Mafimisebi, 2016).

Hall (2012) discusses the different tools needed by project managers to achieve success during all project phases (i.e., initiation, planning, execution, control, and closing). These include weekly status reports, functional decompositions, use case diagrams, risk management check lists and risk impact assessments, among others. These tools can prove to be valuable in multiple ways, such as within project communication and project risk management. All too often, project teams are asked to carry out their work despite a lack of communication. Team members are told what must be done, but they are not told why. This frequently leads to a lack of knowledge regarding how their efforts will help the organisation achieve strategic goals and impact the bottom line (Longman and Mullins, 2004). Practical project management tools that encourage and streamline communication within the project team are needed in addition to PMM in order to help ensure project success.

There is limited and rather shallow coverage of the effects of leadership, Leadership Self-Efficacy, the utilisation of ITM tools on project outcomes, or on the challenges faced in the project team environment, in the explored literature for this study. This insufficient coverage, in particular of Leadership Self-Efficacy and of the use of ITM tools, in PM research confirms the justification and need for the present study which examines the effect of each of these two factors on project outcomes at the project dimension level. The present study also seeks further insights regarding the concept of LSE and concepts related to ITM tools, as indicated in Chapter One.

2.6 Leadership and Self-efficacy as Project Success Factors

In project management literature, the issue of project manager leadership competencies continues to provoke debate with regard to their contribution to project success, which highlights the need for research on leadership competencies to fully understand how they relate to project performance (Anantatmula, 2010; Muller et al., 2012). Past studies focused on analysing and
recognizing project manager leadership competencies (Berg et al., 2016) and identified lack of leadership competence as the reason for many project failures. This competency represents one of the main reasons for the inability of project managers to organize available resources, to meet stakeholder expectations, to meet deadlines, and to take corrective actions for improving project performance (Sunindijo, 2015).

Berg et al., (2016) used qualitative research methodologies and a case study approach. They used in-depth semi-structured interviews, from 12 project managers. They used a qualitative form of content analysis to analyse how project managers practice a coaching leadership style. The analysis was carried out in several steps. First, the transcribed interviews were read and checked regarding accuracy by the main researcher. Then they read all the interviews for an overall assessment. In the subsequent data reduction, the interviews were processed separately by both researchers who performed manifest as well as latent content analysis. They sought for words, statements, differences, nuances, patterns and similarities in the responses. Berg et al., found that specialized and sophisticated project management tools alone are not enough to improve project performance, and development of a project manager’s leadership competencies is also required. In other words, they seem to imply that the focus on tools and techniques needs to shift to “soft skills” with a specific emphasis on leadership competencies that deliver desired results. Berg et al., support a core perspective of the current research that there are other project manager skills that are needed to support and increase project success. Leadership and, in particular, project manager leadership are required to embrace challenges and responsibilities and increase the probability of project success.

Anantatmula (2010) conducted a study to identify and develop a better understanding of how people-related competencies affect project performance and suggests that future studies should develop and test a leadership model for project managers by employing different quantitative research methods representing a wide range of industries or business sectors. Also, Attakora-Amaniampong (2016) suggest future research efforts to assess the relationship between project manager competencies and project performance. These assertions highlight the need to investigate the influence of project manager leadership competence on project performance at the industry, sector, or country levels.
According to Loufrani-Fedida and Missonier (2015, p. 1121), competence is “the ability of an individual, a team, or a company to mobilize and combine resources (i.e., knowledge, skills, and attitudes) in order to implement an activity in a situation.” Project manager leadership competencies, as critical factors of failure or success, are considered a means to assess project performance (Anantatmula, 2010). Limited research has been conducted to examine the relationship between people-oriented leadership competencies of project managers and their relationship with project performance (Anantatmula, 2010; Fung, 2014). In projects, an important leadership competence is developing trust among the project team members and key stakeholders. Trust is known to influence project performance (Brewer and Strahorn, 2012); this relationship establishes an environment of confidence among project team members and other project stakeholders. Trust promotes willingness among team members and subordinates to accomplish project activities which ultimately impact overall project performance (Brewer and Strahorn, 2012).

Various modern-day self-efficacy researchers, such as Ugwu et al. (2013) still regularly refer to the researcher who pioneered the concept of self-efficacy, Albert Bandura (1986), and his “self-efficacy” definition: “people’s judgments of their capabilities to organise and execute courses of action required to attain designated types of performances (p. 60).” For many researchers, the term “self-efficacy” is not concerned with the skills one has, but, rather, with the estimation of what one can attain with the skills one possesses (McCormick, 2001). These researchers explain self-efficacy as the belief in one’s capabilities to activate the motivation, cognitive resources, and courses of action needed to meet given situational demands. By definition alone, the study of self-efficacy already appears to be relevant to the practice of project management.

Bandura has identified four kinds of experiences that influence the self-efficacy estimate. From most to least influential they are:

(a) enactive mastery, (b) vicarious experiences, (c) social persuasion, and (d) emotional and physical states.

The first, enactive mastery consists of repeated personal performance accomplishments. It is by doing and succeeding at doing that individuals build the confidence to perform the task in the future. The second is vicarious experience, or the observation of others (i.e., models). Models are particularly important for developing interpersonal skills (like leadership) and can be a source of inspiration.
when the model is a highly regarded other (Hollenbeck, 1997). The third is social persuasion. This consists of positive performance feedback and the positive opinions of important others like coaches, peers, parents, and bosses. In short, it is easier to sustain a belief in one’s capabilities if knowledgeable and credible others express confidence in one’s capabilities (Eden and Zuk, 1995). The fourth is physiological and emotional states. Studies have shown that participants’ efficacy beliefs can be positively altered by improving physical conditioning, reducing stress levels, and controlling negative emotional tendencies (Cioffi, 1991).

Kihlstrom and Harackiewicz (1990), in their review of Bandura’s work, state efficacy expectations are self-judgments of how well someone can execute courses of action required to deal with prospective situations. Hence, efficacy expectations are future oriented, rather than retrospective, and they are specific to a particular situation and action. The same researchers believe self-efficacy should be seen as a property of a person itself, which means it could possibly be developed under the right combination of circumstances, experiences and/or training regardless of the personality of an individual.

One of the most relevant studies on measurement of self-efficacy was conducted by Paglis and Green (2002). Paglis and Green investigated managers’ motivation to promote and practice a change-oriented leadership. The aim of their study was to explain differences in managers’ behaviour in American industries. They linked leadership and general self-efficacy and proposed that high self-efficacy managers will be seen by their direct collaborators as engaging in more leadership attempts, showing high resilience to adversity, and emphasizing change perspectives. Their model was tested through a questionnaire-based survey which involved 150 managers and 41 direct collaborators, in a real estate company and in a chemical firm. Self-Efficacy was measured with a 12-item scale. Accordingly, Paglis and Green’s study was particularly focused on managers’ motivation for attempting the leadership of change. The definition of leadership of change was based on three of the main leadership tasks in change processes, so LSE here reflects managers’ judgments of their capabilities for: (1) setting a direction for where the work group should be headed; (2) gaining followers’ commitment to change goals; and (3) overcoming obstacles standing in the way of meeting change objectives. Bobbio and Manganelli’s (2009) work was influenced by Paglis and Green’s results and final scale. However, Paglis and
Green’s scale was limited to 3 categories to measure the leader self-efficacy, where Bobbio and Manganelli’s scale was more comprehensive to measure the managers (or leaders) Leadership Self-Efficacy.

Bobbio and Manganelli (2009) focused on finding ways that Leadership Self-Efficacy might be measured on a multidimensional scale. They constructed a questionnaire consisting of 61 items exploring self-evaluations of being an effective leader. Respondents were asked to provide their answers to each item in the form of a scale ranging from 1 = strongly disagree to 6 = strongly agree. Three hundred seventy-two (372) university students and 323 non-student adults took the self-administered survey. A detailed analysis of the 695 surveys resulted in identifying 21 items that fall into six categories. The six categories are: 1) starting and leading change processes in groups, 2) choosing effective followers and delegating responsibilities, 3) building and managing interpersonal relationships within the group, 4) showing self-awareness and self-confidence, 5) motivating people, and 6) gaining consensus of group members. Bobbio and Manganelli’s study is particularly influential in the present research in that Bobbio and Manganelli’s 21 item LSE scale is used to measure the LSE of the participants. Furthermore, the items and categories themselves concern interpersonal behaviours and self-evaluations giving insight into the features of LSE; such information might be applied in training people to develop such characteristics, behaviours, skills and self-awareness.

The above discussion indicates that Leadership Self-Efficacy is an underlying quality of a person, something in between a trait and a skill. It is not the same as actual leadership behaviour or leadership skill, but LSE is intricately entwined with the activity of leadership. To grasp the relationship of LSE and leadership, Max De Pree’s (1989) view may be helpful. He says that in many ways, leadership is an art. “The art of leadership is about liberating people to do what is required of them in the most effective and humane way possible (p. 32).” This is how Max De Pree explains what leadership is in the introduction of his book *Leadership is an art.*

Though a lot has been written about project leadership, most of the researchers have been focusing on the role of the project leader and project team members, in a traditional cost-driven project environment. However, project managers personal leadership attributes, which are considered as intangible factors, and their impact on project success is generally lacking (Shi and Chen,
Research into leadership has demonstrated that strong leadership is crucial to the success of projects (Mascia, 2012). During last few years, an ever-increasing awareness has been observed with the requirement to identify the intangible factors, which are considered important from the perspective of the role of an individual’s success in the workplace (Deepa and Seth 2013).

Apart from the contributions made by the earlier research there are a limited number of studies which place emphasis on the human factors influencing project success (Belout and Gauvreau, 2004; Leybourne, 2007).

Miles and Maurer (2012) state self-efficacy predicts performance and motivation across a wide variety of tasks in corporate environments. The more confidence one has in their ability to perform a particular task, the more the likelihood one will participate in the activity, set higher goals than normal, persist through difficulties, and ultimately be successful. As, mentioned in Chapter 1, Locke (2009, p. 180) states:

Efficacy beliefs affect self-motivation and action through their impact on goals and aspirations. It is partly on the basis of efficacy beliefs that people choose what goals and challenges to undertake, how much effort to invest in the endeavour, and how long to persevere in the face of difficulties. When faced with obstacles, setbacks and failures, those who doubt their capabilities slacken their efforts, give up prematurely, or settle for poorer solutions. Those who have a strong belief in their capabilities redouble their effort to master the challenges.

Bandura (1997) pointed out that because individuals have the capability to alter their own thinking, self-efficacy beliefs tend to influence physiological states, including anxiety, stress, and fatigue. Mulki et al., (2008) state people who are high in self-efficacy believe in their ability to handle their work well and are more likely to become successful in their careers. Self-efficacy enhances employees’ willingness to invest additional effort and master a challenge and, thus, plays a significant role in increasing work effectiveness, job satisfaction, and productivity.

Research on self-efficacy has widely revealed how the motivational construct of self-efficacy influences the choice of activities, the stated goals and level of goals set, efforts and persistence towards the task to be accomplished, and the subsequent performance (Bandura and Wood, 1989). Hence, the self-efficacy factor plays a vital role in both influencing the skills individuals possess and in determining what they do with the skills (Hoyt, 2005). Past research shows how self-efficacy relates to various forms of performance outcomes. In a meta-
analysis conducted by Stajkovic and Luthans (1998a), self-efficacy is shown to be strongly and positively associated with work-related performance. As such, self-efficacy is critical in, not only influencing the skills an individual possesses or perceives to have with regards to a particular domain, i.e. project management, but it also influences an individuals’ perceived potential (Hoyt 2005).

Interestingly enough, none of the studies directly address leadership performance (Dixon, 2009). Self-efficacy in a project leadership situation is simply referred to as one’s overall belief in his or her general ability to lead (Hoyt et al., 2003). Hoyt (2005) considered leadership efficacy as an important personal quality affecting the organisational outcomes, individual and group, as it plays a specific role in especially stressful conditions. In a review of related literature on LSE, Hannah et al. (2008) observed that the concept of leadership efficacy has received relatively little attention in the leadership literature. At the same time, they argue that, despite the call by Gist (1989) to apply this potent construct to leadership research, there exists limited theory building contributions linking efficacy to leaders, as they found only a small number of studies on leader efficacy. This is somewhat surprising considering that effective leadership requires high levels of agency and confidence (Hannah et al., 2008).

Leadership is a process of social interaction where the leader’s ability to influence the behaviour of followers can strongly influence performance outcomes (Humphrey, 2002). According to Paglis and Green (2002), self-efficacy is an estimate of one’s ability to orchestrate performance by successfully executing the behaviours that are required to produce desired outcomes. Eden (1988) argues that leadership is the mechanism through which managers raise performance expectations and enhance self-efficacy, which, in turn, increases performance. Bandura (1986) states that self-efficacy is the chief construct that links ability to performance. The higher the degree of self-efficacy people feel, the more confident they will feel about successfully completing a task (Villanueva and Sanchez, 2007). According to Riggio et al. (2002), high self-efficacy has been shown to lead to increased performance in a wide range of situations.

The competencies needed by project managers have evolved significantly over the years, as can be seen in academic literature. In the early days of the profession, authors like Pinto and Kharbanda (1995) referred to “accidental project managers,” stating project managers of that era were often appointed due to their technical competency in industries like civil engineering, banking, and IT. This
appeared to be acceptable in that era. Fisk (1997), then, pointed out PM was later found to be very similar to professional construction management. The need to see construction projects completed within time and budget led to the classic notion that project manager effectiveness should be measured around the ability to manage projects within time, cost, and quality constraints. Themistocleous and Wearne (2000) find the emphasis at the turn of the century remained largely on factors like project planning, monitoring and control, and risk analysis, as well as related classical project problems of execution. It is evident during this period that project managers perceived abiding by the project management life cycle and project management methodologies as a main determinant of effectiveness (Murugesan, 2012).

Studies utilising a practice-based approach differ widely in terms of their methodological approaches and the bases of their arguments. Traditional practice-based studies seldom focus on education and, instead, address the practices of a project manager (Hällgren et al., 2012). ITPM is complex, yet fruitful ground for creative, spontaneous, and intuitive applications of particular theories to meet stated objectives in a constantly changing environment (Kleina et al., 2014). As companies have begun to realise the effect productive PM has on profitability, their focus has, in turn, begun shifting on achieving professionalism in ITPM (Milin et al., 2012).

Packendorff (1995) claims in the dominant line of research, projects are seen as tools, PM is largely considered to be a general theory, and empirical research is not sufficient. This is partly due to the fact PM is not solely scientific in nature. There is also an art behind it (i.e., establishing leadership, building team relationships, etc.). These elements cannot be justified through empirical research; they require qualitative analyses to prove their effectiveness, which is why personal interviews with experienced professionals is part of the present research design.

Shenhar and Dvir (1996) explain that most research on PM suffers from a scanty theoretical basis and lack of concepts. Koskela and Howell (2002) argue there is no explicit theory of PM in prior literature and this has slowed the diffusion of PM methods in practice. Soderlund (2004) criticizes, saying too much effort has been dedicated to clarifying the reasons behind project success and failure, while researchers should actually address what might be at the core of each in order to further the knowledge about PM.
After the early 2000s, the PM fraternity experienced a shift towards a leadership focus, when the global trend moved towards separating the concepts of leadership and management (Alicke and Govorun, 2005). PM has traditionally been a good fit with the planning, organising, leading, and controlling aspects of the typical management framework, where management implements processes to drive a project towards successful completion (Henri and Sousa-Poza, 2005). Leadership, however, does not consist of only project success, but should also be concerned with motivating and helping people to realise their potential and achieve tough and challenging company goals. Accomplished PM researchers like Turner and Muller (2005b) studied the link between project managers’ effectiveness and their leadership competencies, finding that effective project managers need both management and leadership competencies. Neuhauser (2007) highlighted one of the core elements of managing successful projects is the ability to manage project teams. He also stated organisational effectiveness requires project managers to combine their technical competency of project methodology with an effective display of leadership. The work of Geoghegan and Dulewicz (2008) on the correlation between project managers' leadership competencies and project success further highlighted leadership’s impact on project manager effectiveness. Besides these major themes, other general attributes and competencies were also shown, through the years, like political acumen for instance, to increase the effectiveness of project managers.

Some recent studies, though, have shown a much greater emphasis on more personal, intrinsic attributes of project managers. Meredith and Mantel (2010) explored PM capabilities, such as ability to deal with failure and stress, as being important since project personnel of the current era often need to operate in turbulent and ever-changing environments. The work of Muller (2009) shows PM involves much more than tools and techniques. He emphasises factors like matching projects to the psychological profile of the project manager, the importance of combining “emotional competence” with IQ and management intelligence, and personal traits of project managers as significant success factors. Muller concludes his paper by stating his work is merely a first step from leadership towards personality theory of project success, leaving room for expanded studies on project manager personal traits and project outcomes. These researchers show project managers in modern organisations are being challenged as never before, in a personal sense, and require additional competencies beyond the
traditional ones. The latter researchers allude to more intrinsic competencies whereas previous focus areas were on technical knowledge and project methodology (relating to the project itself) and politics or leadership (relating to dealing with others).

While project leadership is a topic of growing interest, there are challenges to its investigation. One of those is captured by Slevin and Pinto (1991) who, themselves, assert successful project management requires effective leadership. However, they add that its study is complicated by the fact that it is simultaneously well-known and little-known. A second challenge in the study of project leadership is the wide range of meanings ascribed to the concept by different authors. In his paper titled “Technical Project Leadership,” Thite (1999) uses the term “technical leadership” to reference the leadership provided to technical and scientific staff. Some authors consider project leadership to mean something different, such as a skill for effective project management, while others think it involves such elements as interpersonal relationships and facilitation (Gemmill and Wilemon, 1994; Kezsbom, 1988, 1994).

Kotter (2001) notes there is an increased need for leadership when working in a volatile environment and dealing with change. Kotter asserts LSE is important in a project environment where climates can differ from one project to the next. Consistent with this view is one description calling the project manager’s role “a leader-intensive undertaking” (Pinto et al., 1998).

The study of leaders and the leadership process stems from social psychology, sociology, psychology, and organisational behaviour (Pierce and Newstrom, 2006). Since the late 1950s, there have been as many as 65 different classifications of leadership (Northouse, 2004). Achieving balance does not necessarily mean a leader should possess any one particular trait or employ any set style of leadership; rather, the leader should possess the ability to analyse a situation and adopt an approach mobilising his or her followers to work toward a specific end goal (Breso et al., 2011).

How PM and leadership skills are implemented during the various stages of a project’s execution usually depends upon the type of project being developed and the life cycle stage of the project (Hannah et al., 2008). For complex projects and projects built on a large or even global scale, established standards must be achieved; goals must be met, and the deliverables must be constrained by the time frame, project budget, and market dynamics. Projects of this nature involve
large and varied project teams comprised of members of diverse disciplines. Implementation for such projects are also multi-phased. In such situations, project success and business sustainability can be achieved only through smart and effective leadership.

A project manager should appropriately and swiftly manage change (Pieterse et al., 2012). An effective project manager should be able to anticipate change and address it proactively. He or she should, likewise, be able to direct his or her team on how to cope with change and use it to their advantage.

In addition, during the planning phase of a project, a project manager should lead his or her team and the project’s other stakeholders through a streamlined project study in order to accurately convey project needs. This phase should be emphasised to ensure all parties gain complete awareness of project requirements.

Regardless of a project’s size, to best facilitate success, a project manager’s leadership style should be innovative, flexible, and collaborative. While a project manager should maintain a degree of authority in order to oversee the project, he or she should also work to maintain the motivation of his or her team members, as well as emphasise team building.

As explained above, self-efficacy stems from Bandura’s (1997, 1999) Social Learning Theory and refers to “the belief in one’s capabilities to organise and to execute the courses of action required to produce given attainments (1986, p. 60).” In essence, then, self-efficacy is a person’s own judgment of his or her competence to complete an action. Neither self-confidence nor self-esteem truly conveys the same meaning as self-efficacy, however. The former centres on a person’s assurance of an outcome, while the latter represents a person’s estimate of his or her own value. Self-efficacy is assuredness of a positive outcome (Bandura, 1986).

A person’s beliefs about his or her abilities can have a significant influence on the outcome of his or her actions. People tend to seek out activities and situations in which they can succeed and avoid those where failure is likely. They also tend to adjust their level of effort based upon the expected outcome of a situation, exerting more effort if a positive outcome is expected and less effort if a negative outcome is anticipated, according to Robertson and Williams (2006). Their suggestion is important, but their article did not refer to any collected data or research supporting their view.
Bandura (1997) maintains a person’s behaviour is better predicted from his or her beliefs than from the actual consequences of his or her actions. For example, when faced with frustrations and failures in the undertaking of a task, a person with strong self-efficacy is more likely to recover quickly, to demonstrate persistence, and to employ creative problem solving because such an individual believes he or she will find a way to succeed if only he or she works hard enough. In fact, an individual with a high level of self-efficacy will often persevere at tasks even when he or she lacks the ability to perform it well or is likely to fail. For such an individual, obstacles tend to spur greater effort (Bandura, 1999).

Research has demonstrated self-efficacy is also strongly related to performance within organisations (Bandura, 1999; Stajkovic and Luthans, 1998b). They suggest that the impact self-efficacy can have on an individual’s leadership skills and overall performance should be clear. Project managers and individuals in other types of leadership roles who possess high levels of self-efficacy will actively seek out ways to develop motivated employees. Although task-specific self-efficacy can be increased through successful performance, effective project managers and leaders will also incorporate repetitious and progressively more difficult mastery experiences for their employees to further develop their skills, effectiveness, and productivity (Eden and Zuk, 1995; McNatt and Judge, 2004; Breso et al., 2011). Though these authors provide a context about the concept of Leadership Self-Efficacy, their approaches do not overlap with the aims of the present study.

For the purpose of this study, the guiding definition of leadership regards an individual’s ability to recognise the need for change, to establish direction, to align people, to motivate, inspire, and build teams among them, to communicate effectively and share decision-making responsibilities, to mentor and coach subordinates, and to demonstrate a high degree of integrity (see Bass, 1990; Kouzes and Posner, 2007; Skipper and Bell, 2006). In light of this, leadership is viewed from two perspectives found in the literature: first, as the ability to make strategic decisions using communication and, secondly, as a set of human resource skills emphasising interpersonal relationships, utilisation of project management tools, motivation, decision making, and emotional maturity (Zimmerer and Yasin, 1998).

The present study examines leadership and Leadership Self-Efficacy in three ways: 1) through a survey of questions related to leadership styles and
leadership self-efficacy used to measure participants’ LSE levels and 2) through
text analysis of their interview transcripts regarding word associations between
words representing concepts related to success and failure, ITPM tools and
project manager behaviours. While these associations do not prove direct
connections or actual behaviours, the study will be able to compare participants
deemed to have LSE compared to participants deemed not to have LSE. And, 3)
the research design includes a statistical analysis regarding the effect of the
possession of LSE by project managers on the odds of successful outcomes in
four project dimensions.

2.7 Impact of Leadership and Leadership Self-Efficacy on Project Success

Jacobs, and Kamohi (2017) found that project managers who can manage
their self-assessment with regards to their projects will be more effective in these
turbulent times. Their work also showed that Leadership Self-Efficacy had a
significant improvement in 5 specific personal competencies sorely needed in
contemporary organisations: adaptability/flexibility, ability to handle ambiguity,
persistence/perseverance, emotional Intelligence and resilience. Jacob and
Kamohi used an in-depth literature review of 30 papers, which synthesises and
then translates separate qualitative studies to form new findings. Jacobs,
and Kamohi chose a research methodology that utilises the work of previous
researchers on self-efficacy, while creating new knowledge for project practise.
Jacobs, and Kamohi used a condensed and simplified, “light” meta-ethnography
to synthesise the qualitative findings in academia of the 3 separate concepts of
self-efficacy effects, the competencies that make project managers effective and
personal competencies required to thrive in the modern organisation. A formal
academic filtering tool called the Critical Appraisal Skills Programme (CASP), as
well as using traditional academic writing principles, was used to ensure that only
existing qualitative research of proper academic standard was used in the meta-
ethnography. Jacobs, and Kamohi then conducted their own qualitative research
via e-interviews, on a sample of 12 project managers from diverse industry
backgrounds and levels of experience, to determine if the results of the meta-
ethnography could be verified by actual project managers in the real world. They
found that project managers now require deeper, intrinsic and more personal
qualities than what has been focused on through the years, in order to thrive in their role. Previous areas of focus were on industry or technical knowledge and project methodology as well as leadership and interpersonal skills. Jacob and Kamohi’s findings support the aims of the current research regarding the impact of project manager leadership self-efficacy on project success, however Jacob and Kamohi’s approach was through meta-ethnography qualitative analysis of previously conducted research work and their own findings. Adopting mixed research methods, the present research will validate Jacob and Kamohi’s findings through statistical analysis yielding statistically significant results.

Per Nawaz, et al. (2016), Project manager’s leadership was positively correlated to project success and teamwork which also has a positive relationship with project success. Due to changes in environmental factors in companies, competencies required of project managers will need to continually evolve. Mere technical or industry skill, project methodology application and leadership ability has largely been the focus of project management competencies required up to now, but will not suffice for the modern-day project manager. Project managers today typically operate in corporate environments that are increasingly stressful, hostile and cut-throat. Recent factors like the global recession, modern technology and the Internet have changed the outlook of the modern organisation and its expectations. Project managers now require deeper, intrinsic and more personal qualities than what has been focussed on through the years, to thrive in their role. Previous areas of focus were on industry or technical knowledge and project methodology (management of the work of the project itself) as well as leadership and interpersonal skills (management of other people involved in the project) (Jacobs and Kamohi, 2017). The next generation of project managers must consider the focus to be on him or herself and his or her self-efficacy for increased effectiveness; self-efficacy is a person’s own judgment of their capabilities to organise and execute the courses of action required to attain predetermined goals. Their paper shows self-efficacy to have a positive effect on the following personal, intrinsic attributes sorely needed in the modern organisation: adaptability\flexibility, ability to handle ambiguity, persistence\perseverance, emotional Intelligence and resilience. Hence, the ability of a project manager to understand self-efficacy, the impact it has on project management effectiveness, and how to nurture and maintain it in any particular project or situation will make the project manager more effective in contemporary organisations.
Project management is defined as an application of knowledge, skills, and techniques to project activities in order to meet the needs of project requirements, according to Heagney (2011, p25). Leadership, in these applications, is required to enhance successful project deliverables. With various leadership styles and project methodologies this can be achieved. Kerzner (2013) states four elements, which are essential when exercising good project management leadership methodologies, namely effective communication, effective co-operation, effective teamwork, and trust.

Tracy (2007,129) states that there are four main concerns within project management that cause projects to fail, which are described below.

- Not enough time set aside for certain tasks to be completed;
- The assumption that there will be no obstacles in the way of completing a project successfully and not planning for the possibility of needing extra time and resources;
- Project managers tend to rush projects to safeguard the limitation around money, time and quality. This often leads to errors, which lead to poor quality; and
- Project managers take on too many responsibilities or place too much responsibility on their team members.

Presently, the demand for project work is much greater with the limited supply of skilled resources within organisations. In today’s economy, companies are faced with many financial difficulties, whilst they have to employ more skilled resources to reduce project failure.

Leadership is about influence, and influence comes through power, and power is the ability to influence. Maxwell (2004, p242) stated that power is usually recognized as “an excellent short-term anti-depressant.” There are many people who thrive in achieving power over others by influencing them positively or negatively.

Leadership is defined as improvement of human beings and equipment; improves quality standards; ensures that there is a substantial amount of delivery; and brings pride of workmanship to human beings. Leaders should be influential, have a sense of power, demonstrate persistence, and engaged in consistent team development as well as people management. To be successful, project managers
should be able to use a wide range of project methodologies, whilst drawing on political and interpersonal skills (communicating, negotiating, team building and creating ownership), as Boddy & Buchanan (1992, p. 52) state Leaders should be innovative, have respect for others, be courteous, sensitive, and go beyond their ability in order for any organization to be highly effective. Leaders should show confidence, display integrity, demonstrate extraordinary persistence, work hard, be responsive, have a high degree of energy, and develop humility (Flanagan & Finger 2003, p. 38).

2.8 Impact of IT Project Manager’s Tools, Leadership and Leadership Self-Efficacy on Selected Project Management Dimensions

Technological advancements and accelerated marketplace changes on a global scale have created enormous strains on organisations. Many companies now realise ITPM can take a leading role in facilitating and enabling such changes (Koskela and Howell, 2002). Project management knowledge gaps among the project team members and other stakeholders can result in serious consequences, such as delays, budget changes, and unmet expectations. This section discusses more perspectives of various authors regarding the four key dimensions of project management, selected for the present study, where knowledge gaps may occur and also regarding the impact of project management tools, leadership and leadership self-efficacy on management progress and outcomes in the selected dimensions. These four areas can be considered key dimensions of any IT project, because they represent the beginning and end stages, ongoing risk management and management of information exchange among team members and other stakeholders in all of four of these dimensions, which is essential in order to facilitate a successful outcome for the overall project.

2.8.1 Communication Management Dimension

According to Bruce (2015), the importance of communication in project management cannot be stressed enough. And every good project starts with a solid communication plan. This is a basic strategy that details what effective communication will look like on any given project.
The aim of a communication plan or strategy is to ensure the ongoing commitment and support of all key stakeholders. Gaps in communication often appear unpredictably and in any number of contexts. An individual can create communication gaps or fall victim to those created by others, but he or she can also eliminate them—or at least reduce the likelihood they will occur (Hamel, 2007). Project communication refers to information exchanges intended to create understanding among project stakeholders (Tang and Zimmerman, 2013). Stakeholders are any group of individuals who can affect or are affected by the project (Jauhar and Tajuddin, 2015), including the local communities, regulatory agencies, customers, project team members, project sponsor, and others that may be involved.

The following are some examples, from the personal experience that motivated this study regarding communication gaps in the management of a given project.

1. Throughout the initial phases of a project designed to implement an approval workflow solution for a high-tech company in the US, the project manager did not communicate the project status to the steering committee with sufficient frequency. The steering committee only became aware of project delays through the submission of additional change requests. These delays negatively impacted subsequent project phases and, ultimately, the product’s release.

2. A network management group, in one of the biggest third-party logistics companies in the US, undertook the upgrade of networking equipment used by its internal customers, many of whom were highly dissatisfied with the group’s service delivery. Customers asked to be involved in the effort, so the network group complied. Nevertheless, customers remained unhappy.

3. A well-liked project manager, in one of the largest internet providers in the US, stopped by the cubicles of several employees on a high-pressure project to see how they were doing and to offer encouragement. She asked one top-notch employee, “How are you feeling?” She was surprised by the employee’s negative reaction.

4. After a team, in one of the largest consumer goods companies in the US that had been tasked with implementing a global transportation solution, wrestled with alternative approaches to solve a challenging problem, the
IT project manager announced the strategy the team would follow. Team members responded quickly and angrily.

Clearly, situations like these can have a damaging or counterproductive impact on projects as well as on the relationships between team members. They result from what is known as a “communication gap,” a term used to refer broadly to any situation in which miscommunication—or perhaps a complete lack of communication—adversely affects either the work being performed or the relationships among the people performing such work.

A common misconception is that such gaps are caused by too little communication. While this is certainly true at times, often the problem is the reverse, and too much communication is taking place (Carvalho, 2014). As a result of over-communication, time may be used inefficiently or tasks may become overly complicated, even if the intention is to simplify the tasks being performed. At times, too much information can confuse and complicate a goal rather than streamline it.

Often, too, the problem is not simply the quantity of communication, but rather the type or quality of communication. Gaps are frequently caused by misdirected, one-way, poorly timed, or badly worded communications. A project manager communicating project success before the user-acceptance phase had been completed and/or prior to client sign-off is a good example.

In addition, some gaps result from misunderstandings, misinterpretations, and/or miscommunications (Yang et al, 2009). Even if an individual believes he or she has communicated his or her points accurately and in an acceptable fashion, others may respond in unexpected or puzzling ways.

Problems occur when faster decision-making tools and techniques are needed than those that exist in a normal operation (Murphy & Ledwith, 2007) and when resources provided by the organisation are inadequate (Remidez & Jones, 2012). As project organisations grow larger and the complexity of the project objective increases, it becomes harder for project teams to manage efficient communication (Remidez & Jones, 2012); project team members representing knowledge areas of different dimensions of the project need to communicate despite possessing different knowledge backgrounds. Therefore, project teams need to understand and operate efficient project communication. Difficulties in managing efficient communication are especially seen in large technology companies with hierarchical structures (Steinheider & Al Hawamdeh, 2004).
When tools for communication are not sufficient, an increase in waste activities, such as response time and search time, appear. A tool for communication is recognized as an object that helps to fulfil the objective of project communication. Information technology, IT, is a tool for communication that enables transmission of information between two or several destinations (Sing, 2008). Achieving efficiency in project communication is a direct ambition for all projects since it is positively correlated with project profitability (Kossai, 2014). Efficient communication doesn’t necessarily mean an increased amount of information shared (Blum et al., 2005). When project managers have strong communication skills that support teambuilding, project performance can be improved by maintaining relationships throughout the project (Remidez & Jones, 2012).

Implementing tools that facilitate communication contributes to increased project communication efficiency (Grudin & Poltrock, 1989). Communication can occur between physically present people or through IT-based solutions; tools for communication can either be based on physical presence or IT-based. Tools are recognized as an object used to achieve a special objective (Kay, 1995). Thus, project communication tools aim to enable information sharing between two or several stakeholders. Information technology, IT, is the technique that allows information to be transmitted between transmitter and receiver. It can also be described as the electronic processing and storage of information (Sing, 2008). IT-based tools for communication can provide communication channels and platforms. A communication channel is the medium through which information travels and a platform are channels by which information flows (Sing, 2008).

The characteristics of a project manager indicate the type of leader and leadership style that the project manager applies during the management of projects (Zulch, 2014). Communication is required for the leader as well as the organization to be efficient and effective (Zulch, 2014). With the help of communication, the project manager can be enabled to share, assert and evaluate his/her ideas (Zulch, 2014).

Reluctant communicators are unlikely to hold influential positions or be perceived by the team members as project leaders. Relationships should exist between project leadership with a high level of verbal participation (Emmitt & Gorse, 2007). Campbell (2011) states that, “good communication and strong leadership go hand in hand”. Project managers succeed by producing projects on
time and within budget as well as by effectively managing the interaction and communication between people and organisations.

To manage a project effectively three types of communication occur: vertical communication, the up and down flow of communication based on hierarchical relationships; horizontal communication, based on communication with peers; and diagonal communication, the upward relationships with managers and diagonal communication with contractors and/or suppliers or team members of other departments (Campbell, 2011). Influential team members often realise that people making the most noise have little relevance and efforts should be made to encourage the reluctant communicators to participate (Gorse and Whitehead, in Emmitt and Gorse, 2007). Those project leaders with considerable communication skills and influence emerge as the dominant communicators, thus the attributes of dominant communicators may be closely associated with those of leaders (Emmitt and Gorse, 2007). Leaders lead through effective communication. Good communication skills enable, foster and create the understanding and trust necessary to encourage others to follow a leader. Without effective communication, a manager accomplishes little. Without effective communication, a manager is not an effective leader. In fact, being able to communicate effectively is what allows a manager to move to a leadership position (Zulch, 2014). As stated by Kouzes and Posner in Kellerman (2012, p. 269) leadership “is not a solo act, it’s a team effort.” Communication therefore is a strong force that influences project success. The project leader needs to develop a leadership style that fosters effective and efficient communication with stakeholders.

Per Zulch (2014, p. 179), “the core skills that project managers need in order to be able to communicate effectively might be for example the skills of writing and speaking. Managers need to be able to structure and write effective and complex correspondence and documents, from emails and memos to proposals and reports.”

Per Harrin (2019), clearer communication sees the highest success rates when project managers take a proactive approach to conveying information, listening to feedback, and recognising the need for open lines of communication among everyone involved in an organisation’s projects. This is consistent with the findings of this study regarding the importance of electronic communication and the effect of project managers with Leadership Self-Efficacy in the communication management dimension.
The corporate communication skills that project managers need to be able to communicate effectively might be for example to be a leader. Effective communication depends on a style of leading the team and the external stakeholders. Leaders will find that, as they move into higher levels of an organisation, they become the project’s face to the public.

2.8.2 Requirements Gathering Dimension

For successful completion, a project should have a quality analysis, a pragmatic risk assessment, a sound business case, and reliable requirement gathering tools. In addition, project developers (project manager and project consultant in this case) should also grasp the business requirements of their clients and the high-level requirements typically provided by management and a board of directors. Business processes and requirements are linked inextricably to both a company’s vision and to a project itself. Closely coupling these processes and requirements is not only desirable, but also inherently critical (Iqbal and Khan, 2012).

Hall (2019) commented, “I often ask project managers the reasons for project failure. One of the top responses is a lack of leadership and sustained engagement by the project sponsor. The sponsor paints a fuzzy picture of what they want, throws it over the fence to the project manager, and goes on their merry way.” According to Hirsch blog (2013), requirements are the demands, needs, and specifications for a product as outlined by project stakeholders. Requirements are what the customer needs. Requirements can also be many types. They can be product related requirements, performance requirements, quality requirements, project management requirements, etc. Accurate and complete requirements is the responsibility of the project manager and he/she needs to make sure the requirements gathering phase is handled according the project specifications. Although it is a challenging skill to master, effectively gathering user requirements is a critical first step for any project. Without a well-designed discovery phase and requirement gathering tools directed by the project manager, a project’s design and execution will not reflect the actual deliverables of the project. This will ultimately impact both its timeline and budget. It is vitally important, then, for a project to be built upon well-formed and verifiable user requirements to avoid cost overruns, unsatisfied users, or even project cancellation (Yang et al., 2009).
According to Joubert (2019), the project manager has always been important to the function of business, and he/she is only getting more important as time goes by. Per McIntire (2017), the requirements gathering tool functional decomposition "helps manage complexity and reduce uncertainty by breaking down processes, systems, functional areas, or deliverables into their simpler constituent parts and allowing each part to be analysed independently." Gerush (2017) found that functional decomposition drives the connection between business goals and development tasks. Specifically, it advances projects through the process of: 1) Taking business initiatives and defining the capabilities required to support them, 2) Breaking the capabilities into features or epics, and 3) Writing those features or epics as user stories for the development team. The key is linking the user story back to the business initiative it supports in order to drive a successful requirements gathering phase.

Per Gupta (2019), use cases, another requirements gathering tool, in simple words are exact statements written in an informal manner depicting the specific action that the user is expected to do while dealing with a particular functionality of the product. Gupta stressed that project success is greatly tied to clear and detailed requirements. Detailed documentation of an IT project use case diagram provides detailed requirements that lead to detailed design and successful implementation. The statistical findings in this research support Gupta’s claim.

One challenge to gaining this level of understanding is users’ frequent difficulty explaining exactly what they need. Problems related to this issue only increase when developers fail to translate their requirements into working programs. A “requirements-gathering gap” occurs whenever a discrepancy arises between the true user requirements and what has been gathered (Niu and Easterbrook, 2009).

Such gaps occur when the business requirements, as stated by users, are misunderstood by the team designing and constructing the application under development. Requirements may also be incomplete, even if this is not due to the users’ negligence (Pandey et al., 2012).

It seems obvious that the IT project team—composed of the IT project manager, analysts, programmers, and testers—should have a clear understanding of the business requirements as expressed by a project’s users; otherwise, this team would have no hope of launching an application (Nienaber
and Barnard, 2007). Unfortunately, these needs are often expressed in a language
unfamiliar to members of the team. While users tend to give requirements in terms
of their job responsibilities or the metrics of a business, IT personnel use a
vocabulary built on systems. These differing languages may produce a
requirements-gathering gap (Didar and Chad, 2005).

Requirements management is a critical part of the project manager
leadership skill, not only for software, but for all products. Well-articulated
requirements are the underpinning of any project, while poorly expressed
requirements produce one of the most challenging situations a project manager
may face (Bloch et al., 2012). There are frequently hundreds, if not thousands, of
requirements for any given project. When these requirements are poorly explained
or poorly understood, project managers and teams are encumbered with an
impossible task because they are left to guess what is needed (Lindbergh and
Hass, 2011). Requirements should, therefore, be well-written, quantifiable, and
testable (Mulla and Girase, 2012).

Beginning a project with a solid understanding of its requirements and using
an effective requirements management system/tools are critical to a project’s
success. While it is difficult for all projects to maintain requirements stability
throughout the duration of their life cycles, change can be controlled to some
extent. It is the responsibility of the project manager—through use of a good
requirements management system—to minimise changes to help mediate
requirements gaps (Davis et al., 2006).

Requirements must be accurate with regard to what a product must deliver.
The general source of these requirements is the customer or end user. A
knowledgeable user can determine if a requirement is correct and realistic.
Because of this, having users and functional experts involved throughout the
requirements gathering process is invaluable to product development. These team
members can save others on the project team a considerable amount of trouble
and wasted effort. Without their expertise, the project manager and team are only
able to speculate as to the reality and/or attainability of a requirement.

Requirements must also be unambiguous. Multiple readers should come to
the same understanding of what each requirement means. If a requirement can
be interpreted in numerous ways, this will inevitably produce negative impacts on
the project (Weill and McDonald, 2010). In addition, all requirements must be
feasible and achievable. In other words, the product in question must be able to
be created with available technology and with the time and money available to the project team (Azar et al., 2007).

While especially critical in software development, it should be possible to trace a requirement from identification through development to verification for any project. To assist in this endeavour, requirements should be written using the same terminology and the same standards throughout the various facets of the project. Such consistency will not only help ensure traceability from start to finish, but also help organise requirements into defined categories. This will allow the project team to more easily and quickly identify duplications, inconsistencies, and contradictions in a project’s development (Robertson and Robertson, 2011). For software projects, in particular, linking the design elements, source code, and test cases is a time-consuming, but vital function. If these cannot be linked from beginning to end, it is impossible to discern if the initial requirements have been met (Leffingwell and Widrig, 2003).

Without properly articulated requirements, client expectations and needs frequently remain unmet because project managers cannot gauge if the project is moving toward a successful completion. Communicating good requirements, especially in written form, is time-consuming, but time ultimately well-spent if it expedites processes at other points in the life cycle of a project. Writing good requirements comes with practice, thoughtful consideration, and sufficient review and discussion (Majumdar et al., 2013). Following these basic rules can aid in good requirements development (Dick et al., 2012):

1. Keep users involved;
2. Develop and refine requirements;
3. Define and use consistent terminology;
4. Organise requirements;
5. Monitor and/or track development and changes;
6. Document all requirements and changes, as well as the reason(s) behind the changes; and
7. Make requirements management one of the repeatable processes of PM.

In order to avoid gaps in requirements gathering, a project will also need tools for tracking requirements from initial identification through deployment. Organisations will want to examine which resources, preferably those already owned to avoid extra costs, best meet the project’s and project manager’s needs.
These resources should allow for identification and tracking throughout the development process, as well as provide an audit trail of all changes, who made them, and when they were made. Project management tools should also have the capability to present information in different ways (Kimball, 2011). For small projects, a simple spreadsheet is often sufficient, while larger, more complex programs with hundreds or thousands of requirements need a resource designed specifically for requirements management. Through whatever process requirements are tracked, project managers should keep the audit trail up to date. A record of both current and historical requirements should be kept, including any that are deleted, because requirements may resurface (Davey and Parker, 2015).

Even if requirements gathering and process gaps are eliminated, translating business requirements into a useful system is still a daunting task (Boehm, 1988). If all projects were stable and static—with no external drivers, such as changing market conditions, competitive developments, and new technology requirements with which to contend—the smooth progression from process requirements to design and implementation would be more easily achieved. Yet, seldom, if ever, is this the case. Projects should, therefore, progress and adjust with the dynamics of the business (Savolainen et al., 2012). To meet this need, PM tools that enable the project manager and team to react to external influences and overcome difficult transitions should be employed (Coughlan et al., 2003).

According to the Project Management Institute (PMI), the rate of effective and successful requirements gathering improves by approximately 40% when project managers possess and nurture the ideal skill set, i.e., a powerful mix of technical, leadership, and business management expertise (PMBOK, 2013).

2.8.3 Risk-Management Dimension

According to O’Quinn (2019), it is impossible to talk about project management without talking about risk. The gap between research and practice is strikingly evident in the area of IT project risk management. In spite of more than 30 years of research into IT management risk factors, the adoption of risk management methods into actual practice has been inconsistent (Carbone and Tippett, 2004), resulting in what is known as a “risk-management gap.”
In its most basic form, the science of risk management (RM) developed during the Renaissance. Over the many years since, it has slowly matured into its modern incarnation. Since 1990, a number of authors have proposed a wide range of processes in the sub-area of risk management process (RMP). This range of processes highlights a level of variation making ITPM more complicated for many IT project managers (Alhawari et al., 2012). Managing risk in IT projects remains a key challenge for many organisations (Chapman and Ward, 2004). Risk response planning is an essential aspect of project risk management and the responsibility of the IT project manager. Chand (2019) commented, “project risk is an uncertainty that cannot be avoided, but it can definitely be managed. Managing risk through a risk assessment checklist is very important, especially when it comes to project management, as the risk can impact your project positively or negatively. But in either case, your final outcome will be deviated from what you have promised. Thus, project risk management becomes a vital skill that every project manager must possess to ensure the success of their projects.”

In many projects, risks are identified and analysed in a random fashion (Jun et al., 2011). This can be fatal to the success of the project in question as unexpected, abrupt problems often arise and must be dealt with on an emergency basis. Very early in the preparation and planning stage, therefore, it is essential that potential risks be identified, categorised, and evaluated so that they can be defended against in a planned and measured manner. Rather than look at each risk independently and randomly, it is much more effective to identify risks and group them into categories or to draw up a list of categories and then identify potential risks which may develop within each one. In this manner, common influences, factors, causes, potential impacts, and potential preventative and/or corrective actions can be discussed and agreed upon (Chapman, 2006).

Categorising risks is a means of not only systematically identifying them, but also of providing a foundation for awareness, understanding, and action (Choi and Ahn, 2010). While each project will naturally have its own structure and differences, there are some relatively common categories existing across projects. Examples of such are “operational” teams discussing issues such as availability, delivery timing, cost, capability, necessary conditions for operation, and stakeholder teams identifying the potential risks generated (examples: selecting the wrong database system or system vendor goes out of business). Once risks are categorised, the potential actions to mitigate them should be documented in a
risk-management plan and discussed at all key stages of the project’s development (Cooper, 2003). The actual actions taken to address risks and the outcomes of these actions should also be recorded and reviewed so lessons may be learned and applied to future projects (Hillson, 2004).

Many project managers become concerned with their ability to manage the risks they may encounter. Because evaluations are rarely conducted to determine the expertise, experience, and capabilities of the individual, team, or organisations in place to manage such risks; these individuals or groups may be ineffective in dealing with risks if they do occur (Cooper, 2006). This is often the case when the planning team is not the same as the project team charged with executing the project in question or when key individuals on the original project team leave and are replaced by individuals with different skills, experience, and capabilities. Because of these factors, each potential risk needs to be carefully analysed and the project team, supporting individuals and teams, and the organisation(s) involved in managing the project should all be evaluated to ascertain their capacity to successfully manage it. Where gaps in capabilities are identified, corrective action, suitable to the situation, must be taken. Throughout the life cycle of the project in question, the capabilities of these individuals and groups should be monitored and supplemented as necessary to ensure potential risks are adequately addressed (Hyvari, 2006).

One such potential risk involves conflict over practical PM tools (Bakker et al., 2010). Frequently, this type of conflict occurs near the midpoint or at later stages of a project’s life cycle because new, unforeseen demands arise and are given a higher priority than those already in existence. This can lead to tools originally allocated for one aspect of the project being taken away or reduced in quantity or quality, generally to the detriment of the project as a whole. To prepare for a dilemma of this type, the management team of a project should proactively include this as a major potential risk as well as secure and continually monitor allocation agreements (Kwak and LaPlace, 2005).

Fundamentally, many of the issues related to risk assessment involve determining the proper instruments to assess and manage risk. Often, the responsibility of identifying, assessing, and managing risk is left to the project team, especially once the project has started. There are, however, other individuals and groups who can monitor particular activities and provide feedback to the leader of the project team. They include the client, the project’s sponsor,
key specialists within the project team’s organisation, and the major external participants (i.e., disaster recovery consultants, system engineers, etc.) (Dey, 2010).

Project risk can be defined as a “measure of the probability and consequence of not achieving a defined project goal” (Zwikael and Ahn, 2011). Risk management dynamically minimizes risk levels by identifying and ranking potential risk events, developing a response plan, and monitoring actively during project execution (PMI, 2013). One of the most commonly used risk management tools in project management is the risk register. This is basically a repository for all risks identified including information such as risk probability, impact, countermeasures and risk owners. Risk management is considered as the tool that limits the effect of unexpected events or prevents such events from happening. Therefore, risk management contributes to overall project success (De Bakker et. al., 2011).

Most authors use the term risk management tool in a broad sense, including not only special purpose tools such as risk registers, but also practices and processes likely to contribute to the management of risks in projects. Organizations that report better project management performance use certain tools in their risk management processes (Ackermann et. al., 2007). The tools support the implementation of a generally agreed upon process, with differences between them in implementation methodology, such as variation in the level of detail or assignment of tasks to steps and phases. These tools include the assessment of risk impact, ranking and classification of risks, and additionally periodic review of documents (Raz & Michael, 2001).

The notion of risk efficiency is central to the theme of project risk management. All risk management processes consume valuable resources and can themselves constitute a risk to the project which must in turn be effectively managed. The level of investment in risk management within projects must be challenged and justified on the basis of the level of expected benefit to the overall project (Chapman & Ward, 2007). However, the issues processed by the risk management process are uncertain. When a risk does not materialise, it may be that the risk simply did not occur, it can be due to either good risk management or erroneous risk identification. If the project budget is thus underspent, is it possible to explain this underspending in terms of the effectiveness of risk mitigation measures. The effectiveness of the risk management process is difficult to
measure in isolation. This difficulty in explicitly attributing project outcomes to risk management is particularly acute in contexts driven by performance such as engineering and manufacturing (Irizar, 2014).

### 2.8.4 Project Support Transition Dimension

New projects and programs often have multiple releases to various business units. These releases can easily place the project into what is commonly identified as the “project support transition gap.” This gap develops in the period between the completion of a project by the project development team and its delivery to the designated support team. During this time, the likelihood of errors and/or misunderstandings entering into a project significantly rises (O’Sheedy, 2012). Project teams, specifically, run the risk of facing challenges when the initial release is not properly transitioned to an operational support model. When this occurs, team members may continue to work on the next release while struggling with the transition support role. In such a scenario, the project team quite often ineffectively balances operational activities with key project deliverables. Without defined operational roles and responsibilities, project teams endanger future releases and suffer from role confusion (Aghion and Schankerman, 2000).

According to James (2015), the final phase of the project is project transition to support. In this phase, project team members are transferred from the project, all the required documents are archived, and the support team is trained on how to maintain the health of the final product. After completing all the formalities, the project client takes over the product that has been built by the project development team. Even though project support transition is an end stage of the project, project managers need to plan for the transition to the support team in the early stages of the project; he/she need to make sure the plan is in place to handle this final phase smoothly. Levin (2010) indicated that every organization wants to make use of project management to deliver its products and services with superior outcomes and benefits that can be sustained for its customers and users. If the organization can implement knowledge management effectively, it is the key to success in project management and thus could transform the organization to excellence. Levin argues that knowledge management must become an integral part of each project professional’s daily project work. She suggests that it is necessary to integrate knowledge bases to projects so the people involved in the
project can combine individual contributions to those of the project’s objectives and align with the organization’s strategic objectives. Knowledge is created via projects, and continuous creation of innovative knowledge is essential for the survival of organizations. Per Makar (2018), “Enterprise projects and programs often have multiple releases to various countries and business units. Project teams run the risk of becoming lost in transition when the initial release is not properly transitioned to an operation support model. In this scenario, the project team continues to work on the next release while struggling with the transition to support role. The project team ineffectively juggles operational activities with key project deliverables. Without defined operational roles and responsibilities, project teams endanger future releases as well suffer from role confusion.” This puts the burden on the IT project manager to lead the effort to transition the completed project phase to the support team and free the project team to work on the new releases; otherwise, it is going to impact the project’s new phase and success, in terms of schedule and budget, because the project team is not dedicating their full time to implement the new phase.

Take, for example (Highsmith, 2009), the following scenario involving an IT organisation, in one of the biggest automotive suppliers in Michigan, USA, that attempted to implement a new financial accounting package over six months with two planned releases. The first release was implemented for one-third of the organisation, and the second release was scoped for the remainder. The first launch faced challenges because the system experienced transition support issues, and the business partners did not believe the system was stable enough to support the remaining two-thirds of the organisation. When the team reached the point at which a decision for the second release had to be made, the business partners and the project team decided to postpone the launch for thirty days.

The key reason for this delay was not a product deficiency or the existence of any outstanding transition support incidents, but concern over the instability of the application and lack of sufficient operational support. After further investigation, however, this instability was determined to be merely a perception rather than a reality. The application response time was acceptable and the web server never went down; the system functioned as designed. It was determined that the perceived instability was related directly to a lack of response from the support team due to the operational support never transitioning properly (Highsmith, 2009). The project team continued to respond to operational issues,
while also trying to deliver the next release of the software implementation. Because the project also relied on multiple vendors to manage integration with the software product, still more challenges arose as the various vendors raised operational issues at multiple points of contact, resulting in confusion. Once the decision to defer the launch was finalised, the project team members became defensive and expressed disappointment with the lack of ownership for these struggles as well as with the lack of recognition for the long hours they spent delivering the second phase and transition to support (Highsmith, 2009).

As illustrated by this example, the project support transition gap can create significant levels of inefficiency and trouble, hindering a project’s success. In addition, the exploration of the literature found that very little research has been conducted on this particular knowledge gap, which suggests further investigation is needed.

The above discussion of knowledge gaps emphasises another aspect of the challenging role a project manager plays. The perspectives expressed by the cited authors emphasise the problems that gaps in knowledge sharing, in these four dimensions of IT projects and IT project management, can cause. The literature on these areas of project management provided background on and support for the selection of these four dimensions for the present study’s abbreviated IT project model.

2.9 Conclusion

The topics reviewed in this chapter where chosen for two distinct purposes: first, to provide a foundation and context for the study and, second, to understand how the findings of this study might benefit actual practical project management in organisations. Leadership research is arguably one of the prevalent topics, but it is also challenged by both the situational nature of leadership and difficulty in agreeing on a definition for the term itself.

Additionally, organisational change has evolved from being a linear, cause-and-effect style event to a highly complex, system-type phenomenon. Companies strive to evolve effectively and efficiently in light of external changes and internal opportunities. The systems approach to organisational change adds to the complexity of determining factors that leaders can and should address to achieve organisational goals. Social cognitive theory, more specifically, the concept of self-
efficacy, introduces an interesting factor linked to employee motivation. Where human capital is increasingly viewed as an organisation’s most valuable resource, it is arguably also the most variable. Self-efficacy is malleable and, as such, provides managers with the opportunity to address specific opportunities to help employees develop their self-efficacy which may in turn positively influence self-confidence, motivation and performance.

The above exploration of literature has clarified the situation of IT project management, its resources and developments, and also many of the inadequacies of project management methodology, lack of support, appropriate tools, and resources. The review included literature that highlights the importance of understanding the multi-dimensional structure of many IT projects and how all aspects and phases can be crucial to the smooth progress and final outcome of a project. Perspectives and examples from various authors also support the selection of communication management, requirements gathering, risk management and project support transition as the dimensions to be investigated in the present study and their representation of the multi-dimensional nature of IT projects.

The literature review has also elaborated the surrounding context of project management in a changing and globalizing world on the large scale and the company culture immediately surrounding a project. Furthermore, previous research has addressed management and leadership as important in project management and also recognises a shift toward the need for more leadership. Leadership is needed to manage not only the accomplishment of tasks on a project but also to mentor and develop team members confidence, skills and promote their value and the importance of their contributions to the project so that they feel personal purpose and satisfaction in their work. Many organisations are recognizing that human resources in the form of effective, confident, skilled, and involved workers may be the most valuable asset a company or organisation may have.

This brings leadership to the forefront, both as a needed element in actual project management and as a factor that needs to be studied in research. Leadership also needs to have a greater presence, as a topic and as a skill to develop and hone, in the training programs and ongoing development of project managers (and other employees). Here the quality of Leadership Self-Efficacy is involved; even though leadership training can educate someone in many aspects
of leadership, adopting the behaviours and investing oneself into the leadership role clearly varies greatly among individuals in leadership positions. The literature includes studies regarding leadership and Leadership Self-Efficacy but also confirms various and sometimes differing perspectives on the definition, identification and the ways a person may come to possess the property, or quality, of Leadership Self-Efficacy and also how to develop high level practical leadership skill. In view of the perspectives uncovered in the literature, the present study has focused on Leadership Self-Efficacy, rather than the larger concept of “leadership,” as the target to investigate. The literature review has also found a lack of data-based studies that concretely assess the implications of Leadership Self-Efficacy in practical project management and move the research into a more quantitative realm while continuing to use qualitative data which is always essential in studying a personal quality. This has prompted the use of quantitative analyses in the present study.

Bobbio and Manganelli (2009) constructed a multidimensional scale to measure Leadership Self-Efficacy. Through reviewing other studies and theoretical analysis, Jacobs, and Kamohi (2017) conclude that project managers now require deeper, intrinsic and more personal qualities, than what has been focussed on through the years, in order to thrive in their role. In the present research, the author utilised Bobbio and Manganelli’s (2009) Leadership Self-Efficacy scale to measure participants’ LSE level and then use LSE as a variable in a quantitative analysis to statistically prove the impact of IT project managers’ Leadership Self-Efficacy on the odds of successful outcomes at the project dimension level. Thamhain (2013) and Nakayama and Chen (2016) qualitatively researched the effects of using project management tools; however, their studies were generic and did not quantify the impact of project management tools on project success at the dimensional level. In the present research, along with finding the impact of IT project manager Leadership Self-Efficacy on the odds of IT project success at the dimension level, the impact of IT project management tools, independent of project managers’ LSE, on increasing the odds of success of an IT project at the dimensional level is also found to be a favourable impact.

As put forth in Chapter One, the ongoing problems in IT project management have motivated the present study, and literature has confirmed many of the factors identified in the personal IT project management experience of the author, his colleagues and IT professional workshops and conferences.
Understanding the skill of leadership, in combination with management, is a key reason for the study. The literature has provided confirmation for the perspective taken in this study and has offered vast insight into the concepts of Self-efficacy and Leadership Self-Efficacy on which the present study builds. In particular, the background research and work in survey and questionnaire design for identifying management styles, leadership styles and Leadership Self-Efficacy provide an understanding of elements associated with Leadership Self-Efficacy and serve to identify and measure it. Furthermore, this area of the literature indicated that LSE measurement scales have been developed and are available. Measuring the LSE level of the participants of this study is one of the three types of data used in the quantitative analysis. The LSE measurement questionnaire used here will be described in Chapters Three and Five. From the base offered by previous research on LSE, the present study further expands into finding a relationship between Leadership Self-Efficacy and project outcomes at the project dimension level with reliable statistical evidence.

Next, Chapter Three explains the research approach, design, and details of the research method.
3 CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter explains the framework of the research and the methods used for data collection and data analyses. The research design of the present study is based on the author’s knowledge and background of IT project management and his knowledge of data analyses methods. Selected types of data were collected directly from IT project managers regarding their understanding and approach to leadership, their use of selected IT project management tools, and their evaluations of the success of projects they had personally managed, especially in terms of success in four dimensions of the projects. This data provided details that could be analysed for identifying possible connections between Leadership Self-Efficacy and IT project success or failure in the selected project dimensions, and also the connections between eight IT project management tools and dimension success. (See Appendix A1 regarding the background of the problems to be investigated and the development of the design of the research model and research instruments.)

By addressing these two relationships at the project dimension level, the data requested from participants is more specific, facilitating participants’ ability to provide relatively accurate information. Additionally, analysing dimensions gives a detailed view of the underlying work of project management in various project areas, each of which contributes to the success or failure of the whole project. The overall outcome of a project is dependent on the outcomes in all the dimensions.

The results obtained from studying the two relationships of the factors of LSE and ITPM tool use and project success at the project-component level of the dimension should also provide insight into the relationships between project managers’ LSE and ITPM tool use and overall project success.

As a solid foundation of previous data-based studies statistically identifying a relationship between LSE and overall project success was not found, the present work takes a first step toward finding statistical evidence with a realistic approach using a feasible and reproducible method and an abbreviated version of a project consisting of four basic project dimensions and two commonly used ITPM tools specific to each.
The specific research aims, objectives and the research questions have been explained in Chapter One (Sections 1.2 & 1.3). Next, the research approach, design, methods, materials and participants are described in detail.

3.2 Research Approach

The term “research approach” relates to one’s belief regarding the manner in which data should be gathered, analysed, and used (Gliner and Morgan, 2000). In the Western scientific tradition, two major philosophies regarding how to do this have been identified: positivist — sometimes called “scientific” — and interpretivist (Galliers, 1991; Thomas, 2003). The positivist philosophy makes use of quantitative evaluative methods as it involves numerical measures; the interpretivist philosophy makes use of qualitative evaluative methods as it focuses on the examination and explanation of text, material culture, and other content-dependent evidence (Creswell, 2008; Muijs, 2010). Research incorporating both approaches is known as mixed research methods, which is the approach applied in this study.

The mixed research methods approach can offer added value by increasing the validity in the findings, informing the collection of the second data source, and assisting with knowledge creation. Using a mixed research methods approach helps researchers gain a deeper, broader understanding of the phenomenon than studies that do not utilise both a quantitative and a qualitative approach (Molina-Azorin, 2011). Mixed research methods also help researchers cultivate ideas for future research (O’Cathain et al., 2010). In addition, researchers state mixed research methods is the only way to be certain of findings (Coyle and Williams, 2000; Sieber, 1973) and interpretations (Morse and Chung, 2003).

The mixed research methods approach was adopted for the present research where 1) both qualitative and quantitative data were collected and 2) where the same topics were addressed with more than one analyses. (See Figure 3-1.)

The qualitative method was applied in the collection of recorded interviews conducted with a semi-guided approach to allow for expanded discussion of topics concerning management, resources and tools in four dimensions of IT projects. The interview transcripts were analysed both qualitatively for content and later were analysed quantitatively using the word2vec algorithm to find and calculate
associations between selected word pairs in the text data of the interview transcripts that had been pre-processed for word2vec. The word2vec analysis showed results for two groups of project managers: those with high LSE scores and those with low LSE scores.

Quantitative data was collected by two survey instruments: 1) a survey to measure Leadership Self-Efficacy consisting of 21 questions with a six option Likert Scale from “strongly disagree” to “strongly agree” and 2) a Yes (1) or No (2) survey of the use or not of two IT project management tools in each of four project dimensions and the successful or unsuccessful outcome in each dimension for 10 projects managed by the participant. This data was analysed with Logistic Regression to explore the relationships of 1) LSE and project dimension outcome and 2) each ITPM tool and project dimension outcome.

The word2vec analysis of text data taken from the interviews also concerned LSE, project outcomes and ITPM tools in the four dimensions. The interviewees’ qualitative responses also addressed these topics.

To consider all the data types for corroboration, support or complementation, a triangulation technique was used. Figure 3.1 shows the overall flow of the research process.

![Figure3-1 Process of data collection, analysis and overall analysis with triangulation](image)

Further details regarding the research instruments, data collection and analysis are given later in this chapter.
3.3 Research Design

The following subsections will describe participant selection criteria, participant recruitment, a description of the actual participants, types of data, data collection, and data analysis methods.

3.3.1 Sample: Qualifications of Target Participants

**Identifying appropriate participants**

Primary data, collected in a straightforward manner directly from respondents, is essential information to a research study (Taylor and Bogdan, 1998). Marczyk et al. (2005) state the use of surveys is a critical step in defining the outline of an investigation and collecting such data as surveys are expressly designed to obtain specific types of information. Experienced IT project managers were needed to answer the research questions. ITPM business leaders formed the available population for this study. Twenty-nine IT senior vice presidents and directors of project management from various states in the United States and some parts of Mexico who had handled 1,000+ projects in 400 different companies across 4 industries (high-tech, retail, automotive and logistics) were invited to participate. Inclusion criteria for this study were that each individual: a) had served as IT program and project manager; b) had been involved in the IT project management field for ten years or more; c) had overseen ten or more projects with spending plans of at least one million dollars; and d) could read and understand English.

**Determining the Sample Size**

A relatively small sample size was considered due to the challenge of finding a large number of IT professionals with the required experience to accept a two-hour interview. The limited resources of this project also put constraints on the amount of travel and time available for interviews. Numerous sources in the literature discuss small samples and when they are appropriate. According to Atran et al. (2005), because qualitative research is very labour intensive, analysing a large sample can be time consuming and often simply impractical. Furthermore, Mason (2010) clearly stated that if the sample is too large, data becomes repetitive and, eventually, superfluous. Jette et al. (2003) suggested that expertise in the
chosen topic can reduce the number of participants needed in a study. Morse (2000) adds “the scope of the study, the nature of the topic, the quality of the data and the study design” (p. 4) have a big impact on the required qualitative sample size. Charmaz (2006) suggests that a small study with “modest claims” might achieve saturation quicker than a study that is aiming to describe a process that spans disciplines. Lee et al. (2002) suggest that studies that use more than one method require fewer participants. According to Bertaux (1981, p. 35), the smallest acceptable sample size for all qualitative research is fifteen. On the other hand, Creswell (1998, p.64) suggested five to twenty-five; Morse (1994, p. 225) said at least six. The most common sample sizes were twenty and thirty (Morse, 2000).

The sample size in the present study was determined using the principal of theoretical data saturation. Theoretical saturation is a point at which observing more data will not lead to discovery of more information related to the research questions. Theoretical saturation is closely related to grounded theory and was originally defined by Glaser and Strauss (1967, p. 2) as “the point at which no additional themes are found from the reviewing of successive data regarding a category being investigated.” Support for determining sample size based on the theoretical saturation was found in the literature. Morse (2000) suggests that if saturation is the guiding principle of qualitative studies, it is likely to be achieved at any point, and is certainly no more likely to be achieved with a sample ending in a zero, as any other number. Vorberg and Ulrich (1987) hypothesized that twenty to thirty in-depth interviews would be needed to uncover ninety to nine-five per cent of all relevant data.

The theoretical saturation subsequently sets the sample size, using theoretical sampling (Ando et al., 2014). This principal is particularly relevant to data analysis with Natural Language Processing (NLP), which is used in this study. The necessary number of participants was determined to be twenty-nine IT project managers, providing enough diversity to cover the scope of topics concerning project management approaches and the use of tools to bridge knowledge sharing gaps in each of the four selected project dimensions, and viewpoints on needed changes and improvements in the project management profession toward improved project execution and increased success in project outcomes. At the same time, the degree of repetition of factors, approaches to ITPM, viewpoints, concerns, suggestions and comments from this number of participants would
allow identification of common elements in the analysis of the interviews. And it was expected that this number of participants would also allow for adequate amounts of survey data to be collected during the meeting with the participants. A back-up plan was also in place in the event that saturation had not been reached after twenty-nine interviews, in which case, two additional interviewees would have been added, incrementally, until saturation was achieved.

Thirty-eight people were contacted and twenty-nine participated. Respondent demographics were compared to a current business roster\(^1\) to determine if the sample was biased in any way, no bias was found.

**Recruiting Participants**

The best way to find participants meeting the above requirements was through professional acquaintances. In fact, all participants were known to the author of this study. While the previous or existing relationship with the participants could be considered an element creating subjectivity, in reality, it seemed to facilitate open information exchange because of shared experiences in facing challenges. This was especially helpful as the study asked participants to talk about failures as well as successes in their IT project management experiences.

Invitations to participate in the study included information regarding the purpose of the study, a brief synopsis of the study, the expected amount of time it would take to participate in a face-to-face interview, contact information for the author, and the name of the dissertation sponsor.

Possible participants were contacted by phone and email. The author personally scheduled and later conducted the interviews. Each participant was telephoned at a pre-arranged time and given the opportunity to cancel or reschedule. If participation was confirmed, consent for the formal interview to be recorded was obtained. The consent form can be found in Appendix A2.

**Confidentiality**

Although all participants were known to the author of this study, with varying degrees of professional relationships, their participation in this research maintains their anonymity. Furthermore, there is no mention of their companies included in

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\(^1\) The business roster used was an internal document of the researcher’s employer and cannot be included in the appendices as it is confidential.
this research as, in transcribing the interviews, all identifying information was removed. Confidentiality is important for the participants—as professionals and as individuals—and for the companies employing them, as well as for stakeholders of projects managed by these participants.

### 3.4 Description of Participants

The criteria to become a participant of this study is described above in Section 3.3.1. All participants voluntarily agreed to participate. The sample is not random.

Gender, age, and work location were not considered relevant to participation; however, those details were collected. Though it is not within the scope of this study to use these items as factors in data analysis, the author recognises they are important and merit consideration in future research. For the purposes of this study, the distribution of gender, age, and work location is considered when balancing the sample for such factors; this is discussed below.

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**Figure 3-2 Demographic Information and LSE Scores**

US=USA, TX=Texas, VA=Virginia, NC=North Carolina, PA=Pennsylvania, MI=Michigan, OH=Ohio, IL=Illinois

MX= Mexico, NL=Nuevo León, CM=Ciudad de México. M= Male, F= Female.

* LSE=Leadership Self-Efficacy score with range of 1 (lowest) to 6 (highest).

In Figure 3-2, participants are ordered from left to right by participant code number (bottom row of Figure 3-2).

At the time of data collection, twenty-one participants were based in the United States; eight were based in Mexico. Thirteen participants were located in Texas, which is largely related to the author being based in Texas.

The age range is from thirty-five to fifty-seven. Years of experience range from ten to thirty-two.
There are thirteen women and sixteen men. Both genders are distributed among the United States and Mexico, in all age ranges and years of experience ranges. The sample does not seem to be skewed for any of these factors.

The participants characteristics will be further considered in Chapter 5.

### 3.5 Data and Collection Procedures

Three kinds of data were collected in this study within the framework of an in-person meeting of approximately two hours. The conceptual framework for the collection of data in this study is depicted below in Figure 3-3.

![Conceptual Framework for Data Collection in this Study](image)

“IT Project Manager” was placed at the centre of the diagram because the project manager’s role forms the focus of this study and the interviewed project managers provided the three types of data. As indicated in Figure 3-1, three types of data were collected: 1) information concerning ten projects, that the participant had managed, which was recorded by hand on the “IT Project Management 10 project details” survey; 2) the measurement of Leadership Self-Efficacy, titled “Project Management Questionnaire;” and 3) the recorded semi-guided interview. The decision to use these three instruments was made with the aim of gaining a range of both quantitative and qualitative information from the participants and to follow up with probing questions designed to get more in-depth information. The interview guide included experiences and viewpoints regarding each of the four project dimensions comprising the research model: communication management, requirements-gathering, risk management and project support transition. The model required a measurement of each participant’s LSE. Information was needed
regarding each participant’s use, or not, of eight ITPM tools often used to facilitate work in the four project dimensions for ten projects he or she had managed. The participant’s evaluations of the success, or not, in each of the four dimensions of each of the ten projects was also needed.

A majority of meetings were conducted outside the work environment at a location convenient for the participant, usually a coffee shop. The researcher travelled to meet the participants at each decided location. Conducting the interview away from the work environment allowed the participant to feel more relaxed, avoid the possibly conversation-restricting work atmosphere, and continue talking without work-related interruptions.

Each participant was asked to bring reports of ten projects he or she had managed. These reports served to refresh the participant’s ability to remember each project and provided the participant with a reference in order to report accurate information on the Project Management 10 project detail survey. These project reports were not given to the researcher, but rather remained the possession of the interviewee.

### 3.6 Details of the Research Instruments

A detailed description of research instrument follows.

#### 3.6.1 Research Instrument One -- Objective Measure Survey of Leadership Self-Efficacy (LSE): Project Management Questionnaire

For this study, a survey is used to collect primary data directly from participants to assess their levels of LSE.

A search for LSE measurement tools that were both psychometrically sound and aligned to the specific aims of this study uncovered two that, with modification, could add credibility to the qualitative findings. The General Self-Efficacy (GSE) scale is, by definition, general in nature and cannot be tied to any particular set of traits or skills. Because of this, many researchers have found it to be a poor predictor of future leadership (McCormick et al., 2002; Platt, 2010). The Leadership Self-Efficacy Scale, however, is a twenty-one-item instrument addressing six highly correlated but distinct dimensions of effective leadership.
(Bobbio and Manganelli, 2009). In light of this, the latter tool was selected and tailored to the selected population for the purposes of this study.

The LSE measurement survey required each respondent to use a Likert-type response scale ranging between one (1) “strongly disagree” and six (6) “strongly agree,” to define his or her abilities through responses for several questions in each of the following categories:

- A change-oriented mind-set;
- The ability to choose followers and delegate responsibilities in order to accomplish tasks;
- Key personal abilities related to communication and management of interpersonal relationships;
- Self-awareness and self-confidence;
- Motivation; and
- Consensus building.

Statements centred on the importance of leadership, the kinds of leadership skills IT project managers should pursue, and the most-commonly used skills. In addition to the questions to assess Leadership Self-Efficacy, leadership styles were added to the questionnaire, asking the participant to indicate their primary, secondary, and tertiary leadership styles. The questionnaire can be found in Appendix A4.

The Leadership Self-Efficacy measurement survey was emailed to participants in advance of the meeting with the objective of saving time and allowing the full two hours for the semi-structured interview. However, no one completed it beforehand; therefore, the first part of the meeting with each participant was dedicated to filling out the Project Management Questionnaire 2016, i.e., the survey measuring LSE, which took approximately twenty minutes to complete. Most participants completed this without any interaction with the researcher; there was an occasional clarification requested and a response was provided. While the participant was completing the LSE measurement survey, the researcher familiarized himself with the project reports\(^2\). When the participant had completed the LSE measurement survey, it was given to the researcher.

\(^2\) As indicated earlier, these reports are not part of the data collected, but rather references for the participant. The researcher was able to browse these reports in the presence of the participant. No copies or notes concerning the content of these reports were kept by the researcher.
3.6.2 Research Instrument Two -- Semi-Structured Interview Guide for Recorded Interview

After the participant completed the LSE measurement survey and submitted it, the researcher confirmed with the participant that the recorder would be turned on, and the semi-structured recorded interview began. A discussion guide was drafted to facilitate the conversation, including questions about the project dimensions used in the research model and the commonly used project management tools used in the management of each dimension. The interview guide can be viewed in Appendix A3.

The interview was recorded for two reasons: first, to confirm information provided by the participants and, secondly, to provide text data that could be quantitatively analysed using the Natural Language Processing (NLP) technique of word2vector.

3.6.2.1 Participants’ Reference Materials: Project Reports

Each interviewee was asked to bring ten reports on projects they had managed. Project reports had to meet the following criteria:

- Projects experienced clear communication problems at all levels;
- Projects experienced issues meeting the timeline due to vague gathered requirements;
- Some projects were to be executed with a clear risk management plan and some were to not have such a plan in place; and
- Projects experienced long transition to support time due to an unclearly defined support transition plan.

Each interviewee was asked to be prepared to discuss the issues leading to the success or failure of each project with regard to the four dimensions selected for this study, to identify practical leadership resources and tools that may have been missing during the execution of the project, and to suggest project management methodologies, tools or other resources that were not available but might have improved the success rate of each project.

As introduced above, these documents were requested to:
CHAPTER THREE: RESEARCH METHODOLOGY

- Give the participant a chance to review and refresh their experience before the interview;
- Allow the participant to respond to the Project Manager Survey from a more self-informed perspective by having prepared the documents;
- Make it easier to talk about the details of each project by being able to refer to the documents; and
- Serve as a reference for the participant to fill out the “Project Management 10 Project Details” form.

3.6.3 Research Instrument Three -- Project Management 10 Project Details

Before the scheduled end of the meeting, the interviewee was asked to fill out the “Project Management 10 Project Details” survey (See Appendix A5), indicating tools used or not used in each project dimension and a declaration of success, or not, in each dimension of ten projects managed. In filling out this form, the participant was asked to use a one (1) for use of tools and for success in the given dimension, and a zero (0) for no use of a tool and for not achieving success in the dimension. As mentioned, while the participant filled out the “Project Management 10 Project Details” form, he or she was able to refer to the actual project reports in order to remember details, supply accurate information regarding the use of ITPM tools, and make good quality evaluations of the success or failure in each of the four project dimensions.

Using this research instrument allowed for the collection of data from 290 projects, ten for each of the twenty-nine IT project managers, varying in degree of success and complexity. This document gave the researcher needed data, collected directly from each participant, in ready-to-use binary form, which could easily be used in the planned quantitative analysis of the same.

3.7 Implementation and Response

The data collection plan was tested, as a small-scale pilot study, with two people in the IT project management field. This was helpful to organise the timing of each part of the meeting and guide the interview so the needed data could be collected within the planned approximate two-hour timeframe, while still allowing some time for expanded conversation.
One of the two candidates selected for the pilot interviews shared the same interest as the author of this study regarding the importance of the project manager LSE trait and its impact on project success. However, the other candidate did not have any background about the impact of LSE on project success. The two pilot candidates helped benchmark the interview process regarding reactions to the interview questions and the time needed to go through the whole interview process.

The two people who agreed to do the pilot also became participants; however, they were contacted as all other participants, scheduled for a meeting, formally interviewed, and requested to do the LSE survey and project check list again.

The first few formal interviews took longer than anticipated, but then the process improved and stayed relatively close to the allotted time period, following the semi-structured interview guide. Since the interviewees had very similar professional experiences as the interviewer, clarifications were rarely needed, allowing the time to be spent on productive data collection. Furthermore, because the interview was recorded, there was no need to take notes which allowed the researcher to give total attention to the conversation with the participant.

Overall, the interviews generally went as planned. Meeting with the participants outside of the workplace did seem to provide a relaxing atmosphere and facilitate open conversation. As mentioned, this was important as the interview process requested the participants to talk about not only their successes but also their failures in projects they had managed in the past. Participants were generally interested in the topic and also saw a need for research regarding the role of and resources for IT project managers. Each of the twenty-nine participants provided a complete set of data, including the Project Manager Questionnaire, the interview and the Project Management 10 project details survey.

A thank you email was sent at the end of each interview (Appendix A6).

3.8 Methods of Data Analysis

Each type of Data analysis is described in this section.
Qualitative analysis of interview transcripts

The interviews conducted were audio recorded, transcribed, and purged of name and place identifiers in preparation for narrative analysis by the researcher. The transcripts were summarised and the content considered from a qualitative perspective (see Chapter 4), considering overall themes and trends in viewpoints.

Quantitative analysis of interview transcripts

The word2vec Natural Language Processing (NLP) technique was utilised to quantitatively analyse selected cosine similarity of word associations in the transcripts to determine differences between the group of higher LSE score participants and the group of lower LSE score participants.

Natural Language Processing is a field where data is inherently unstructured and requires extensive pre-processing, as compared to other fields of data analysis because the data is textual data, meant for humans to read and understand, and not provided in a format for machines to interpret. Any body of text written by humans for humans will need to be manipulated appropriately before use in Natural Language Processing (Collobert and Weston, 2008).

Pre-processing of text data for the word vector algorithm analysis

The present author performed Natural Language Processing analysis using word vectors technique. These vectors were created by training Google's word2vec algorithm using the interview data.

As explained above, the raw text data of the full interview transcripts had to be pre-processed. The steps involved were:
- Converting each sentence into a list of words within brackets,
- Removing any interview guide or interviewer text,
- Removing special characters,
- Assuring all words were in all lower-case characters,
- Removing “stopwords” (examples: “the,” “and,” “or”).

A search word and a base word were selected by the researcher. The word2vec algorithm searches for the co-occurrence of the two words within brackets. The numerical representation of the word association is represented as a calculation of cosine similarity.
The algorithm provides the word association cosine similarity of the given word pair for the LSE group (high score LSE group) and the no LSE group (low score LSE group). So, the purpose of this analysis has a focus on the factor of LSE and the difference in the degrees of cosine similarity between the two groups for a particular word pair.

Full details of the pre-processing are given in Chapter 7.

Word Cloud Visualization

Another text analysis involving word counts in the full text of the transcripts was used to generate word cloud visualizations. These provide a visual representation of the relative frequency that various concepts occur in the transcripts. Word cloud visualizations are created for the higher score LSE group and lower score LSE group in order to compare the results for the two groups as a context.

Quantitative analysis of LSE survey and 10 project details survey data

A statistical analysis was conducted with regard to the LSE survey and 10 project details survey. The frequencies, means, and standard deviations of the participants’ responses in each inventory were determined using Logistic Regression. Logistic regression is a standard approach used for predictive modelling when the dependent variable is categorical in nature (Peng et al., 2002). A logistic model, utilising R and Python packages, was used to calculate the relationship between Leadership Self-Efficacy and the odds of successful outcomes in the four project dimensions of communication management, requirements gathering, risk management, and project support transition. The same model and packages were used to calculate the relationship between each of two dimension-specific tools and the odds of successful outcomes in each dimension.

Binary data

Logistic regression requires data in a binary form. The data from the “10 project details survey” was collected directly in binary form. The data from the “Project Manager Questionnaire,” used to determine LSE scores, was first calculated as the average of the 21 Likert Scale responses (values of 1-6) to
create an LSE score for each participant. Based on their scores, participants were ordered from highest to lowest scores; an average was calculated and the participants were divided into two groups of high LSE score and low LSE score. For the purposes of clear binary data, the higher score group was designated as having LSE, and the lower score group was designated as not having LSE so that they could be coded as 0 (zero) and 1 (one) in the data entry for the logistic regression analysis.

Complete details of the preparatory calculations and the results are given in Chapter 6.

Comparing and corroborating results with the technique of triangulation

Triangulation is a technique of integration combining quantitative and qualitative findings (Bogdan and Biklen, 2007; Erlandson et al., 1993; Lincoln, 2005). This process greatly facilitates validation of data through cross-validation from two or more sources.

The term triangulation emerged from navigating and surveying professions, in which it is used to describe how two known points are used to find the location of a third, unknown point (Farmer et al., 2006; Knafl and Breitmayer, 1991). In his seminal work, Denzin (1978) described four types of triangulation: methodological, data (analytical), theoretical, and investigator. Researchers have both reiterated these categorisations (e.g., Farmer et al., 2006) and expanded them, identifying a unit of analysis as another type of triangulation (Knafl and Breitmayer, 1991).

The use of multiple methods can also include “combining analytic approaches (e.g., constant comparison, immersion/crystallisation, matrices, manual analysis, and computer-assisted analysis), and/or analysing the same data with two different methodological approaches” (Meadows and Morse, 2001, p. 194).

In this study, method triangulation was used as shown above in Figure 3-1 in Section 3.2).

3.9 Ethical Considerations

The translation of information and the reporting of discoveries are required to follow moral rules (Polonsky, 1998). The researcher consciously maintained objectivity in collecting and analysing data so that individual biases were not
allowed to influence the information gathered or the results found through examination and analysis. The steps and rules of ethical research prescribed by the University of Bolton were followed. These are described in the link given in footnote 4.

The respondents in this study were provided with information about its purpose, as well as what would happen with its findings once the study was completed. In order to remain aligned with ethical standards, as mentioned above in Section 3.4.1, confidentiality of identifying information, such as personal names, company names, project names, etc. was assured. Additionally, all original data and participant information remained (and remains) in the possession of the author who has sole access, following the suggestion of Cooper and Schindler (2013). As the recording of information aids in the compiling of complete documentation and facilitates analysis, verbal and written consent for recording the interviews was requested in advance (according to Fisher, 2010). The author made certain to clarify no transcripts would be revealed to the public without prior written permission. If there are publications of all or parts of the present research, any references to participants will be anonymous.

Another detail concerning ethics is the voluntary nature of participation. The participants were volunteers and agreed to provide the answers they supplied in the interviews, the “Project Management Questionnaire” and “Project Management 10 Project Details.” Although each participant was asked to complete all questions, the author reminded them that 1) it was voluntary and 2) if any question was uncomfortable to answer, for any reason, the participants had the option to skip such questions (See Appendix A2).

3.10 Conclusion

In this chapter, a detailed account of the research method from which this study was conducted has been presented. This chapter explained the research plan for this study, the target population and characteristics of the actual participants, methods of gathering information, analyses for each type of data, and

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the use of triangulation to consider the validation of each result in the context of other results.

The research design used an abbreviated version of an IT project based on the four project dimensions (also referred to as knowledge areas) of communication management, requirements gathering, risk management and project support transition. Two commonly used ITPM tools for managing each dimension were included.

The data comes from a non-probability sample of twenty-nine highly qualified IT project managers. Participants with the required experience and expertise were identified within the researcher’s professional network. Each participant agreed to a meeting of approximately two hours within which he/she filled out a survey to measure Leadership Self-Efficacy, a survey of ITPM tool use and project dimension outcomes for projects he/she had managed, and complete an audio recorded interview addressing topics in management of four dimensions of IT projects and IT project management in general.

Survey data was analysed with logistic regression to find the impact or LSE and each of eight ITPM tools on the odds of successful project dimension outcomes.

In order to compare and analyse the data from multiple sources, the results obtained from the data analyses were viewed and interpreted through the process of triangulation (Creswell and Plano-Clark, 2011).

The exploration of background research did not uncover previously conducted data-based studies showing statistical evidence of a relationship between Leadership Self-Efficacy and project success or between ITPM tools and project success. The present research attempts to bridge that gap by providing a reproducible research model that yields statistical evidence that can serve as a base model for future research.

The findings of the research conducted in each aspect of this study will be introduced and analysed in Chapters Four, Five, Six and Seven. Then, in Chapter Eight, the triangulation of the results is shown; a detailed discussion of these results and their interpretations follows in Chapter Nine.
4 CHAPTER FOUR: Recorded Interview Transcripts:
Qualitative Analysis

4.1 Introduction

This chapter presents and discusses the qualitative analysis of the data gathered from the semi-guided recorded interviews with the 29 participants. As explained in the previous chapter, participants volunteered to participate in the study, were informed about the topics and recordings, and consents for recording were obtained. Some of the interviews were conducted at the participant’s place of employment; others were conducted in public places such as coffee shops; the researcher travelled to meet the participant at the agreed upon location. Regarding preparation, the interviewees were informed by their own reports of 10 projects that that he or she had managed during their career in that the researcher had requested each participant to bring these reports to the interview as reference material for 1) the planned semi-guided conversation about their ITPM experiences and 2) also while filling out the 10 Project Details Survey (to be discussed in the following chapter, chapter 5). The semi-guided conversation was, for the most part, a relatively spontaneous conversation, and participants did not necessarily refer to these reports. All answers and comments by participants were voluntary.

As mentioned earlier, these participants were all known to the researcher through his professional network, which facilitated access to these busy ITPM experts and also to easy open discussion since all of them had had similar experiences over the years of their career and had concerns for and an interest in improving the IT project success rate and in increasing effectiveness in project management for themselves and for future project managers. In these conversations, the researcher restricted himself to the interviewer role by introducing the topics and sometimes asking for elaboration in order to keep the focus on the interviewee’s responses. The interviews contain many hours of

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4 These reports themselves are not considered part of the data of this study, but rather part of the preparation for the interviews and 10 Project Details survey, to encourage participants to refresh their memories and facilitate conversation drawing on real personal experience. The degree of preparation for the interview, using these reports, by each participant likely varies. Many participants did refer to particular project reports during the interview.
expert perspectives on IT project management, examples of issues that often pose obstacles, resources and tools that IT project managers need to be effective, examples of adaptations, suggestions for improving resources, views related to training and development and thoughts regarding leadership in the ITPM role.

4.2 Report and analysis of Interview Data

The transcripts of the semi guided interviews with each of the participants were reviewed. All interviewees responded to all questions and most of the transcripts are similar in length and amount of detail; a few were longer. All interviews were recorded and conducted by the researcher. The transcripts of the recordings were prepared by the researcher.

The questions/topics were introduced in the same or similar way in all interviews; the questions posed requested participants to give explanations. (See Semi-guided Interview Guide in Appendix A3.) Occasionally, an additional comment or question was added by the interviewer in order to develop or expand on something the interviewee had mentioned; in some cases, interviewees interjected information and the conversation flow was more spontaneous than in others.

The interview with each participant was semi-guided and geared the discussion toward each of the four project dimensions: communication management, requirements gathering, risk management and project support transition as well as overviews of skills and training needed to do their job as IT project managers and the interviewees’ viewpoints on what changes in IT project management could facilitate the success of new project managers.

The data is summarized and analysed. Examples from particular participants are indicated by the symbol “#” and the participant code number; however, those are examples; the number of participants expressing the same or a similar idea is not limited to the participants cited in parentheses.

The analysis is discussed in terms of the themes that guided the semi-guided interviews. The following is a summary and not quotations unless indicated with punctuation; however, the terms used to refer to ITPM activities, materials and resources are the terms used by the participants as recorded in the written transcript.
In the following discussion, the participants mentioned (by code) are not differentiated by higher and lower Leadership Self-Efficacy scores. The results of the LSE survey is discussed in the following chapter.

4.3 Semi-guided interview responses and analyses

The presentation of the results follows the items on the interview guide. A summary of the content of the responses and, with the exception of item #1, quotations from participants are given. Then analytical observations and comments are given.

4.3.1 Introduction, Needed Training and Skills, Formal Training

1. Talk about your current work, project management activities, and business environment.

The responses to this item generally included the participant’s job, the industry in which he/she is managing IT projects, his/her main responsibilities and years in the position, with the company and/or in the IT field.

2a. What training or skills do you feel you need to effectively accomplish your job?

In responding to this question, numerous participants indicated communication (participants #20, #23, #29) as the most important skill set and setting communication plans (participant #26) as a priority in the project. One participant said, “how to coordinate and communicate (participant #26).” Even more participants specifically mentioned leadership skills as high priority skills in project management and as a core skill. Leadership training was also mentioned. The phrase “how to lead a project” (participants #8, #14, #15, #23) was used; also, how to execute projects and the “ability to simplify project execution (participant #11).

Many participants commented on training as needed for their jobs: training on tools and training on how to use resources. Training on functional, technical

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5 The quotations have been written with standard grammar and spelling. Differences may exist in participants’ actual individual speech, quality of recorded sound, or written transcription, or the recording; however, such details are irrelevant for the present purpose.
and management aspects of project management work, including tools which were mentioned by nearly everyone, as well as training in documentation and the roles and responsibilities of project managers. One participant used the phrase “training on project management framework (participant #1).” Several participants referred to “practical project management training” (participants #17, #7, #5). Management methods and planning skills were mentioned along with relating theory to practice. Leadership training (#16, #25, #29) and communication training (participant #13, #14, #23, #26, #29) were mentioned often.

One participant talked about being familiar with the industry and Industry related training, decision making, how to answer functional and technical questions from the client, and how to plan and execute a project and apply concepts from training (participant #22).

Quotations:

“PM methodologies are really high level and do not get into the details and do not provide tools. Project managers would need to execute each phase and task of his/her daily PM activities. We really need a set of well-defined and detailed PM tools and resources, and we need our current and new project managers trained on them.” (Participant #7)

“Leadership is a really important skill for project managers. Leadership provides ability for project managers to be able to take control of the project whatever the situation.” (Participant #24)

“A project manager needs to have the leadership skills to manage a project and be able to handle the stress that comes with it.” (Participant #2)

“Project planning is key to have a successful project.” (Participant “21)

2b. If formal training How did the training experience shape or influence your business practices?

Many of the comments given in response to this question seemed to imply how the participant thought training should be done or what details it should cover. It was not clear that the comments represented how training had influenced the participant himself/herself. No one stated that they did not have formal training, nor did anyone say they did have formal training in project management.
Nonetheless, their comments are insightful as to what kind of training could benefit IT project manager, and all communicate a need for training.

Tools, using tools and resources were frequently brought up as training issues. How to find answers, how to run a project, how to lead projects, how to make accurate time and cost estimates, and the idea that formal training provides the how-to-do-things aspect of project management. Project communication was another topic mentioned, as were basic project management and leadership. The idea that training should be delivered by project managers with practical experience was pointed out by some interviewees and one person mentioned that training is needed to update skills on an ongoing basis.

Quotations:

“I felt the training I was provided immediately before starting the project impacted my ability to document that project and keep track of documentation from other teams to make sure all documents were available during and after project completion.” (Participant #3, referring to a training for implementing a tracking system)

“Formal example, training in using communication tools helped new project managers to utilise the tools experienced project managers came up with.” (Participant #13).

Analysis
1. It is clear from the expert knowledge of these participants that training on practical tools and resources is very important for IT project managers.
2. These professionals stressed leadership training that will help IT project managers align project teams and control project success.
3. There is a need for project management training in effective areas like communication, how and when to effectively use project management tools and resources.
4. Participants expressed the view that training will be more effective if provided by experienced IT project managers to provide real case scenarios and issue resolution.
Comments

The interviewees’ comments are consistent with the practical situation and practical needs which have been recognized for some time by many professionals. For example, At the 2012 PMI Global Congress conference (October 2012) in Philadelphia, USA, the author had a discussion with Danial P.\textsuperscript{6} (Appendix F2), who at that time was the Vice President of Project Management Office at a major hardware manufacturer, about the importance of project management training and how it should be conducted. Danial’s suggested idea was to have the project management training conducted by project managers with 10 years or more experience in project management. The reason was because project managers with such a profile would have experienced all types of project management methods and tools and would provide real life experience. Danial added that such experience would be more valuable than all the theories around how to execute projects.

At the same conference, the author talked with Andy S. (Appendix F3), who was then Director of Program Management at a major food distributor. Andy’s interest was how the personality traits of project managers would control and drive the project toward success effectively. Andy suggested having experienced project managers with track records of project success conduct project leadership training and workshops to show new and inexperienced project managers how to use project management tools in all project dimensions to increase successful project outcomes.

4.3.2 Communication Management

a. Talk about your communication practices.

The responses to this item indicate that communication is among the highest priorities and is the activity that occupies most of the project manager’s time. Several participants indicted that communication was 90\% of a project manager’s activities (participants \#8, \#18, \#28); one person indicated 99\% (participant \#16), and another indicated more than 70\% (\#19).

\textsuperscript{6} The IT workshop attendees with whom the researcher had person to person conversations are referred to only by first name and initial of the last name at the participants’ requests. Personal privacy is a priority and only participants who agree to the disclosure of their full name will have their name included.
Communication is considered a key skill among all participants as keeping everyone informed and involved in the project work is essential. Communication was categorised in various ways:

- Formal and informal communication
- Written communication, emails, postings on forums
- Informative or for escalation
- Horizontal and vertical
- Internal and external
- Strategic, tactical, execution

The frequency of communication mentioned included inter-day, daily, weekly, bi-weekly and monthly, with different frequency of contact for different groups of stakeholders. There should be consistent update meetings (participant #12). All stakeholders need to be kept informed at various intervals. All teams involved in a project, developmental and quality assurance, need to be in the communication loop. Communication needs to be tailored to the type of project, people in the mix and the type of situation (participant #21). The project manager needs the skill to determine the way of communicating with different stakeholders; the manager must communicate in ways that help the project (participant #11). Other comments indicated the importance of the documentation of communication and having a history of communications that can be referred to as needed.

Participants emphasised the importance of communication and indicated that successful execution of a project is based on communication; projects depend on the communication skill of the project manager (participant #16).

Quotations:

“Project management communication is 90% of the project manager time. Lack of communication fails the project.” (Participant #18 continues to talk about horizontal communication with team members and vertical communication with upper management.)

“Communication is the major role of a project manager, communication either with the project team, with the client or with the executive sponsorship team is the most important aspect of a project manager.” (Participant #27)
“Without effective communication, project execution will not go as planned because each team member will have a different message. It is important to communicate one message to the whole team.” (Participant #29)

**Analysis**

1. Communication has a very big weight in the project manager’s skill set and role.
2. Project managers spend most of their time communicating about all aspect of the project.
3. The type of project manager communication depends of the project task and project situation. For example, informative communication is performed as a weekly/by-weekly status report. Escalation communication is performed daily or maybe twice a day.
4. Project team communication must be continuous and transparent about the project status and project issues to ensure that the entire project team is always aware of the many aspects of the project status.

b. Please outline project communication tools project managers will find necessary.

In a majority of the interviews, this question was answered in the response to question three above. Tools pointed out by participants include: in person and virtual meetings, use of portals and chat rooms, web forums and secure forums, social media, email, whiteboards, escalation communication venues, and calls. Some participants indicated a set of communication practices that they found useful; these sets included various combinations of the aforementioned communication tools.

**Quotations:**

“Have an initial meeting with [the] project team and set the stage for communication frequency: monthly communication with the executive team, weekly communication with the project team, daily communication, and it can be multiple times a day, in case of high (show stopper) issues…Since then, my communication was smooth and successful.” (Participant #8, commenting on the communication tool used in one of the project reports brought as reference material to the interview.)
“[I] created a private blog for the project team to discuss issues and seek help. I feel social media is a very important tool to facilitate communication between project teams.” (Participant #6, discussing the details of communication in one of the project reports.)

**Analysis**

The IT communication management tools in the comments can be categorised into two categories:

1. **Electronic communication**, which takes the form of:
   a. Email communication.
   b. Virtual meeting communication (i.e. Skype communication). This is especially effective for geographically distributed project teams.
   c. Secured portal project management communication. This is especially effective for historical reference of project documentation and for escalation handling and to go back and check previous project communications when needed.

2. **In person communication**:
   a. This takes the form of in person meetings and this is greatly effective for collocated teams in the same geographical locations.
   b. Usually, documentation of the discussion of the meeting is managed by the project manages in the form of meeting minutes and electronically distributed to the meeting attendee’s after the meeting to inform them of meeting discussion and action plan.

**Comments**

The viewpoints about communication of these participants are similar to the perspectives of many others in project management. In June 2011, the author participated in the Dallas, TX, USA, PMI chapter workshop about the impact of project communication in project success. A major discussion occurred after the workshop between the author and David B. (Appendix F1), Principle/Director of project management at a major logistics provider at the time. David’s point of view was that project communication and how to use project communications tools were the key factors in project success. He reiterated that most of the project requirements issues were due to lack of communication, and mainly lack of documented communication that the project team can refer to. He mentioned that
with technological advancement, tools available that allow sharing real time communication with the project team, and project managers should make use of such tools.

Another conversation at this workshop was with Mary S. (Appendix F1), who was at that time Project Management Principle at a major automotive supplier. She also insisted on the fact that documented communication using emails and project portlets are important in order to validate project team commitment. She also mentioned that communication has to be directed to the internal team as well as external (client) team to make sure that everybody has the same understanding of the project status.

4.3.3 Requirements Gathering

a. Talk about your requirement gathering practices.

Participants indicated that accurate and thorough requirements gathering is crucial to project success and smooth project execution, and that it can be a difficult aspect of project management. If requirements are not gathered correctly and accurately, the project will always be in danger and set for failure (participants #10, #21, #22).

Successful requirements gathering makes project management smooth and easy to complete (participant #3, #8). However, there is always a gap, the project manager needs the skill to reduce the gap (participant #14).

Sometimes project managers do not get involved but manage requirements gathering at a higher level, and this doesn’t allow them to evaluate the quality of the requirements or to understand how they can impact the project (#4, #20, #23). Project managers need to be present and involved in requirements gathering (#26, #27). Project managers need to know when there is scope creep and how to evaluate it (#13). And they need to know how to ask the right questions. One participant explained that requirements gathering needs to have its own phase; it cannot be mixed with other phases (participant #24).

Several participants commented on the need for practical tools to manage this aspect of projects. For example, project managers need a tool to help them measure the requirements’ accuracy and validate requirements and also something like a requirements portal (participant #2). Some participants talked about a “discovery” phase and the need for a tool within discovery to validate
requirements. Other participants mentioned the need for a requirement gathering framework.

Quotations:

“Requirements gathering is one of the phases that most project managers are not really heavily involved in. They usually act as pure time and scheduling experts without diving in the details of gathering to be able to determine the impact on project plan and project deliverables.” (Participant #23)

“Requirements gathering is very difficult to define, and there is always a gap in requirements gathering. But I feel the project manager should have the ability to reduce the gap.” (Participant #14 continues by describing an example used in one of the project reports.)

“If project requirements were not clear and detailed, the project will be in a dangerous status and set for failure.” (Participant #22)

“We really [need] a defined requirement gathering questionnaire that can help facilitate requirements gathering.” (Participant #11)

Analysis

1. The participants concur that requirements gathering is very important to shape the project outcome.
2. The IT project manager’s role is to be effective in reducing any requirements gap.
3. IT project managers play a pivotal role in requirements gathering. Even if they are not performing it directly, they must oversee and control the whole requirements gathering phase.
4. To support the requirements gathering phase, IT project managers will need proper project requirements gathering tools to evaluate the completeness and quality of the requirements gathered.

Comments

At the 2013 PMI Global Congress conference (October 2013) in Philadelphia, USA., one of the break-through sessions was about the impact of requirements gathering and how mastering requirements gathering helps align projects to move along the path of success. The session was led by Michele M.
(Appendix F4), who was Principle Project Manager at a leading provider of supply chain solutions. The discussion Michele focused on the issue of establishing a proper requirement management process that would provide high value to projects. Her perspective was that such a process would give the project the right start; it would lead the project planning towards the creation of value for the business; it would guarantee that the voice of the business was heard throughout the project; and it would increase the maturity of the organization in creating business value through the projects. The project manager must first understand that requirements are documented and managed at different levels, involving many stakeholders. And the schema, which includes Business, Stakeholder, Solution and Transition Requirements, should be followed as best practices. Bringing a professional Requirements Management approach can significantly improve project results and lead projects towards delivering a real business value. The participants of the present study expressed similar perspectives.

b. What are some of the techniques project managers find necessary to manage the project requirement phase?

As in the case of communication management many participants stated this question was answered in the response to question three above. Some participants pointed out the need for industry knowledge in requirements gathering. Another tool mentioned is a set of questions to determine if requirements were gathered correctly and accurately.

Some participants outlined a series of meetings with the client and team members; these often included a discovery session using discovery questions, getting approval of clients and reviewing the gathered requirements more than once. Another series of steps mentioned included inviting experts from the client side, a workshop to document pain points in the current processes, capturing requirements to solve pain points, reviewing and getting approval (participant # 16). Another variation was creating a requirement gathering check list, validating the requirements listed with the client and having the client sigh off on the requirements (participant #19).

The term “value stream mapping” was indicated twice. One version includes defining the as-is model, then identifying pain points and preparing a “to-be” model (participant #5). The other version has an initial discovery, then deep
dive and then value stream map and validation (participant #9). “ValueFirst approach” was explained by one interviewee as the implementation of software solutions in increments (#18).

Using an online questionnaire and question lists for requirements gathering were also mentioned.

Quotations:

“Understand and have experience in the industry of the project...The project manager needs to be involved in project requirements gathering, be able to handle a discussion with the project team to be able to communicate issues related to requirements gathering to the client and executive sponsors...The project manager needs to have the set of questions that will give him/her the feeling if requirements were gathered correctly and ready for sign off.” (Participant #4)

“I feel we need tools like predefined discovery documents put together by experienced project managers by industry.” (Participant #20)

“ Invite experts from client sides in the current process and current pain points; conduct a workshop to document pain points in current processes; capture requirements to resolve pain points; conduct review with the same group about requirements gathered to get their approval.” (Participant #16)

Analysis

The expert viewpoints of the participants show that:

1. Discovery client and project team meetings with the presence of the IT project managers are important tools to gather complete and quality requirements.
2. Clear project requirement documentation is very important
3. Client approval of the requirements is important to make sure no gaps exist in the requirements gathered.
4. Requirements gathering tools are very important in gathering quality project requirements.

Comments

The concerns about requirements gathering expressed by participants above are common in practical project management and are topics at professional
development workshops. A workshop was organized by the PMI chapter in Dallas, TX, in June 2013. The workshop was about developing a requirement gathering model for project requirements. The workshop was conducted by Anant J. (Appendix F5), who is a Project Director at a major food and beverage manufacturer. Anant was keen on forming practical tools to gather clear and firm requirements where clients always certify and approve requirements before implementing them. A requirement gathering model is usually defined to create awareness on a current practice (as-is) and to understand how to progress from the current state to the target status (to-be). A discovery model as a requirement gathering tool helps an organization to understand the current status. Anant suggested creating a questionnaire (also known as discovery document) that would help project managers and project teams identify requirements and uncover the details of requirements. Anant was clear that after the questionnaire phase, where the project team interacts with the client to gather requirements, the project team needs to have detailed documented requirements reviewed and approved by the client.

4.3.4 Risk Management and Mitigation

Talk about how you manage mitigate risk in projects.

In regard to risk management and risk mitigation approaches in project management, interviewees expressed the following issues and concerns.

IT project risk centres around project resources. There are lots of theories but not enough practical tools. Tools need to be made by experienced project managers. An example of a needed tool is a set of risk identification questions to discover risks and corresponding mitigation plans. A framework is also needed for risk identification and mitigation planning. Risk management is difficult to teach, and it could be beneficial if experienced project managers could share questions and answers to help identify risks early in the project. Observing for and identifying scope creep is also needed in risk management.

Techniques, tools, interventions and concerns were mentioned in the responses. Use of check lists for each phase of a project, question and answer sheets, risk identification questionnaires in general and by phase, and outlining cost risk factors were indicated. Also, predefined risk management and mitigation
tools could be helpful. Some participants said they had designed a tool to identify risk and map risk mitigation plans.

Participants also made comments regarding having risk qualification discussions with the team (participant #9). One interviewee talked about identifying inconsistency, documenting risk, mitigation planning and discussing these issues with stakeholders to get their feedback, and then publishing the risks, risk impacts and the mitigation plans (participant #5). Another person indicated using a list of issues that can happen, testing questions to find out if the issues are real, documentation, and meeting to discuss with the responsible team members (participant #11). Another approach included having team members document their work in case a transition takes place and keeping project documents in a central place to help minimize knowledge losses if someone quits (participant #12).

Quotations:

“Clearly identify inconsistency. For example, if the project manager notices inconsistency in requirements after requirements gathering and identifies it as a change, then this is a risk.” (Participant #5)

“What seems to be a risk for you might not be true for the client…Suggested tools: Risk identification questionnaire by phase. This questionnaire will help set the criteria for risk and define what it means to be a risk for the client. Risk qualification discussion. The project manager will need to have a risk discussion with the team to be able [to determine] what can be qualified as a risk and how to deal with each identified risk.” (Participant #9)

Analysis

1. These participants consider that IT project managers need less theories and more practical tools to manage risk.
2. Project management experts will need to drive the details of risk management tools. A set of rules (framework) is needed for risk management and risk identification.
3. Risk identification in IT project management is very crucial and helps mitigate project risk.
4. Risk mitigation planning helps realign project expectations and project deliverables.

Comments

The perspectives and comments expressed by the participants support viewpoints that the researcher has also observed in professional workshops. In 2014, the PMI Global Congress conference (October 2014) was held in Phoenix, AZ, USA. The author attended a workshop to discuss the impact of project risk management tools on project risk mitigation and identification. The workshop moderator was Danny J. (Appendix F6), Project Director at a major automotive safety products supplier. Danny had a strong view that Risk management is recognized as one of the most critical project management practices. It is vitally important that program/project managers and systems engineers utilize the same language, tools and philosophy when discussing project and program risks on an engineering program. Until recently, risk management standards have focused primarily on the theoretical risk management process, techniques and tools, but not on practical tools that help in identifying risk, such as risk management checklists and risk impact assessment tools. Recommendations out of the workshop were: Align the language of risk management, establish a cross-discipline risk management process based on an alignment of standards and certification bases, create templates for a coordinated multi-discipline Risk Management Plan and align risk handling with monitor/control activities.

4.3.5 Project Support Transition

Describe a project in which you transitioned from implementation to support.

Project support transition, also referred to as transition to support, requires planning early on in the project work. The interviewees talked about various types of approaches, tools and interventions that assist in this dimension of project management.

Using a support transition checklist for details, transition to support questionnaire, documentation and implementation of plans, implementation diagrams, preparation of a training plan for the client support team, publishing documentation, including project support transition items in weekly status
meetings are the tools and techniques used by these participants to manage project support transition. Listing all documents, training and troubleshooting techniques for all known issues is also useful.

It is important to discuss with and get the approval of team members for the transition plan and to add tasks to the transition to support plans when needed and as the project advances closer to the transition phase, and having the deliverables checked by the support team. The transition to support requirements needs to be part of the project requirements.

Several participants indicated the need to have a support consultant on the implementation team; this consultant can perform documentation, troubleshoot, and provide and document training (see participants #1, #5, #10).

One participant explained the following steps in his/her approach to project support transition:

1. Detailed documentation of functionality is done; the client is asked to validate the documentation; a consultant is involved to document functional and technical training for the client team; the consultant trains the client support team; six weeks before the go-live date, the client team shadows the consulting team; three weeks before the go-live date, the client support team takes over support; the client team provides their transition to support list. For this participant, using this process was smooth with fewer problems (participant #7).

Another interviewee gave the following details. Use implementation diagrams early in the project; consistently keep detailed documentation; have meetings with the implementation team and the support team; ramp up knowledge transfer by the support team in the later stages (participant #9; related comments were made by participants #10 and #12).

A third participant talked about transitioning through three levels of support (participant #25).

Participants also commented on what would make managing this project dimension easier. Predefined processes and tools would help. Some participants think that there are no well-defined tools on a generic level even though each organisation has their own tools. Documentation of practical experience and a framework are needed to improve project management resources for the project support transition dimension.
Quotations:

“We usually involve our support team in project planning to help define the transition process and support transition requirements. Usually, we have a support transition list defined, but during planning the support team elaborates on it per the project.” (Participant # 15)

“I really follow a practice I found helpful 10 years ago; I ask for a support consultant to be part of the implementation team. That support consultant is always responsible for reviewing team documentation and adds to it what would be helpful for support team…He/she is always asked to provide the training. (Participant #1)

“Involves support team [from] the inception of the project to provide feedback about their requirements to successfully transition the project after completion…Plan support requirements with the overall project plan and assign tasks to the project team. At the time of the specific support task deliverable, meet with the support team to validate the deliverable and get sign off from the support team.” (Participant # 10)

Analysis

1. The professional perspectives of the participants indicate that project support transition should be planned early and included in the project planning phase.
2. Project management tools, such as a project transition checklist, are very important to facilitate project transition at the end of the project implementation phase.
3. Involvement of the support team in project implementation helps facilitate project transition to support.
4. Maintaining project documentation helps support smooth the process of project transition to support.
5. Defining project transition to support helps facilitate implementation of transition to the support team.

Comments

The author attended the PMI Global Congress conference in October 2014 in Phoenix, AZ, USA. One of the topics was project deployment and project transition to support. The presenter was Tom W. (Appendix F7), Vice President of program management at a major food supplier in the US. Tom’s entire discussion
revolved around the fact that project transition to support needs to be planned within the overall project plan. The project team needs to pay attention to project documentation and make sure that project documentations are detailed to the level that will facilitate project transition to support. Tom suggested to engage the project support team in the implementation to make sure they understand the project objectives, deliverables, technical architecture and detailed design, which will help facilitate project transition at the end of the implementation. Again, the participants comments reflect the concerns of many others in the field.

4.3.6 Needed Changes to Facilitate the Success of New Project Managers

What changes in project management practice do you feel are needed to facilitate the success of new project managers?

Among the comments of things needed to facilitate the success of new project managers, tools are near the top of the list. Having simple effective tools in a comprehensive project management framework, having more practical tools, having predefined tools based on industries and knowledge areas, having specific tools to facilitate communication and escalation tools, and a framework and map for practical tools are included in these comments. One participant put it very simply: “tools, tools, tools” (participant #15). From another participant’s viewpoint, a living framework of tools that could have tools added or changed would be helpful (participant #5).

Frameworks were referred to frequently, and not only for tools. A more detailed framework of resources, a framework of the basics of project management, a predefined framework detailed to each aspect of project management and the tasks of the project manager, and a framework of challenges and solutions were suggested. A framework of documentation of practical experience was also suggested, as was outlining resources and procedures for each area of project management.

Simplified project management methodologies, generic resources, continuous improvement of resources and tools, use of technology and social medial to make project management easier and fun were mentioned (participant #10). The view that such practical approaches, not more theories, are needed was frequently pointed out.
Mentorship (participant #14) and leadership skill are needed. Managers need to be empowered (in relation to both the client and the company) with leadership training that is provided by experienced project managers, along with having generic tools in a framework, and training by experienced project managers on the details of the tools and how to use them (participant #7). Elaborating on this, training on tool use needs to be well defined and designed by industry-experienced project managers, with experience in all aspects of project management, who can teach how and when to use each tool (participant #13). Sharing experience through documentation is another suggestion (participant #5).

Quotations:

“A framework would be helpful, but it has to go [to] the lower level of details, if we have a set of detailed defined project management tools and resources.” (Participant #12)

“We do not need any more project management methodologies; we need tools PM can find handy to handle their PM tasks.” (Participant #25)

“I feel project managers need a much more detailed framework of resources.” (Participant #26)

“We really need a tools and resources framework project managers can utilise to run their project management daily job.” (Participant #19)

“Per our discussion, all tools that we have been utilising and other project managers have been utilising can be packaged as a framework for the benefit of the project management practice and new project managers. We really look forward for such a practical framework; as I mentioned, no more theories, just practical tools out of experience.” (Participant #17)

“We need more practical processes and tools.” (Participant #28)

Analysis

1. Leadership is very important to facilitate smooth and well directed project execution. IT project manager leadership helps keep the project in alignment with the project charter and project plan.

2. Practical project management tools are the top requirements that help project execution and project success.
3. A more detailed framework of resources and a framework of documentation of practical experience will help simplify the IT project manager role and responsibilities.

4. Having access to expert project management knowledge from experienced project management professionals can very useful in facilitating the project managers success.

5. IT project management experts need to be involved in training newer project management professionals, and they need to share and document their experience so that the next generation can benefit from their experience and skills.

Comments

In December 2014, a workshop was organized by the PMI chapter in Dallas, TX. This workshop had the title “Project Management road map, the road for better project management.” The facilitator of the workshop was Krishnamurthy D. (Appendix F8), a project director at a major Semi-conductor manufacturer. The discussion was centered around the following points.

1. Creating a practical project management framework that will include a set of practical project management tools that will enhance project success. Project managers that attended the workshop agreed that the industry does not have a clear set of practical resources and tools that will help new and experiences project managers enhance project success.

2. A focus on project managers’ leadership traits because it is one of the drivers of project success.

3. Leadership as a general and specific characteristic of a project manager, and understanding when leadership becomes an effective trait to drive project success.

4. Experienced project managers need to be the leaders in providing their experience and expertise to new project managers by arranging for training to share specific cases of their experience and how they used specific project management tools to interact with specific situations.

As indicated by the participants, the concern and need for frameworks of resources and tools has not yet been solved. And the need for leadership development to improve project management and increase successful project outcomes is still a priority concern. These participants
also agree that the best practical training is likely to come from veteran project managers who share their experience in concrete examples of situations they have managed and the procedures, tools and resources they have utilised.

4.4 Discussion

In the views expressed by these ITPM professionals, experience is definitely of high importance. It is a mistake to believe that passing the popular project management certifications, such as PMP or Prince2, will automatically make a good project manager. Such qualifications provide project managers with the basics to exercise a project management role, but this is just part of what a project management role requires. Sharing expert knowledge and experience is very important and helps reduce the learning curve for newer project managers. This perspective points to the importance of new project managers having the opportunity to work alongside experienced professionals, having mentors to observe and consult, companies providing ongoing training, and also internships.

The primary purpose of project management tools is to help managers plan, execute and control all aspects of the project management process. Companies rely on key tools for managing a project to ensure that each task is completed on time and to balance staff workload for optimal time management. Because project management tools enhance resource efficiency and ensure project scope, such tools are especially important for project managers involved with large, complex projects.

Participants emphasised that documented practical project management tools and resources are very important for the success of IT project managers. The importance of practical project management tools is apparent for any project manager seeking to ensure project success. Yet, being able to effectively find, choose, and utilise ITPM tools is not necessarily a simple procedure. According to these participants, tools need to be more easily available in a framework along with other resources and project managers need training and/or more training about the “how to” of using such tools and resources.

There is a huge list of soft skills needed, in areas of communication, leadership, risk identification and assessment etc. which are of much higher impact on project success. Some of the participants referred to such soft skills in
terms of leadership, decision making, asking the right questions and developing their own protocols to bridge information gaps. The involvement of IT project management experts is important to shape and define the IT project management soft skills tools and framework. Again, leadership training and mentors come to mind as essential elements in project manager training and development.

In combination with industry and project management knowledge and availability of needed resources and tools, awareness of the project managers many responsibilities and leadership skill needed to guide the project team are mentioned specifically and are further implied in many of the responses.

The above qualitative results, from a practical standpoint, clearly indicate the essential need for tools and the implications of using tools for project outcomes, according to these expert IT project management professions. These participants’ indications of the high priority need for a project manager’s training and preparation, a manager’s ability to be involved in all aspects of a project, and to effectively communicate in order to lead projects to successful completion also points to the need for training in leadership and self-awareness. Self-awareness can facilitate a manager’s skills to make appropriate decisions to deal with spontaneous situations, to deal with consequences and find solutions to problems, as well as to develop team members’ abilities. And this type self-evaluative skill is intertwined with Leadership Self-Efficacy.

The qualitative results also show that among these 29 IT project management experts, the overall themes were relevant to all of them. There is variation but really no disagreement on their concerns for improving project management and project success, and their emphasis on tools and leadership as key elements.

Some suggestions for applications in project manager training can be drawn directly from these interview transcripts, as discussed above; however, this study provides further evidence of the importance of leadership and tool utilisation in project management in the coming chapters with statistical analysis of the survey data. And, selected details from these interview transcripts will be further analysed, quantitatively, with a word to vector technique in chapter 7.
CHAPTER FOUR: Recorded Interview
Transcripts: Qualitative Analysis

4.5 Conclusion

This chapter has provided summary and a qualitative analysis of the transcripts of the recorded interviews with 29 veteran IT project management experts regarding the work of project management in general and in the four selected dimensions of IT projects selected to comprise the abbreviated version of an IT project of this study.

The examination of the transcripts of the interviews with the twenty-nine participants, all experts in the field of IT project management, provided a detailed view of the real situation in which IT project managers work on a daily basis and the tools and resources they use as well as tools and resources that could improve practical IT project management, facilitate a smoother course in guiding a project from start to finish, and hopefully facilitate successful project outcomes. An emphasis was placed on tools, tools and resource frameworks and involvement of seasoned expert project managers in the development of such tools and resources and in the training of newer project managers. Participants also emphasised that the profession was not in need of more project management methodologies, but rather more organised, effective, specific and practical tools and resources, along with leadership and leadership training.

Some of the most important insights to be drawn from this data analysis are:

1. Communication accounts for 90% of the project manager activities. A project manager spends most of his/her time on communication in projects, so utilization of project management communication tools is important to:
   a. Document the status and activities of the project for all project stakeholders.
   b. Keep all stockholders aware of the project status and activities to be completed in order to keep the project on track (on schedule, and on budget).

2. Project communication continues throughout the whole project lifecycle; to make it more effective, tools like emails and status reports are important to document project activities.

3. Requirements gathering is usually conducted at the initial stage of the project. To have better project execution and to align it with the project’s planned schedule and budget, project managers need to make sure that
requirements meet project expectations by using the appropriate tools to gather detailed requirements and share them with the project stakeholders.

4. Risk management usually travels throughout the project lifecycle; it helps identify, monitor and mitigate project risk. To support risk management, a project manager should always use project risk management tools; for example, risk management checklist and risk impact assessments play important roles in aligning the project to the planned schedule and budget.

5. Planning project support transition helps minimize the closing phase of the project and provides the support team with all the tools to facilitate project transition. Engaging the support team early in the project planning makes it easier for the project manager to move the project to the steady state phase.

6. Project managers’ leadership traits is considered as the inclusion factor or umbrella that covers all project activities. Project managers’ leadership traits play an important role in tying the whole project and project dimensions together to enhance project success.

7. Having veteran project managers train new project managers is critical. Sharing their experiences and specific use cases on how they utilised project management tools in specific occasions can give new project managers practical understanding of the real-life experience of project management and use cases of how tools can be utilised.

The next chapter will examine the data from the LSE Measurement survey and the 10 Project Details survey to show what can be learned from a basic analysis of the raw data and set the stage for more elaborate quantitative analyses.
5.1 Introduction

Chapter Five presents an examination of the raw data collected with the “Project Manager Questionnaire,” which includes questions regarding leadership styles and a set of questions to assess the level of Leadership Self-Efficacy, and the “IT Project Management 10 Project Details,” which is a report of success or failure in each of four project dimensions and the use or non-use of eight dimension-specific ITPM tools in each of ten projects managed by each participant.

Understanding the raw data sets the stage for understanding the purposes and the results of more sophisticated data analyses. Several calculations and graphics have been made to summarize and/or illustrate data. The data providing a basic description of the participants has already been shown in Chapter Three, section 3.5. Here, some of the details of participants’ leadership styles and selected items of the questionnaire to determine the LSE score of each participant are examined. The data concerning the project dimension outcomes and tool use is examined in terms of individual results and averages for groups of participants in relation to LSE scores. The raw data provides a base and some expectations about the possible results of the analysis with logistic regression; this data also provides justification for selecting details for advanced analysis.

5.2 Project Management Questionnaire: LSE Level, Leadership Styles and Participant Characteristics

The Project Management Questionnaire includes two parts: 1) self-reported primary, secondary and tertiary leadership styles and 2) a series of questions to assess Leadership Self-Efficacy and determine an LSE score. Each of these parts of the questionnaire are discussed in the following sections.
5.2.1 Leadership Styles of the Participants

The “Project Management Questionnaire” provided eight leadership styles from which to choose, and participants were asked to select their primary, secondary, and tertiary leadership styles. A summary of the data is displayed in Table 5-1.

<table>
<thead>
<tr>
<th>Primary Leadership Style</th>
<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
<th>Total</th>
<th>Primary Percentage</th>
<th>Primary Ranking</th>
<th>Secondary Percentage</th>
<th>Secondary Ranking</th>
<th>Tertiary Percentage</th>
<th>Tertiary Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaborator</td>
<td>8</td>
<td>4</td>
<td>1</td>
<td>13</td>
<td>27.59%</td>
<td>1</td>
<td>13.79%</td>
<td>3</td>
<td>3.45%</td>
<td>4</td>
</tr>
<tr>
<td>Energiser</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>11</td>
<td>20.69%</td>
<td>2</td>
<td>13.79%</td>
<td>3</td>
<td>3.45%</td>
<td>4</td>
</tr>
<tr>
<td>Pilot</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>10</td>
<td>13.79%</td>
<td>3</td>
<td>10.34%</td>
<td>4</td>
<td>10.34%</td>
<td>3</td>
</tr>
<tr>
<td>Provider</td>
<td>6</td>
<td>6</td>
<td>1</td>
<td>13</td>
<td>20.69%</td>
<td>2</td>
<td>20.69%</td>
<td>2</td>
<td>3.45%</td>
<td>4</td>
</tr>
<tr>
<td>Harmoniser</td>
<td>3</td>
<td>8</td>
<td>3</td>
<td>14</td>
<td>10.34%</td>
<td>4</td>
<td>27.59%</td>
<td>1</td>
<td>10.34%</td>
<td>3</td>
</tr>
<tr>
<td>Forecaster</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>11</td>
<td>3.45%</td>
<td>5</td>
<td>13.79%</td>
<td>3</td>
<td>20.69%</td>
<td>2</td>
</tr>
<tr>
<td>Producer</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>7</td>
<td>0.00%</td>
<td>6</td>
<td>0.00%</td>
<td>5</td>
<td>24.14%</td>
<td>1</td>
</tr>
<tr>
<td>Composer</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>8</td>
<td>3.45%</td>
<td>5</td>
<td>0.00%</td>
<td>5</td>
<td>24.14%</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 5-1 Primary, Secondary and Tertiary Leadership Styles: Percentages and Rankings

“Collaborator” ranks highest as the most popular self-reported primary leadership style followed by “Energiser,” “Pilot,” “Provider,” “Harmoniser,” “Forecaster,” “Producer,” and “Composer.” Harmoniser ranks highest as the secondary leadership style followed by “Provider,” “Energiser,” “Collaborator,” “Forecaster,” “Pilot,” “Producer,” and “Composer.” “Producer” and “Composer” rank highest as the tertiary leadership style followed by “Forecaster,” “Harmoniser,” “Pilot,” “Collaborator,” “Energiser,” and “Provider.”

“Harmoniser” is the management style included most frequently, considering all three styles of each participant. “Producer” and “Composer” were included least frequently, even though they were the most common selection for tertiary leadership style. Figure 5-1, below, illustrates this data, using a radar chart.
Figure 5-1 shows the ranking of the three leadership styles in a radar graph. Some leadership styles overlap in ranking, for example, “Provider” ranks second in both primary and secondary leadership styles. “Collaborator” ranks the highest in primary leadership style, while “Harmoniser” ranks highest in secondary leadership style. All leadership styles overlap in the lower rankings.

5.2.2 Leadership Self-Efficacy

The level of LSE for each project manager is the average of the twenty-one survey responses for each individual project manager. As explained in Chapter 3, the responses to the LSE survey were in the form of a 6 item Likert Scale with the following response options and assigned numerical values from six (6), the highest, to one (1) the lowest. The scale is as follows: strongly agree (6), agree (5), somewhat agree (4), somewhat disagree (3), disagree (2), and strongly disagree (1). The range of possible LSE scores is, then, the same as the range of possible response values (i.e., between 1 and 6).

5.2.3 Assessment of LSE Level

Assessing Leadership Self-Efficacy involved asking IT project manager participants to rank their agreement or disagreement on a six-point Likert scale,
CHAPTER FIVE: Project Management

Questionnaire (LSE Level, Leadership Styles) SURVEY and 10 Project Details SURVEY as described in Section 5.2.2 above, for twenty-one statements in six categories.

The six categories are:

1. Change orientation (Statements #1–3);
2. Choose followers and delegate responsibilities (Statements #4-7);
3. Communication and management of interpersonal relations (Statements #8–10);
4. Self-awareness and self-confidence (Statements #11-15);
5. Motivate others (Statements #16-18); and
6. Consensus building (Statements #19-21).

These categories indicate the types of characteristics and skills that are considered related to Leadership Self-Efficacy. Flexibility, decision making, communication skills, ability to trust and evaluate one’s self, inspire others and gain the trust and cooperation of others are indicated by these categories. Though it is not within the scope of this study to address the details of each of the 21 items and their possible importance or influence in successful project management, it is recognized that these details are important and may be of help in determining whether particular management or leadership styles are more, or less, closely interrelated with the degree of Leadership Self-Efficacy that an individual has.

The LSE score for each IT project manager who participated was calculated as the mean of the sum of each of the values for each of the twenty-one statements. The LSE scores obtained ranged from:

Next, the stacked bar graph in Figure 5-2 shows the distribution of answers for each of the twenty-one statements (the complete survey can be seen in Appendix A4) by the percentages of the choices on the six-point Likert scale.
Looking at the figure above, “Strongly agree” was chosen most often for more than one-half of the statements; this is especially noticeable for Statement #1, #9, #12, #13, #15, #18, and #21. “Strongly disagree” is most noticeable for statements #3 and #21. Overall, agreement with the statements is more common than disagreement. The statements and specific percentages can be found in Appendix B1.

Overall, a total of 69.0% of the IT project managers fell into the “Agree” category, (comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 31.0% of the IT project manager fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), making it clear that a majority of project managers consider themselves able to lead a group with the consensus of all members.

Next (Figure 5-3), the statements and self-evaluations of the participants are considered in terms of the six categories (mentioned above).
Categories: 1 Change orientation (Statements #1-3); 2 Choose followers and delegate responsibilities (Statements #4-7); 3 Communication and management of interpersonal relations (Statements #8-10); 4 Self-awareness and self-confidence (Statements #11-15); 5 Motivate others (Statements #16-18); and 6 Consensus building (Statements #19-21)

**Observations**

Category Six, “Consensus building,” includes leading a group with the consensus of all members and making all group members appreciate and gain the consensus of other group members. This category has the IT project managers with the most agreement, and the existent disagreement comes from the 5 IT project managers with LSE scores of 3.1 or lower.

Those strong in Category Three, “Communication and management of interpersonal relationships,” establish good relationships with co-workers, communicate with others in a direct manner, and successfully manage relationships with all the members of a group. Yet, this category has the highest level of disagreement among all categories, all of which comes from the 9 project managers with LSE scores of 3.2 or lower.

Table 5-2 provides the details of the calculations of the percentage of participants choosing each Likert scale answer for each of the 6 categories of items on the LSE measurement survey.
5.2.4 Leadership Self-Efficacy and the Characteristics of the Participants

Table 5-3 shows the participants’ LSE scores in the context of their demographic information and leadership styles. In this figure, participants are ordered from left to right by LSE scores, from the highest score (6) to the lowest (2.4).

An evident trend in this sample is that participants whose age is older and who have longer IT project manager experience also have, with few exceptions, higher average LSE scores. Age and years of experience coinciding with each other is not unexpected. Although, while LSE is considered to be a personal quality, it is thought to be one that develops and improves; experience would likely provide opportunities to hone project management and leadership skills which, in turn, seem likely to be interrelated with LSE. All participants in this study had a
minimum of 10 years in IT project management, and the range of experience is from 10 to 32 years. Overall, maturity may also be related, as is seen here; participants older than forty have LSE scores of 5 or higher with one exception, and those younger than forty have scores of 3.5 or less. Furthermore, an association between LSE and experience also seems to indicate LSE, or at least its development, may be able to be facilitated by training. The next paragraphs consider a few more details seen in Figure 5-6.

The ratio of women to men in the LSE score range of 5.2 or above is 9/7; in the lower LSE score range, the ratio is 4/9. So, there are some differences in gender distribution in relation to LSE scores. However, in this small sample, the gender distribution is not considered to skew the sample as the total ratio is thirteen women and sixteen men. LSE scores were not known at the time of determining the participants.

In the higher LSE score range (LSE > 3.5), 14/16 participants are over forty years old as compared to 6/13 in the lower LSE score range.

Fifteen of sixteen participants in the higher LSE range (LSE > 3.5) are based in the US and 7/13 participants in the lower LSE range are based in Mexico.

Regarding location and LSE, 15/16 participants with LSE scores of 5.2 or higher are based in the US and only 2/16 are under forty years old. In the case of the thirteen participants with LSE scores of 3.5 or lower, 7/13 are based in Mexico and, of these seven, four are under 40 years old. Three of the six managers located in the US, in this lower LSE score range, are also under forty years old.

While location appears to possibly be associated with LSE scores, the age of participants is also more consistently younger in the lower LSE range, and older in the higher LSE range, so this may simply be coincidence. Nonetheless, in a larger sample, with more participants based in each location, it would be of interest to investigate the possible presence of cultural business-culture factors that could affect the project manager role and the project managers’ perspectives on their range of authority, decision making powers, employee relations, and other aspects of business protocols and traditions.

Years of experience is a criterion for participation, and all participants have the minimum of ten years. As mentioned above, longer experience is associated with higher LSE scores with few exceptions. In the higher LSE range, 3/16 participants reported less than 15 years of experience; in the lower LSE range,
Questionnaire (LSE Level, Leadership Styles) SURVEY and 10 Project Details SURVEY the ratio is 7/13 individuals with less than 15 years of experience. If the 20 or more years of experience is considered the base, the ratio for those with less than 20 years of experience are 8/16 and 8/13 for the higher and lower LSE ranges respectively. Keeping in mind the size of the sample, 15 or fewer years of experience might be associated with lower LSE scores. In the case of 20 years or more, participants with this length of experience are distributed approximately equally in both the upper and lower LSE score ranges.

As mentioned above, LSE seems to be closely intertwined with experience, and age, at least up to a certain point, in this sample of participants. In a larger sample, age and years of experience, as well as gender, could be cross analysed with LSE scores to determine which factors are most closely correlated with LSE level and, then, whether the factor of LSE on project success can be differentiated within groups of length of experience, age ranges groups and gender groups.

As in the analysis of leadership styles indicated above, the reported styles do not per se show a strong trend in any direction. Looking at primary, secondary and tertiary styles as a whole, the provider leadership style is more prevalent on the right side of the table, coincident with the lower LSE scores. Collaborator and Harmonizer are more prevalent on the left side of the table, coincident with the higher LSE scores. In future research a comparison between the characteristics of leadership styles and items used to evaluate LSE might yield useful perspectives about the relationship between the personal quality of LSE and actual leadership behaviours.

5.2.5 LSE and Leadership Styles

There is a large discrepancy between the average LSE score for each leadership style (Figure 5-4). “Providers” have, by far, the lowest LSE scores, and “Forecaster, “Composer,” and “Pilot” have the highest average LSE score according to the results of these participants. However, this sample of participants is too small to draw definitive conclusions from this graph. Particular leadership styles may be associated with higher levels of LSE and this could be tested in a larger sample.

Understanding the participants in terms of the details described above provides a context in which to interpret the data.
5.2.6 Transformations Applied

For data analysis with logistic regression, binary data is needed; in order to use LSE scores in this type of analysis, a transformation was applied to the LSE score variable. This transformation converts an integer scale from 1 to 6 to a binary variable indicating the presence or absence of LSE. This transformation required the selection and application of a numerical threshold above which LSE is deemed positive, or present, and below which LSE is deemed negative, or absent. While many options were available for this threshold, a midpoint of the range was determined through the following calculation:

\[ LSE\ \text{Threshold} = Minimum + \frac{(Maximum - Minimum)}{2} = 1 + \frac{(6 - 1)}{2} = 3.5 \]

In order to validate the appropriateness of this threshold, the balance of the sizes of the post-transformation positive and negative populations was verified (shown below in Table 5-4). The relative size of the populations is similar, close to 50%, confirming the data as valid for meaningful analysis.

<table>
<thead>
<tr>
<th>LSE</th>
<th>Population Size</th>
<th>Relative Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>16</td>
<td>55.2%</td>
</tr>
<tr>
<td>Negative</td>
<td>13</td>
<td>44.8%</td>
</tr>
</tbody>
</table>

*Table 5-4 Division of participants into LSE and No LSE groups*
5.3 IT Project Management 10 Project Details

After completing the “Project Management Questionnaire,” the interview focused on discussing ten projects the interviewee had managed; while doing so, the interviewee was asked to fill out the “IT Project Management 10 Project Details” survey. The details requested for each project were reporting a one (1) for success or zero (0) for failure in the outcome of each of the four dimensions of the project; one (1) for use of each of the dimension related project management tools or zero (0) for lack of use of the tool, and one (1) for an evaluation of overall success of the project or zero (0) for an evaluation of overall failure of the project.

Table 5-5 Number (out of 10 possible) of successful project outcomes for the overall project and for each project dimension

Table 5-5 shows the number of overall successful project outcomes out of the ten projects managed for each participant. The overall number is the reported number of successful outcomes in each of the four dimensions for each participant. The total number of outcomes for each dimension is ten for each participant. The numbers in black font are data from the group with LSE scores of 5.2 or higher (corresponding to participants deemed to have LSE, as explained in the previous section) and the numbers in red font are data from the group of participants with LSE scores of 3.5 or lower (corresponding to the participants deemed to not have LSE). To the right of the individual scores are the average scores of the higher LSE score and lower LSE score groups in the corresponding font colour. Individual LSE scores, participant codes and years of experience in IT project management are shown along the top rows of the graph.

Observations

The group averages for the number of overall successful project outcomes is very close. However, as no trend was indicated for overall project success, the
researcher consulted with a data science expert\footnote{Kalin Stoimenov} regarding possible advanced analyses to statistically relate LSE with overall project success. The expert explained that more detailed data regarding project success would be needed. Such an analysis is beyond the scope of the present study but is a subject for further research.

Two thoughts regarding overall project success and why we do not see a trend of higher LSE scores associated with more reports of overall project success: 1) it is possible that each project manager’s way of defining success or considering the project outcome involved other dimensions that were present in a particular project but not included in this survey. 2) Another possible factor could be the project manager’s expectations of the overall project and of him or herself as the leader and manager in regard to the project outcome.

In contrast to the results of overall project success, in the case of each of the four project dimensions, the averages for the group of participants with higher LSE scores is consistently higher than the group with lower LSE scores by 0.9 – 1.2 points. This relatively simple analysis of the raw data indicates that examining the factor of higher LSE on the odds of success at the level of project dimensions was a reasonable next step, and logistic regression was chosen for more detailed analysis.

Finding a trend at the project component level of the project dimension seems to indicate that using an abbreviated version of a project and a focus on the more specific IT project management work in dimensions is a useful approach to researching project management factors on project outcomes. If the focus had been directly on overall project outcomes, this opportunity would have been missed.
Table 5-6 ITPM tool utilisation


Table 5-6 shows the same structure as Table 5-5 for the individual reports of use of each ITPM tool by each participant and a mean for the higher and lower LSE groups for use of each tool. The maximum number of times for use of a tool is ten. Again, the focus is on comparing the mean for each group’s reported use of each tool.

Observations

In contrast to the consistent trend, of the higher LSE score group having higher means than the lower LSE score group for reported successful outcomes in project dimensions, seen in Table 5-5, the group means in the case of reported tool use do not indicate any consistent trend between the two LSE score groups. The data science expert was again consulted. The feedback indicated that to test for a correlation between LSE and project management tools, more detailed data and additional tools, beyond the 8 tools presented in this research, would be needed. So further analysis with logistic regression was not indicated and an analysis of the relationship between LSE score and tool use was not within the scope of the study.

What is observed in the mean frequencies of tool use is that both groups reported using Tool 1, weekly status report, and Tool 2, electronic communication, less than other tools. Tool 3, functional decomposition, was reported to be used

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frequently by both groups. Tool 4, use case diagram, was reported to have been used more by the lower LSE score group. Use of Tool 5, risk management checklist, and use of Tool 8, knowledge transfer walk through, were reported more frequently by the higher LSE group. Both groups reported using Tool 7, support transition checklist at approximately the same frequency. The tool reported as used the most by the higher LSE group is Tool 8, while the lower LSE group reported the highest mean frequency of use for Tool 6, risk impact assessment. Tools 5 and 6 show the widest mean difference in tool use frequency between the two groups.

While the relationship between LSE and frequency of ITPM tool use is of great interest, the data in this sample does not indicate any clear trend or hint at any connection between these two factors. However, it is clearly a topic for further research.

Nonetheless, this analysis provokes thought as to possible reasons for lack of a trend in overall success and the ITPM tool use. One question is why some of these commonly available tools were not reported to be used. The use, or not of these particular tools was not specifically explored in further detail in the interviews, as the interviews were structured to guide but not directly elicit information, so participants commented from their own perspective. It is possible that a different tool for the same purpose was used or that a variation of a tool, or the same tool having a different name, was used. In the analysis of the interview data, participants rarely referred to ITPM tools with the specific names of those selected for this study. (See summary and analysis of the interview transcripts in Chapter Four.)

No transformations were applied to the variables measuring use of tools, success dimensions, or project success as this data was collected as binary data. This data, as well as the binary data derived from the transformation applied to the LSE scores, will be used in the logistic regression analysis in Chapter Six.

5.4 Conclusion

This chapter has presented an examination of the data from the two survey tools used for data collection. The data collected with the “Project Management Questionnaire” (LSE measurement instrument), from which the LSE score for each participant was calculated, was considered in more detail regarding the
Questionnaire (LSE Level, Leadership Styles) SURVEY and 10 Project Details SURVEY categories of items on the survey and relationship between reported leadership styles and the LSE score. Additionally, LSE scores were considered in relationship to the demographic and length of professional experience of the participants. Secondly, the data from the “Project Management 10 Project Details” survey, showing each participants’ assessment of ten projects he or she managed in terms of success or failure in four project dimensions and use or no use of two ITPM tools specific for each dimension, and overall success of the projects was considered in terms of participants’ LSE scores by grouping them into higher and lower LSE score groups.

The LSE score for each participant was calculated as an average of the sum of the values for each of the 21 items on the survey. Each item had six choices with values of 1-6 on a Likert scale of strongly agree (value = 6), agree (value = 5), somewhat agree (value = 4), somewhat disagree (value = 3), disagree (value = 2), (strongly disagree (value = 1).

The LSE measurement survey results showed that there was more agreement than disagreement with each of the twenty-one different statements on the survey.

The six categories, in which questions were grouped: change orientation, choose followers and delegate responsibilities, communication and management of interpersonal relations, self-awareness and self-confidence, motivate others, and consensus building provide an overarching idea of the characteristics and behaviours relevant to Leadership Self-Efficacy.

The LSE raw scores were converted to binary scores of 1 or 0 which deemed possession of LSE as a value of one (1) and not possessing LSE as a value of zero (0), with a mathematical transformation. Scores of 3.6 or higher were deemed as belonging to the possessing LSE group; LSE scores of 3.5 and lower were deemed as the no LSE group. This is not to say that participants with lower scores do not have LSE, but for the purposes of this study, binary data was needed for analysis with logistic regression.

The data from the Project Management 10 project details survey, concerning the participants evaluations of 1) success or failure in four project dimensions, 2) use or no use of two ITPM tools specific to each dimension, and 3) overall project success or failure for each of ten projects was discussed. A trend of more successful outcomes in all four project dimensions was found for the
higher LSE group as compared to the lower LSE group. However, particular trends were not observed in the group comparison for overall project success or for the use of ITPM tools.

The data collected with the Project Management 10 project details survey was already in binary form and no transformations were required.

Understanding the raw data of the two survey instruments used here adds to the context of the participants’ comments (see Chapter Four) and the variety of viewpoints that exist among IT project managers. This basis forms part of the context in which results of further analysis are interpreted.

Next, in Chapter Six, data from the “Project Management Questionnaire” and “Project Management 10 Project Details” will be analysed with logistic regression. After that, Chapter Seven will present a word to vector text analysis for word pairs found in the interview transcripts.
6 CHAPTER SIX: LOGISTIC REGRESSION: LSE and Success, Tools and Success

6.1 Introduction

This chapter explains the quantitative analysis of the survey data examined in Chapter Five. The data is from 1) the “Project Management Questionnaire” (LSE measurement instrument) and 2) the “Project Management 10 Project Details Survey.” This data is analysed through the quantitative analysis method of Logistic Regression. Of the three research questions of this study, the first and second are answered in this chapter through analysis with logistic regression.

Research Question One:
Is there a relationship between Leadership Self-Efficacy and success in particular dimensions of a project?

Research Question Two:
What is the impact of specific ITPM tools on project dimension success?

6.2 Logistic Regression

The following explanation of logistic regression as used in this study follows the descriptions found in Peng & Ingersoll (2002).

6.2.1 Overview

The factors leading a project to a successful project outcome, at the highest level, can be considered two-fold. First, the traits a project manager intrinsically possesses that facilitate his or her ability to lead effectively. These traits can be numerous; with Leadership Self-Efficacy being one of them. Leadership Self-Efficacy is, indeed, a quality which is believed to facilitate a project manager’s ability to lead his or her team towards success. Second, the tools a project manager utilises to accomplish his or her objectives constitute the second factor. As such, this study investigated the effect the influence of these two factors in reaching project success. The data was gathered through the LSE measurement instrument (“Project Management Questionnaire”) and the “Project Management 10 Project Details” survey, both of which were completed by the participants at the
time of the in-person meeting as described in Chapter Three and displayed in Chapter Five. The logistical regression analysis was performed through a statistical modelling approach, specifically looking at the influence of project managers’ LSE on the odds of successful outcomes in each of the four project dimensions selected for this study: communication management, requirements gathering, risk management and project support transition. The same analysis method was used to determine the influence of each of eight dimension-specific tools (two for each of the four dimensions) on the odds of a successful outcome in the related dimension.

The qualitative analysis of the participants’ expert viewpoints emphasises the importance that IT project managers place on leadership and on practical IT project management tools and their impact on project success. The results of logistic regression provide statistical evidence of the same.

6.2.2 Inputs Gathered

Data gathered for this portion of the analysis falls into 3 categories: Leadership Self-Efficacy, Tools Used and Successful Project Dimension Outcome. Each of these elements constitute a variable.

1. Leadership Self-Efficacy (Independent Variable)

The data for this input was not gathered separately; rather a binary value (positive indicating the presence of LSE, negative indicating the absence) was derived as a transformation of the original LSE score as explained in Chapter Five.

2. Tools Used (Independent Variable)

The interviewees were asked to indicate the use or not use of eight key tools which support project management in the four dimensions of IT projects, two tools for each project dimension.

<table>
<thead>
<tr>
<th>Tool No.</th>
<th>Tool</th>
<th>Project Success Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Weekly status report</td>
<td>Communication</td>
</tr>
<tr>
<td>2</td>
<td>Electronic communication</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Functional decomposition</td>
<td>Requirements Gathering</td>
</tr>
<tr>
<td>4</td>
<td>Use case diagram</td>
<td></td>
</tr>
</tbody>
</table>
In this analysis, the binary variable of the use or not of each tool is an independent variable.

3. Successful Project Dimension Outcome (Dependent Variable)

The interviewees were asked to indicate whether the outcome in each of the four project dimensions were successful or not and whether the overall project outcomes was a success or a failure for each of the ten projects led that he/she had managed. Rather than summarize project success on the large scale overall project level, this component level approach allows for much more granularity in the analysis, thus allowing the data to be segmented by dimensions and for different conclusions to be drawn for each dimension. Including this type of variety was an important factor when constructing the approach because projects can often be considered successful in most facets and yet fail for various reason. Identifying project success or failure at the dimension level and with more granularity should allow for a wider range of and deeper insights to be drawn.

Successful or unsuccessful project dimension outcome is a dependent variable in this analysis.

6.3 Use of binary data

All the data inputs collected are binary in nature. An integer scale was also considered, similar to the data gathered for the measurement of LSE. However, binary data led to several key advantages:

1. Binary data is easier to interpret;
2. Binary data is objective; and
3. Non-binary data can lead to central migration; thus, using binary data can avoid this issue.
The first advantage to using binary data is that it is easier to interpret. Binary data is encoded by convention as either “0” or “1,” with “0” representing a negative entry and “1” representing a positive entry. This is standard practice and has been used by statistical researchers since the inception of statistical computing. This practice also expands beyond the field of statistics and is generally accepted in the wider fields of computing and information theory. In contrast, data encoded in a numeric scale may require a key to interpret the raw values. More importantly, the insight gathered into the relationship between variables through analysis is not as easily interpretable with scaled values as with binary values. The numeric impact of a binary value is straightforward; the size of the impact is simply the coefficient associated with the binary variable. For example, if the coefficient for a college degree \((\beta_2)\) is 1.2, then the interpretation is clear; college graduates tend to earn 20% more than non-college graduates for the same position.

\[
\text{Average Wage} = \beta_0 + \beta_1 \times \text{Number of Years Experience} + \beta_2 \times \text{College Degree}
\]

A second example illustrates the counterpoint. If intelligence is encoded as a scale from 1-5 and the coefficient \((\beta_2)\) is, again, 1.2, then one’s salary is expected to increase 20% for each level of intelligence.

\[
\text{Average Wage} = \beta_0 + \beta_1 \times \text{Number of Years Experience} + \beta_2 \times \text{Intelligence Level}
\]

The second advantage to binary data is that it is objective. This point is closely tied with the first. Any researcher coding data for the college degree variable would likely come to the same result, one (1) for the presence of a college degree and zero (0) for the absence. However, the intelligence level is subjective. The choice of number to associate with a person to indicate their intelligence is not a rigidly defined task and, thus, lends itself to the subjectivity of the researcher.

The final advantage of using binary data is that it forces polarization of the data and does not leave the possibility of central migration. A survey consisting of the following choices: 1 = “Strongly disagree,” 2 = “Neither agree nor disagree,” and 3 = “Strongly agree” is likely to result in the majority of the responses migrating towards the central value of 2. Binary data forces choice and, therefore, leads to more variation in the data between the two poles which can be used to discover more meaningful results.
6.4 Logistic Regression

A logistic model was used to calculate the relationship between Leadership Self-Efficacy and successful project outcomes. Logistic regression is a standard approach used for predictive modelling when the dependent variable is categorical in nature. Logistic regression is applicable if the following is desired (Peng and Matsui, 2015):

- Model the probabilities of a response variable as a function of some explanatory variables, e.g. "success" of admission as a function of gender;
- Perform descriptive discriminate analyses, such as describing the differences between individuals in separate groups as a function of explanatory variables, e.g. student admitted and rejected as a function of gender;
- Predict probabilities individuals fall into two categories of the binary response as a function of some explanatory variables, e.g. what is the probability a student is admitted given she is a female; or
- Classify individuals into two categories based on explanatory variables, e.g. classify new students into "admitted" or "rejected" group depending on their gender.

A logistic regression models the relationship between the predictor variables and the logit, or log odds, of the dependent variable (Peng et al., 2002). It is difficult to model a relationship with a variable with a restricted range, such as a probability between “0” and “1” (Peng and Matsui, 2015). The purpose of the log odds transformation is to map the probability between “0” and “1” to a log odds range between negative and positive infinity. The choice is also reasonably easy to understand compared to alternatives which accomplish the same range transformation (Peng and Matsui, 2015).

The odds of an outcome are defined as follows.

\[
Odds = \frac{\text{Probability of Success}}{\text{Probability of Failure}} = \frac{p}{1-p}
\]
For example, if the probability of an outcome is 70%, then the odds are \(0.7/(1-0.7) = 2.33\). The log odds are, then, the natural logarithm of the odds. In this example, the log odds would be \(\ln(2.33) = 0.85\). Altogether, the log odds transformation, also called the logit transformation, is as follows:

\[
\text{Log Odds (Logit)} = \ln\left(\frac{p}{1-p}\right)
\]

The relationship between the probability and the log odds of an outcome can be observed in the Figure 6-1. It can be seen that the “X range” of probability between “0” and “1” is mapped to the “Y range” between negative and positive infinity (Peng et al., 2002).

There is one observation in the data for each project provided by the IT project managers. The model outputs a prediction for each observation between negative and positive infinity. The final desired model output, however, is a probability of success within a certain success dimension. In order to convert the model estimate into a probability of project success, a logistic transformation must be applied. The logistic transformation is the inverse of the logit transformation and undoes the logit transformation (Peng et al., 2002). The logistic transformation maps the prediction between negative infinity and positive infinity to a probability between “0” and “1.” This transformation is shown below where \(x\) is the output of the logit transformation.
The logistic transformation is demonstrated in the Figure 6-2. It can be seen that the “X range” of log odds between negative and positive infinity is mapped to the “Y range” of probability between “0” and “1.”

\[
Logistic \; Transformation = \frac{1}{1 + e^{-x}}
\]

6.5 Model Formation

Four logistic models were built to investigate the impact of LSE and the use of specific tools towards successful project outcomes within the four project dimensions. A separate logistic model was built for each of the four project dimensions. The general model form is shown below, where “D” represents the respective project success dimension, followed by each of the specific model forms: communication management, requirements gathering, risk management, or project support transition.

\[
Project \; Success_D = \beta_0 + \beta_1 \times LSE + \beta_2 \times Tool_{1_D} + \beta_3 \times Tool_{2_D}
\]

\[
Project \; Success_{Communication} = \beta_0 + \beta_1 \times LSE + \beta_2 \times Weekly \; Status \; Report + \beta_3 \\
* \; Electronic \; Communication
\]
Project Success_{Requirements Gathering} = \beta_0 + \beta_1 \ast LSE + \beta_2 \ast Functional Decomposition + \beta_3
* Use Case Diagram

Project Success_{Risk Management} = \beta_0 + \beta_1 \ast LSE + \beta_2 \ast Risk Management Checklist + \beta_3
* Risk Impact Assessment

Project Success_{Transition Support} = \beta_0 + \beta_1 \ast LSE + \beta_2 \ast Support Transition Checklist + \beta_3
* Knowledge Transfer and Walk Through Sessions

6.5.1 Model Assumptions

The assumptions applying to logistic regression made for this model are as follows:

1. **Sample size is sufficient**

   Statisticians recommend 10-30 observations to be used per predictor variable in order for a model to be statistically valid. Each of the four models has three predictor variables, thus, requiring 30-90 observations in order to validate this assumption. In the present study, the data used to build this model is composed of 290 observations, 10 per interviewee. Therefore, the sample size is more than sufficient to be able to draw statistically valid conclusions from the results.

2. **Predictor variables are independent**

   Multicollinearity is defined as the presence of strong correlation between the predictor variables in a regression, which can lead the results to be misinterpreted or unreliable. If two predictor variables are highly correlated, then the effects they explain in the model overlap and are, therefore, redundant (Dorugade and Kashid, 2010). Of even more concern is the use of correlated predictor variables which can cause unreliable model results; this is due to the impact of each variable in the model, assuming all else remains constant. In the case of two highly correlated predictor variables which both explain the dependent variable well in isolation, the combined use of the
correlated predictors in the model may lead to a result showing neither predictor explains the dependent variable. To illustrate this point, consider the example of a model attempting to predict student happiness. If hours spent studying and hours spent socializing were two predictor variables used in the model, multicollinearity could be present. These variables are highly related and likely highly correlated. Each variable, in isolation, may explain student happiness well. However, the use of both variables in a multivariate regression may lead their effects to appear weak. The result may show neither variable is related to student happiness, when in fact, multicollinearity is skewing the results. Multicollinearity is tested for by calculating the correlation matrix of predictor variables. The concerns for multicollinearity in this study are elaborated in Section 6.7.1.

6.5.2 Model Estimation

The R statistical package was used for the estimation of the logistic models. The code used to perform the estimation is provided in Appendix C. The results of the model estimation are shown in the tables in the next section.

6.5.3 Coefficient Estimates

The coefficient estimates, standard errors, and confidence interval bands are shown for each of the models below. The coefficient estimates and standard errors were obtained directly from the logistic regression estimation in R and are part of the standard regression summary statistics. The confidence interval bands were calculated using the logistic regression output. Each of the fields is defined below.

**Coefficient Estimate**

The coefficients are the weights applied to each of the independent variables in the regression and represent the statistically determined relationship in the data. There is one coefficient for each “X” variable in each regression, along with a coefficient for the intercept (constant) term. The coefficients can be
substituted into the general model equations provided in Section 6.4. For example, the coefficients have been substituted into the equation for Model 1 below.

\[ \text{Project Success}_{\text{Communication}} = -0.615 + 0.429 \times \text{LSE} + 0.464 \times \text{Weekly Status Report} + 0.469 \times \text{Electronic Communication} \]

In a theoretical example where a project manager who possesses LSE does not use a weekly status report but uses electronic communication, the model prediction would be as follows.

\[ \text{Project Success}_{\text{Communication}} = -0.615 + 0.429 \times 1 + 0.464 \times 0 + 0.469 \times 1 \]
\[ = 0.283 \]

A logistic transformation is then applied to this model prediction in order to project a probability of success within the dimension of communication. This is described in detail in Section 5.3.2.

**Standard Error**

The standard error of the regression coefficients can be used to calculate the confidence interval of the coefficients. It is a direct input to the confidence interval calculation as can be seen in the formulas in the confidence interval section below.

**Confidence Interval**

Confidence intervals for fitted values provide valuable information about the usefulness of logistic regression models. The confidence interval is the range of possible true estimates for a given coefficient, given the chosen significance level (Sofroniou and Hutcheson, 2010). For this analysis, the chosen significance level is 90%. The critical value is fixed for each significance level.

\[ \text{Confidence Interval}_{\alpha} = \text{Coefficient Estimate} \pm \text{Critical Value}_{\alpha} \times \text{Std. Error} \]

For the chosen 90% confidence level, the confidence interval is calculated as follows.

\[ \text{Confidence Interval}_{90\%} = \text{Coefficient Estimate} \pm 1.64 \times \text{Std. Error} \]
For any test of model statistical significance, for any model, at the 90% significance level, the critical value is 1.64. This is derived from the properties of a Gaussian (see Gerber and Malhotra, 2008).

The values for the coefficient estimate and standard error were output directly from the statistical regression results in R and are independent of the chosen statistical significance level. Given the same input data, the logistic regression estimation will always obtain exactly the same estimates for the model coefficients and standard errors. By inputting the coefficient estimate, critical value, and standard error into the confidence interval formula the range of estimates is obtained and displayed below, shown in square brackets. The true, exact value of Tool 1 is the true effect Tool 1 has on project dimension success. Since the true, exact value of the coefficient for Tool 1 is unknown, statistical methods can estimate its value from our sample; in this case, using the logistic regression. The confidence interval bands mean the research is 90% confident and the true coefficient for Tool 1 was reached, yet its true and unknown impact is between the lower and upper bound of the interval. From the obtained results, the research is 90% confident the true coefficient for Tool 1 is between 0.043 and 0.885. The calculation for Tool 1 in Model 1 is as follows.

\[
Confidence\ Interval_{90\%} = 0.464 \pm 1.64 \times 0.256 = [0.043,0.885]
\]

Next, Tables 6-1, 6-2, 6-3 and 6-4 summarize the coefficient estimate and standard error for each tool and LSE in each project dimension.

<table>
<thead>
<tr>
<th>Coefficient Estimate</th>
<th>Standard Error</th>
<th>CI 5%</th>
<th>CI 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.615</td>
<td>0.222</td>
<td>-0.980</td>
</tr>
<tr>
<td>Tool 1</td>
<td>0.464</td>
<td>0.256</td>
<td>0.043</td>
</tr>
<tr>
<td>Tool 2</td>
<td>0.469</td>
<td>0.249</td>
<td>0.060</td>
</tr>
<tr>
<td>LSE</td>
<td>0.429</td>
<td>0.241</td>
<td>0.032</td>
</tr>
</tbody>
</table>

Table 6-1 Communication Management Confidence Interval Model

<table>
<thead>
<tr>
<th>Coefficient Estimate</th>
<th>Standard Error</th>
<th>CI 5%</th>
<th>CI 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.671</td>
<td>0.241</td>
<td>-1.067</td>
</tr>
<tr>
<td>Tool 3</td>
<td>0.322</td>
<td>0.240</td>
<td>-0.073</td>
</tr>
<tr>
<td>Tool 4</td>
<td>0.639</td>
<td>0.247</td>
<td>0.233</td>
</tr>
<tr>
<td>LSE</td>
<td>0.438</td>
<td>0.242</td>
<td>0.040</td>
</tr>
</tbody>
</table>

Table 6-2 Requirements Gathering Confidence Interval Model
Model 3 - Risk Management

<table>
<thead>
<tr>
<th>Coefficient Estimate</th>
<th>Standard Error</th>
<th>CI 5%</th>
<th>CI 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.661</td>
<td>0.240</td>
<td>-1.057</td>
</tr>
<tr>
<td>Tool 5</td>
<td>0.516</td>
<td>0.241</td>
<td>0.119</td>
</tr>
<tr>
<td>Tool 6</td>
<td>0.505</td>
<td>0.245</td>
<td>0.102</td>
</tr>
<tr>
<td>LSE</td>
<td>0.488</td>
<td>0.244</td>
<td>0.087</td>
</tr>
</tbody>
</table>

Table 6-3 Risk Management Confidence Interval Model

Model 4 – Project Support Transition

<table>
<thead>
<tr>
<th>Coefficient Estimate</th>
<th>Standard Error</th>
<th>CI 5%</th>
<th>CI 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.655</td>
<td>0.243</td>
<td>-1.055</td>
</tr>
<tr>
<td>Tool 7</td>
<td>0.442</td>
<td>0.240</td>
<td>0.047</td>
</tr>
<tr>
<td>Tool 8</td>
<td>0.491</td>
<td>0.240</td>
<td>0.097</td>
</tr>
<tr>
<td>LSE</td>
<td>0.425</td>
<td>0.241</td>
<td>0.029</td>
</tr>
</tbody>
</table>

Table 6-4 Project Support Transition Confidence Interval Model

The qualitative interpretation of the coefficients in a logistic regression requires some numeric transformation and explanation; this is discussed in Section 6.6

6.6 Statistical Significance of Coefficients

Traditional research uses statistical hypothesis testing to infer something about a population using a representative sample. Statistics are used to answer questions of probability, generally using the scientific method, to determine if a hypothesis can be accepted or rejected. Statistical significance only addresses a hypothesis about whether differences exist, statistically, between groups (Gelman and Stern, 2006).

Statistical significance is based on several assumptions. The sample tested should be representative of the entire population. Inferential statistics assume a normal distribution. A normal distribution is represented by standard deviation (σ) from the mean (μ) value. One standard deviation (SD) represents 68% of the population (in both directions from the mean) while 95% of the population is represented by +2 SDs (Gelman and Stern, 2006).

Determination of whether statistically significant differences exist is centred on accepting or rejecting a “null” or “alternative” hypothesis. A null hypothesis, represented by H0, assumes no difference between groups, or, in the case of this study, no effect of LSE. An alternative hypothesis, represented by H1, can be
directional or non-directional. A non-directional hypothesis, based on rejecting the null hypothesis, provides a reference value for the outcome parameter. A directional hypothesis provides a minimal value for the expected outcome parameter. For example, a directional hypothesis for an intervention that decreases pain by a minimal clinical value may be represented by $H_1 > 2$.

Statistically significant differences are determined using a chosen level of probability (the “p-level” or $\alpha$) to ensure one does not incorrectly reject the null hypothesis due to chance, when the null hypothesis is in fact accepted (Type I error). The generally accepted p-level of $\alpha = 0.01$ suggests there is a 90% probability the researchers correctly reject the null hypothesis when there is no difference between groups. Therefore, the p-value is only the chance to make the correct “yes” or “no” decision regarding a hypothesis (Gelman and Stern, 2006).

Below, the coefficient “p values” for each of the models are shown. These were obtained directly from the logistic regression estimation in R and are part of the standard regression summary statistics.

The 10% level of significance was chosen in the design of this research. Standard levels of statistical significance are typically either 1%, 5%, or 10%. With smaller sample sizes, larger range of statistical significance are more commonly used (Gelman and Stern, 2006). The size of the survey data, with 290 observations, is sufficiently large, but may warrant a higher alpha level. For this reason, the 10% level was chosen. An interpretation of the alpha level is the statistically 99%, 95%, and 90% confidence in the results, at the alpha levels of 1%, 5%, and 10%, respectively. Statistical significance is the confidence that the results obtained were not due purely to chance and are indeed representing the discovered relationship and not a relationship obtained randomly in the data. The p value is the metric which provides the result of the statistical significance test. If the p value is lower than the alpha value, then the coefficient is statistically significant. If the p value is higher than the alpha value, then the coefficient is not statistically significant.

Tables 6-5, 6-6, 6-7 and 6-8 summarize the p values and statistical significance for each tool and LSE in each project dimension.
Model 1 - Communication Management

<table>
<thead>
<tr>
<th></th>
<th>p Value</th>
<th>Statistically Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.006</td>
<td>Yes</td>
</tr>
<tr>
<td>Tool 1</td>
<td>0.070</td>
<td>Yes</td>
</tr>
<tr>
<td>Tool 2</td>
<td>0.059</td>
<td>Yes</td>
</tr>
<tr>
<td>LSE</td>
<td>0.076</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 6-5 Communication Management Statistical Significance Model

Model 2 - Requirements Gathering

<table>
<thead>
<tr>
<th></th>
<th>p Value</th>
<th>Statistically Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.005</td>
<td>Yes</td>
</tr>
<tr>
<td>Tool 3</td>
<td>0.180</td>
<td>No</td>
</tr>
<tr>
<td>Tool 4</td>
<td>0.010</td>
<td>Yes</td>
</tr>
<tr>
<td>LSE</td>
<td>0.070</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 6-6 Requirements Gathering Statistical Significance Model

Model 3 - Risk Management

<table>
<thead>
<tr>
<th></th>
<th>p Value</th>
<th>Statistically Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.006</td>
<td>Yes</td>
</tr>
<tr>
<td>Tool 5</td>
<td>0.032</td>
<td>Yes</td>
</tr>
<tr>
<td>Tool 6</td>
<td>0.039</td>
<td>Yes</td>
</tr>
<tr>
<td>LSE</td>
<td>0.045</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 6-7 Risk Management Statistical Significance Model

Model 4 - Project Support Transition

<table>
<thead>
<tr>
<th></th>
<th>p Value</th>
<th>Statistically Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.007</td>
<td>Yes</td>
</tr>
<tr>
<td>Tool 7</td>
<td>0.065</td>
<td>Yes</td>
</tr>
<tr>
<td>Tool 8</td>
<td>0.041</td>
<td>Yes</td>
</tr>
<tr>
<td>LSE</td>
<td>0.078</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 6-8 Project Support Transition Statistical Significance Model

More discussion of these results is provided in Section 6.8

6.7 Model Testing

Sections 6.7.1 and 6.7.2 address assumption testing and model performance testing.
6.7.1 Assumption Testing

In linear regression, multicollinearity is typically tested for by calculating the Variance Inflation Factor (VIF) -- the ratio of variance in a model with multiple terms, divided by the variance of a model with one term alone (Robert, 2007). However, this calculation does not apply to logistic regression. Therefore, the author created a correlation matrix heat map visualizing the correlation between the predictor variables, shown in Figure 6-3. The calculation of the correlation matrix and the corresponding heat map visualization were performed in Python.

![Figure 6-3 Correlation heat map: ITPM Tools and LSE](image)

The author calculated the Pearson correlation between each of the variables; this is the most common correlation measure and it measures the linear correlation between variables (Robert, 2007). Pearson correlation ranges from -1 to 1 and indicates both the direction and strength of the relationship between two variables.

The direction of a relationship between two variables can be either positive or negative. In a positive relationship, the variables tend to move in the same direction. The relationship between education and salary is an example of a positive relationship; people with higher education tend to earn higher salaries. In a negative relationship, the variables move in opposite directions, like the
relationship between education and crime as people with higher educational attainment tend to be convicted of fewer crimes.

The strength of a relationship between two variables is also an intuitive concept to understand. The relationship between education and crime may be very strong, meaning higher education tends to dramatically decrease crime; educated people are highly unlikely to commit crimes. The relationship between education and salary may be less strong, meaning higher education tends to somewhat increase salary; educated people are somewhat likely to earn higher salaries.

A Pearson correlation of -1 indicates a perfectly negative relationship. A correlation of 0 indicates no relationship. A correlation of 1 indicates a perfectly positive relationship, likewise, a correlation of -1 indicates a perfectly negative relationship. A correlation closer to 0, either positive or negative, indicates a weaker relationship.

Multicollinearity, as explained earlier, is the presence of high correlation between predictor variables in a statistical model. High correlation between predictor variables is not desired in a regression and can lead to undesired outcomes (Robert, 2007). In the present study, the largest correlation between Tools and LSE, the two predictor variables, is 0.108, far below the threshold of concern. Although the threshold is subjective, statisticians generally agree correlation less than 0.5 means multicollinearity is not present. The correlation heat map shown below demonstrates multicollinearity is not present in any of the four models because there is no strong correlation demonstrated between the predictor variables.

6.7.2 Model Performance Testing

Model Accuracy

A confusion matrix compares the frequency of positive and negative actual “Y values” with the frequency of positive and negative predicted “Y values.” This provides a high-level overview of model classification performance and allows for an assessment of model accuracy (Arisholm et al., 2010). A confusion matrix follows the form shown below in Table 6-9.
Model accuracy is calculated as follows:

\[
\text{Model accuracy} = \frac{\text{True Positives} + \text{True Negatives}}{\text{All Outcomes}}
\]

In the four models, the dependent variable is success in one of four dimensions. The models attempt to predict a successful or unsuccessful outcome in a given project dimension from the use of either of the two tools or from the trait of LSE being possessed by the project manager. Therefore, the following is true for these models:

- A true positive is the case where the project was predicted to be successful along a given dimension by the model and was, indeed, successful;
- A true negative is the case where the project was predicted to be unsuccessful along a given dimension by the model and was, indeed, unsuccessful;
- A false positive is the case where the model predicted success along a given dimension but, in fact, the project was unsuccessful; and
- A false negative is the case where the model predicted failure along a given dimension but, in fact, the project was successful.

Confusion matrices and model accuracy metrics are shown for all four models below. These were calculated in Python. For Model 1, the interpretation of the confusion matrix is as follows:
- **True positives**: There were 60 projects which were predicted to be successful along the communication dimension by the model and were, indeed, successful;
- **True negatives**: There were 102 projects which were predicted to be unsuccessful along the communication dimension by the model and were, indeed, unsuccessful;
- **False positives**: There were 47 projects which were predicted to be successful along the communication dimension by the model but were, in fact, unsuccessful; and
- **False negatives**: There were 81 projects which were predicted to be unsuccessful along the communication dimension by the model but were, in fact, successful.

One metric combining the information in the four categories above is model accuracy, for example, in communication, model accuracy is 55.86%. This means, 55.86% of the time, the model predicted project success along the communication dimension. Tables 6-10 through 6-13 show results by dimension.

### Model 1 Communication Management Accuracy

<table>
<thead>
<tr>
<th>Actual</th>
<th>Predicted</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>102</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>81</td>
<td>60</td>
</tr>
</tbody>
</table>

Table 6-10 Communication Management Model Accuracy

Accuracy = 55.86%

### Model 2 Requirements Gathering Accuracy

<table>
<thead>
<tr>
<th>Actual</th>
<th>Predicted</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>91</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>60</td>
<td>83</td>
</tr>
</tbody>
</table>

Table 6-11 Requirements Gathering Model Accuracy

Accuracy = 60.00%
Model 3 Risk Management Accuracy

<table>
<thead>
<tr>
<th></th>
<th>Predicted</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Actual</td>
<td>No</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>63</td>
</tr>
</tbody>
</table>

Table 6-12 Risk Management Model Accuracy

Accuracy = 61.38%

Model 4 Project Support Transition Accuracy

<table>
<thead>
<tr>
<th></th>
<th>Predicted</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Actual</td>
<td>No</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>60</td>
</tr>
</tbody>
</table>

Table 6-13 Project Support Transition Model Accuracy

Accuracy = 59.66%

Accuracy for the four models falls in the range of 56-61%, with all models demonstrating similar accuracies. A model operating randomly would expect to perform with 50% accuracy, like flipping a coin. The range of accuracy for these models demonstrates that the models perform better than a model operating randomly. If the goal of the models were to be prediction or forecasting, this level of model accuracy may be less than desired. However, in the present work, these models were not built for the purpose of prediction or forecasting, but, rather, for investigating a relationship. Therefore, the most important metrics, in this case, are the impact of each of the variables, determined through the coefficients, and the statistical significance of these impacts, providing evidence that these relationships are statistically reliable.

6.8 Discussion

The coefficients of a logistic regression show the log odds ratio between the predictor variable being present and absent. In other words, the coefficients of
a logistic regression show the change in the log odds of the dependent variable, given the presence of the predictor. Therefore, taking Euler's “e” and raising it to the power of the coefficient, “exp(coefficient),” will show the change in the odds of the dependent variable, given the presence of the predictor.

The calculation of each variables’ impact is shown in Tables 6-14 through 6-17 below. The coefficient values were obtained directly from the logistic regression output in R, and they mirror the values displayed earlier. The values were transformed directly using the exp(coefficient) transformation. Finally, the impact is calculated as exp(coefficient) - 1.

**Model 1- Communication Management**

<table>
<thead>
<tr>
<th>Coefficient Estimate</th>
<th>Exp(Coefficient)</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool 1</td>
<td>0.464</td>
<td>1.590</td>
</tr>
<tr>
<td>Tool 2</td>
<td>0.469</td>
<td>1.599</td>
</tr>
<tr>
<td>LSE</td>
<td>0.429</td>
<td>1.536</td>
</tr>
</tbody>
</table>

*Table 6-14 Communication Management Odds of Success*

**Model 2-Requirements Gathering**

<table>
<thead>
<tr>
<th>Coefficient Estimate</th>
<th>Exp(Coefficient)</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool 3</td>
<td>0.322</td>
<td>1.380</td>
</tr>
<tr>
<td>Tool 4</td>
<td>0.639</td>
<td>1.895</td>
</tr>
<tr>
<td>LSE</td>
<td>0.438</td>
<td>1.550</td>
</tr>
</tbody>
</table>

*Table 6-15 Requirements Gathering Odds of Success*

**Model 3- Risk Management**

<table>
<thead>
<tr>
<th>Coefficient Estimate</th>
<th>Exp(Coefficient)</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool 5</td>
<td>0.516</td>
<td>1.676</td>
</tr>
<tr>
<td>Tool 6</td>
<td>0.505</td>
<td>1.656</td>
</tr>
<tr>
<td>LSE</td>
<td>0.488</td>
<td>1.630</td>
</tr>
</tbody>
</table>

*Table 6-16 Risk Management Odds of Success*

**Model 4-Project Support Transition**

<table>
<thead>
<tr>
<th>Coefficient Estimate</th>
<th>Exp(Coefficient)</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool 7</td>
<td>0.442</td>
<td>1.556</td>
</tr>
<tr>
<td>Tool 8</td>
<td>0.491</td>
<td>1.634</td>
</tr>
<tr>
<td>LSE</td>
<td>0.425</td>
<td>1.530</td>
</tr>
</tbody>
</table>

*Table 6-17 Project Support Transition Odds of Success*
6.8.1 Leadership Self-Efficacy Results Discussion

Leadership Self-Efficacy has an impact of over 50% in all four dimensions. According to the analysis of the interview transcripts of the participant’s views and expert knowledge regarding the practice of IT project management, leadership tends to be a very important factor in project success, in general. As one of the interviewee participants mentioned “Leadership is a really important skill for project managers. Leadership provides ability for project managers to be able to take control of the project whatever the situation.” (Participant #24). So, IT project manager leadership skill is important and most important is his/her leadership self-efficacy skill. The following sections will discuss in detail the results of logistics regression analysis and the impact of IT project manager LSE skill on specific project dimension success.

6.8.1.1 Impact of Leadership Self-efficacy on IT Project Communication Management

Nothing is more important to the success of a project than effective communication. But difficulties are faced in implementing effective communication due to various factors like the nature of the project, structure of the organization etc. As found though the interview transcript analysis, about 90% of the project manager’s time is spent on communication (see also Rajkumar, 2010). The logistic regression analysis of the Project Management Questionnaire” (LSE measurement instrument) and the “Project Management 10 Project Details.” Survey showed that the IT project managers in this study that have higher LSE scores can impact the odds of project dimension success by 53.6% in the project dimension of communication management. Communication is an essential tool in IT project management. It is gaining importance every day and is the centre of all project management processes. There are two main groups of people with whom the project manager needs to ensure clear and effective communication, the stakeholders and the project team.

The empirical results of the logistics regression suggest that IT project managers with LSE have high probability of success to overcome communication obstacles and increase the odds of success in the IT project dimension of communication management, a dimension/knowledge area which is ongoing in
the project from beginning to end. Also, through the review of the interview transcripts, interviewees stressed the importance of leadership in project communication and how project managers can be trained in project communication to enhance their communication skills. Several participants indicted that communication was 90% of a project manager’s activities (participants #8, #18, #28); one person indicated 99% (participant #16), and another indicated more than 70% (#19). Participants emphasised the importance of communication and indicated that successful execution of a project is based on communication; projects depend on the communication skill of the project manager (participant #16).

6.8.1.2 Impact of Leadership Self-Efficacy on IT Project Requirements Gathering.

The success of a project can only be determined by comparing what a project actually produces as its deliverables against any approved requirements. Once the project’s purpose, potential goals, and general expectations are communicated, this should trigger the requirements gathering process, which involves identifying all the resources, tools, and techniques you will need to ensure you and your team can achieve the project deliverables. The logistic regression showed an impact of 55% in increase of the odds of success of an IT project in the requirements gathering dimension, which proves the impact of project manager personality in aligning project team to make sure clear and complete requirements were gathered. Collecting IT project requirements are not the sole responsibility of the IT project manager, but it is his/her responsibility to make sure requirements were completely gathered, documented, reviewed and verified by clients. In order to make sure requirements were completely gathered, documented, reviewed and verified by clients, the IT project manager needs to have special skill or qualities to be able bring all participating parties, brainstorm, documents, validate and approve gathered requirements. With this in mind, LSE training, could be an important factor in IT project managers’ abilities to effectively manage the requirements gathering phase. Transcripts of the interviews indicate that participants consider that accurate and thorough requirements gathering is crucial to project success and smooth project execution, and that it can be a difficult aspect of project management. If requirements are not gathered correctly
and accurately, the project will always be in danger and set for failure (participants #10, #21, #22). As participant #14 stated, “Requirements gathering is very difficult to define, and there is always a gap in requirements gathering. But I feel the project manager should have the ability to reduce the gap.” This comment supports the finding that IT project manager LSE has an impact on requirements gathering by increasing the odds of success in this project dimension.

6.8.1.3 Impact of Leadership Self-Efficacy on IT Project Risk Management.

Logistic regression shows that the presence of IT project managers LSE increases the odds of project success by 63% in the risk management dimension in the data sample of the present research. Effective risk management strategies allow IT project managers to identify their project’s strengths, weaknesses, opportunities and threats. By planning for unexpected events, project manager can be ready to respond if they arise. To ensure their project’s success, project managers must define and plan how they will handle potential risks in order to mitigate or avoid problems throughout the project life cycle. Having a risk management plan in place allows IT project managers to be proactive and take steps to mitigate possible harms before they arise, instead of constantly putting out fires after they arise. The project team can evaluate the risks that have been identified and convert them to actionable steps that will reduce the likelihood of such risks actually occurring. Those steps then become contingency plans that hopefully can be ready. Should a risk event occur, the contingency plan can be implemented quickly, reducing the downtime on a project. In order to manage all of that, self-confidence and leadership skill are assets, and LSE may be an underlying factor. During the interviews, participants made comments regarding having risk qualification discussions with the team (participant #9), which highlights that it is the responsibility of the project manager to initiate risk qualification discussions with the project team. One interviewee talked about identifying inconsistency, documenting risk, mitigation planning and discussing these issues with stakeholders to get their feedback, and then publishing the risks, risk impacts and the mitigation plans (participant #5).
6.8.1.4 Impact of Leadership Self-Efficacy on IT Project Support Transition

Logistic regression of the data sample showed that the factor of the IT project manager possessing LSE increases the odds of success by 53% in the project dimension of support transition. Transitioning a project after deployment to the support team is key to freeing the project team to handle new projects. Such tasks will need special planning, preparation and skill from the IT project manager. Many IT projects fail to plan and manage this dimension of a project and end up going over schedule and budget by holding the project team to document the project and train the support team. As several participants mentioned in the interview transcripts, it is usually important to plan for the project transition by engaging the support team with the project team early in the process to understand the implemented project and provide feedback regarding how they would like the project documentation to be delivered to them. Participants also indicated the need to have a support consultant on the implementation team; this consultant can perform documentation, troubleshoot, and provide and document training (see participants #1, #5, #10). Convincing the project support team to dedicate a support consultant to be part of the implementation team requires the leadership skills of the IT project manager to plan and coordinate the inclusion of all teams and team members from the beginning of the project through its transition to the support team and end client.

6.8.2 Impact of ITPM Tools on Dimension Outcome

IT project managers who want to deliver good project results must first have good project management tools. Also, project managers need to select the tools that are appropriate for the situational factors of the projects. IT project management is all about using the right tools and techniques. The following sections will discuss the results of the impact of eight selected IT project management tools on the odds of successful outcome in the specific project dimension.
6.8.2.1 Weekly Status Report

From the logistic regression analysis, it was found that using a weekly status report increases the odds of success by 59% in the communication management dimension. The weekly status report tool supports the following project communication functions: documenting the weekly activity of the project, updating project status, critical issues and action plans, sharing project information with all stakeholders, budget and schedule updating.

Using a weekly status report tool increases the odds of successful communication management because it keeps all stockholders involved in the project and alerts them if any issues occur so that adjustment plans can be implemented to control the project schedule and budget.

6.8.2.2 Electronic Communication

Logistic regression found that electronic communication increases the odds of successful dimension outcome by 59.9% in the communication management dimension. Electronic communication provides the following benefits that impact IT project success: instantaneous updates, contacting all team members and stakeholders simultaneously, documentation and electronic record of communications.

Participants (i.e, participant #6) stressed the importance of project communication tools such as private blogs, “[I] created a private blog for the project team to discuss issues and seek help. I feel social media is a very important tool to facilitate communication between project teams.” This shows how impactful IT project communication tools can be in increasing the odds of successful outcome in the IT project communication management dimension.

6.8.2.3 Functional Decomposition

The data analysis found that use of the functional decomposition tool increases the odds of successful outcome in the requirements gathering dimension by 38%. Although not statistically significant, this result does show an impact on the IT project requirements gathering dimension. The functional decomposition tool on IT project requirements gathering dimension: simplifies
requirements, translates business details from end users to technical language, breaks down complicated requirements into components.

Clear requirements gathering helps control the IT project schedule and budget.

### 6.8.2.4 Use Case Diagram

In the analysis of the present data, it was found that utilization of a use case diagram tool increases the odds of successful outcome in the requirements gathering dimension by 89%. Use case diagrams help IT project teams and IT project managers determine the actual application and implementation of each functionality. Capturing requirements in the form of use cases effects a subtle shift in perspective. Use cases capture requirements in the form of interactions with an end user. When requirements are captured in terms of what the system should do, it is easy for important details to be missed. When requirements are described in terms of interactions with end users, missing details become obvious. This is the reason use case diagrams play an important role as a tool in requirements gathering. This tool supports the IT project manager’s efforts in making sure requirements are not missed.

As mentioned, clear requirements gathering helps control the IT project schedule and budget.

### 6.8.2.5 Risk Management Check List

The present study found that use of a risk management checklist tool increases the odds of project success by 65% in the risk management project dimension. A Risk Management Checklist is prepared by a project manager to detect risks and their potential impact on the project. Using a risk management check list helps early detection of potential risks that might happen to the IT project at various points of its lifecycle.

A risk management checklist facilitates the IT project managers’ responsibility to detect risks, find root causes and find actionable plans to mitigate such risks, which should result in increasing the odds of successful outcome in the project dimension of risk management. Using such checklists can improve
early detection of risk and help control the impact of risks on the project schedule and budget.

6.8.2.6 Risk Impact Assessment

The use of a risk impact assessment tool was found to increase the odds of project success by 63% in the project risk management dimension in the present data sample. A risk, by its very nature, always has a negative impact. However, the size of the impact varies in terms of cost and impact on health, human life, or some other critical factor. Use of a risk impact assessment tool provides and estimation of risk impact probability (low, medium, high and critical). Risk impact assessment helps determine the actionable plans needed to be implemented by the project team and project manager.

Participant #9 mentioned the importance of using a risk identification questionnaire by project phase. This questionnaire can help set the criteria for classifying risk and define what it means to be a risk for the client. “The project manager will need to have a risk discussion with the team to be able [to determine] what can be qualified as a risk and how to deal with each identified risk.” Such a tool, which is equivalent to the risk identification checklist, helps increase the odds for successful outcomes in the IT project risk management dimension and help reduce overall project failure.

6.8.2.7 Support Transition Checklist

In the analysis of the present data, using a support transition checklist tool increased the odds of success by 55.6% in the project support transition dimension. A clear project support transition checklist helps the project manager outline the requirements to the project team for transitioning the project to the project support team. A support transition checklist provides tentative timelines, roles and responsibilities of who should do what during the support transition phase of the IT project.

The purpose of using a support transition checklist is to reduce possible confusion between the IT project team and IT project support team. Having a smooth transition between these two teams can minimize interruptions to the IT project schedule and avoid delays and costs that affect the budget.
6.8.2.8 Knowledge Transfer and Walk Through Sessions

As described above, the analysis of the data indicated that the odds of a successful outcome in the dimension of project support transition were increased by 63.4% when the dimension-specific tool knowledge transfer and walk through sessions were used. Knowledge transfer and walk through sessions bring the IT project team and support team together to discuss the details of the IT project implementation, details of issues experienced, and how to solve them. This tool reduces gaps in understanding between the IT project team and the IT support team through review of project documentation and identifying gaps in project documentation that the project team needs to clarify or provide to the support team before handing over the project.

During the interviews, participants commented on what would make managing this project dimension easier. Predefined processes and tools would help. Some participants think that there are no well-defined tools on a generic level even though each organisation has their own tools. Documentation of practical experience and a framework are needed to improve project management resources for the project support transition dimension. This was emphasised by the interview comments in Chapter Four.

6.9 Leadership Self-Efficacy Results

The investigation of the impact of LSE on the odds of successful outcomes in project dimensions was investigated in the dimensions of communication management, requirements gathering, risk management and project support transition. The impact on the odds of successful outcome in each dimension was derived from the estimated model coefficients. Based on the analysis of this sample of 290 data for each dimension provided by the twenty-nine IT project management professionals (10 data for each dimension from each participant), the findings are as follows.

The comparison of the results of the impact of LSE on the odds of success in these four project dimensions is depicted in Figure 6-4.
6.10 Project Management Tools Results Summary

The investigation of the impact of the use of specific IT project management tools on the odds of project dimension success was investigated in the project dimensions of communication management, requirements gathering, risk management and project support transition. The impact for each tool was derived from the estimated model coefficients. The following findings were obtained, based on the analysis of 290 data (for each tool) from the twenty-nine IT project management professionals (ten data for each tool from each participant).

The comparison of the determined impact of project tools towards project success is depicted in Figure 6-5. (See below.)

The results obtained for the impact of both Leadership Self-Efficacy and the use of ITPM tools show statistical evidence of their impact on the odds of successful outcomes in four project dimensions, and, with one exception, these results are statistically significant (at the 10% (p ≤ .10) level or lower), confirming the results are statistically reliable. The one exception is the use of the tool of functional decomposition, specific for use in the dimension of requirements gathering; this tool was not statistically significant and also had the lowest impact on the odds of successful outcome in the related dimension.
Although the result for the impact of using functional decomposition in the project dimension of requirements gathering is not statistically significant, the result for the second tool analysed in the dimension, use case diagram, is significant at the 1% level ($p \leq .010$).

The results for the impact of IT project managers possession of LSE on the odds of success in the dimension of risk management is significant at the 5% level ($p \leq .050$). The results for the two tools analysed in the dimension of risk management are also significant at the 5% level.

In the case of the dimension of project support transition, using the tool of knowledge transfer and walk through sessions is significant at the 5% level.

Considering the results with higher statistical significance, comments from the participants indicated that, while all dimensions carry great importance and depend on the IT project manager’s skills and available ITPM tools, the dimension of requirements gathering can be especially challenging and improved tools and frameworks would be helpful. This was also expressed about risk management and risk management tools; experience in risk management seemed especially important in the view of some participants. In the case of the dimension of project support transition, this area was also considered by many participants to pose problems in that it sometimes overlaps in time with finishing other aspects of the project and sometimes this dimension does not get an adequate focus in project
management. The tool of knowledge transfer walk through sessions, when used, may be very effective, even though other tools and better tools are also needed.

These results answer Research Questions One and Two:

Research Question One:
Is there a relationship between Leadership Self-Efficacy and success in particular dimensions of a project?

Research Question Two:
What is the impact of specific ITPM tools on project success?

6.11 Conclusion

This chapter explored the relationship between LSE, project management tools and success or failure in each of the four project dimensions which contribute to the overall success of projects. These relationships were explored using the binary data from the “Project Management Questionnaire” and the “Project Management 10 Project Details” survey. The rational for the selection of logistic regression was explained and the application of statistical significance testing was outlined in detail. The results obtained show that the use of IT project management tools does impact success in project dimensions and the possession of LSE on the part of the project manager does increase the odds of the project dimension outcome being successful. These results, with the one exception of tool 3, were statistically significant.

As stated in the last section (section 6.10), the results shown in this chapter provide strongly supported answers to Research Questions One and Two, and confirm 1) the connection between IT project managers’ possession of Leadership Self-Efficacy and the odds of successful outcomes in four project dimensions, as well as 2) the impact of each of the eight ITPM tools on the odds of successful outcomes in these project dimensions. Not only do the results confirm the existence of connections between LSE and dimension outcomes, the results also clearly indicate, with statistically reliable evidence, that the impact of project managers’ possession of LSE is positive and increases the odds of successful outcomes in the four project dimensions considered in this study. Similarly, not only the existence of an impact from the use of dimension-specific ITPM tools is confirmed, but also that the impact is positive and increases the odds of successful
outcomes in the related project dimension; again with statistically reliable and, in 7 out of 8 cases, also statistically significant evidence.

Possessing LSE increases the odds of success in the project dimensions of communication management (53.6%), requirements gathering (55.0%), risk management (63.0%), and project support transition (53.0%). (Figure 6-4).

The use of ITPM tools is considered a means to counter anticipated challenges in each of the four main dimensions of projects. In this research, the effectiveness of ITPM tools has been demonstrated empirically. Using project management tools increases the odds of success in project dimensions from 38.0% to 89.5% depending on the tool and the project dimension. (Figure 6-5.)

The successful outcomes in the specific dimensions in turn contribute to the final outcome of the overall project.

Although this study is based on a relatively small sample in terms of the number of interviewees, the data regarding ten projects on the part of each interviewee provided a larger data base, concerning the report of ITPM tool use (or not) and judgements of project dimension outcomes (as successful or not), on which the analysis is based. Furthermore, the statistically significant results support the reliability of these findings and the effectiveness of the model designed for the analysis. Additionally, qualitative data in the form of the expert knowledge provided by the IT project management professionals (Chapter 4), support findings in this chapter regarding the impact of Leadership Self-Efficacy on the odds of success in project dimensions and the impact of dimension-specific IT project management tools on the odds of success in the related project dimensions.

Keeping in mind that data-based studies addressing these relationships had not been found in the review of previous research and related literature, the design and results of this research represent contributions to the knowledge base on the handling of complex processes related to controlling and predicting IT project success in specific areas. These results provide important information to the knowledge base by statistically confirming the relationships between the variables of LSE, tools and successful outcomes in four aspects of IT projects and, thus, this study begin to fill the gap of, until now, an absence of studies.
Next Chapter Seven will analyse data from the interview transcripts using a word to vector technique and will address Research Question Three.
Chapter Seven: Word to Vector Analysis of Selected Word Pairs in the Interview Transcripts

7.1 Introduction

Chapter Seven addresses the word2vec text analysis designed to answer Research Question Three (see below).

Research Question Three:
Is Leadership Self-Efficacy a factor in project managers’ perspectives on IT project management tools and their perspectives on ownership of project success/failure?

The chapter explains the analysis of selected word pairs in the transcripts of the recorded interviews that were conducted with each participant. The analysis is done with word to vector, a text analysis technique of Natural Language Processing (NLP). This data was provided directly by the participant during the audio recorded interview as explained in Chapter Three.

The interview guide asked participants for explanations rather than for short answers. This data consists of the participants’ explanations in response to IT project management topics, usually initiated by the interviewer. The topics are related to IT project dimensions, tools, professional resources and improving the work of project management (see the interview guide in Appendix A3). The responses occurred through interactive conversation, with the participant being the main speaker. This data was collected qualitatively in its full form through recording, and was prepared, i.e., pre-processed, for text analysis.

The word to vector analysis was performed using Google word2vec. This technique involves word frequencies and word associations (also referred to as “word similarity”). The analysis yields result in the form of degrees of cosine similarity of the words involved in the word pairs. The words were selected by the researcher, pairing words representing concepts related to the project dimensions and to success, failure and the project manager.

For each word pair, the results for the group of participants with and without LSE are shown. The degree of difference between the two groups may indicate the existence of LSE as a factor that differentiates the groups regarding particular
word pairs. However, the word to vector analysis does not provide any evidence of the character or type of association between the words.

The paired words were selected by the researcher with an objective of pairing concepts related to ITPM tools and the project dimensions as well concepts representing the project manager and success and failure. The word2vec algorithm findings, for the most part, showed higher cosine similarity for the word pairs in the text data from the group with LSE compared to the group without LSE. The differences between groups and the context of the concepts represented by the words may suggest possible differences in viewpoints about the concepts between the groups of those project managers with and without LSE. This a step toward assessing the relationships between project manager LSE and ITPM tool use and between LSE and project managers’ perspectives on accountability and ownership of project outcome.

7.2 Natural Language Processing and Analysis Overview

Natural Language Processing (NLP) is a tract of Artificial Intelligence and Linguistics, devoted to making computers understand the statements or words written in human languages. Natural language processing came into existence to ease the user’s work and to satisfy the wish to communicate with the computer in natural language. The goal of Natural Language Processing is to accommodate one or more specialities of an algorithm or system. The metric of NLP assessment on an algorithmic system allows for the integration of language understanding and language generation. (Jurafsky and Martin, 2008).

To answer the research question, the author performed the Natural Language Processing analysis using word vectors. These vectors were created by using the interview data to train Google’s word2vec algorithm. The word vectors output from the algorithm calculated the similarity (also referred to as “association”) of words based on specifically selected words in the interviews. The algorithm was trained by the researcher separately for the analysis of the input text data from the interview transcripts of the project managers with LSE and without LSE to allow for comparison of the results for each group.
CHAPTER SEVEN: WORD to VECTOR ANALYSIS of SELECTED WORD PAIRS in the INTERVIEW TRANSCRIPTS

Data pre-Processing

Compared to other fields, Natural Language Processing (NLP) data is inherently unstructured and requires extensive pre-processing. As mentioned earlier, two of the many reasons for this include 1) the data being user-provided and 2) the data being textual in nature. For this data processing, transcriptions of the recorded interviews were manually entered into Word documents. Since this is text written by humans for humans, the transcripts required appropriate manipulation before use in Natural Language Processing (NLP) (Collobert and Weston, 2008). The following pre-processing steps were performed to prepare the transcribed interview data for NLP analysis.

1. Convert each paragraph in each document into a list of words - This is performed so that the algorithm treats each word as a separate entity and can find relationships among all the words in the data.

   The word2vec algorithm requires a very specific type of input. The input text needs to be formatted as lists of words, separated by commas. For instance, the sentence, "I have been a project manager for 10 years," needs to be converted to ["I", "have", "been", "a", "project", "manager", "for", "10", "years"], where [ ] bracket notation indicates a list of elements. Another example: ['chuck', 'already', 'answered', 'previous', 'question'].

   These word sets in brackets are, basically, the words in a sentence, or clause, grouped in the bracket. Once the data is pre-processed, the word pair association analysis with word2vec will search for the co-occurrence of both words of a given word pair within brackets. Then, the frequency of such co-occurrences of the two words in the brackets will be calculated using cosine similarity to yield a numerical association result.

2. Remove paragraphs with interview guide or interviewer text. The presence of any non-interviewee language would bias the data.

   In order to analyse the data effectively, the textual content sourced from the interviewer and the interviewee must be separated. In providing a comparative study of the language of the interviewees, it is imperative to isolate their language.
3. Remove special characters - All special characters were removed for the purpose of this analysis. Special characters, such as !, @, #, $, %, etc., can be disruptive to the string splitting process involved in Natural Language Processing analysis.

In order to perform an NLP analysis, characters represented by strings must be separated into lists of words, as described earlier. A computer program, written in Python, can perform the string splitting by relying on assumptions of what denotes a delimitation of a word. Python assumes spaces represent the termination of words, and any time a space is found in a string, Python separates the text to the left and right of that space into two distinct words. Any character used as a delimiter, meaning to denote the end of a word or phrase, is dangerous because it can allow for errors in splitting the words during pre-processing. Special characters may also be indicative of typographical errors. All special characters were removed for the purpose of this analysis.

4. Convert words to lowercase. Uppercase letters are recognised as different from lowercase letters by the Python language involved in the process to call the word2vec algorithm.

All words are considered as unique distinct entities in NLP analysis. In order for this to be possible, the words must be exactly the same. "Project" and "project" are considered as two different words by the Python language. In order to ensure all words are represented correctly, the words are converted to only lowercase letters for the purposes of the analysis.

5. Remove stop-words. It is a standard practice to remove words such as "the," "and," and "or" from the text before utilising the text for NLP. In fact, packages in Python come preloaded with lists of stop-words for each language.

In natural language processing, some words have more meaning than others. The word "the," for instance, is often extraneous in order to gauge the meaning of a sentence, even for a human observer. Therefore, to
ensure only the meaningful words are analysed, the standard English stop-
words were removed from the text of the transcripts for this analysis.

In summary, the texts of the interview transcripts were pre-processed
according the data pre-processing procedures mentioned above. Once the text
data was pre-processed, the word2vec algorithm was invoked, using the Python
program, to check the occurrence of a selected search word with a selected
comparison word within each bracket [ ]. In other words, each word pair consists
of one search word and one comparison word, and the word2vec algorithm
searches to find both words within the same bracketed set of words, and based
on the frequency of the co-occurrence of the word pair in the bracketed word sets,
the numerical calculation is made for each group of participants, those deemed to
have LSE and those deemed not to have LSE. The word2vec algorithm performs
the word similarity (also referred to as “association” in this context) calculations in
the form of cosine similarity to numerically represent the association of the search
word with the comparison word. For details, please refer to section 7.5.2 (Similarity
metric).

### 7.3 Exploratory Analysis

**Word cloud visualization**

The data was examined before any analysis was performed. Below (Figure
7-1) is a word cloud visualization of the full pre-processed text data from the
interviewees, created through the implementation of Python word cloud generator.
In this type of visualization, the size of the text in which a particular word is
displayed represents the relative frequency of its use. Note that the scaling in the
word size does not represent the frequency of use in an exact way. For example,
"project" being twice as large as "manager" does not necessarily mean "project"
was used twice as often as "manager." But the larger size of “project” does
indicate more frequent occurrence of “project” compared to the frequency of
occurrence of “manager.”
Perhaps not surprisingly, the terms “project manager,” “project,” “project management,” “tool” and “project” appear frequently in the data. This is reasonable because the content of the questions by the interviewer prompted the interviewees to talk about the use of project management tools. “Communication” appears to have been discussed more than the other three project dimensions, with “Requirement gathering” as the second most discussed success dimension. Examining the data in this manner before performing analysis is best practice because it serves as a sanity check. It allows confirmation that the data aligns with expectations and that pre-processing was performed correctly. There were no surprises in the exploratory analysis phase.

7.4 Analysis Approach

The word2vector approach will be used for the analysis of the pre-processed data. The application is explained in detail below.

7.4.1 word2vec Overview

Published in 2013, word2vec, shorthand for "word to vector," is an algorithm developed by Google which converts textual information into numerical representations. Because computers cannot inherently understand human
language and understand only numbers, any textual information must be converted to a numerical representation in order for computers to make sense of the information. word2vec is an algorithm at the forefront of NLP analysis and outputs vector representations of words, which demonstrates deep understandings of syntactic and semantic properties of human language (Pennington et al., 2014).

Syntactic properties of language govern the structure of language. These properties include word order, verb conjugation, tense, masculinity and femininity, and singularity and plurality, and many more. Vectors output from word2vec are able to learn these types of properties. For example, there is a certain vector direction which encodes the relationship between present and past tense. Translating a vector along this direction will convert it from present to past tense. word2vec also understands relationships such as "run is to ran as cook is to cooked" (Tang et al., 2014).

Semantic properties of language represent the meaning of words. These properties include definitions, synonyms, antonyms, analogies, metaphors, and many more. Vectors output from word2vec are able to learn these types of properties. A famous example is a word2vec algorithm trained on a sufficiently large dataset will be able to fill in the following phrase: "king - man + woman = ?" with "queen" (Tang et al., 2014).

7.4.2 word2vec algorithm

This section will detail how the word2vec algorithm works and, specifically, how it arrives at the word vector representation output.

word2vec is a specific type of Artificial Neural Network (hereafter referred to as "neural networks"). Neural networks, an algorithm first developed in the 1950s, has gained enormous popularity since 2010, due to large increases in computing power and the promise of powerful results from successful artificial intelligence machine applications. Some of the common uses of neural networks include machine translation, image recognition, and autonomous vehicles. Neural networks are modelled after the human brain. In the human brain, 100 billion neurons send information to and from each other; this constitutes all of human thought. In neural networks, a neuron is a computational unit which performs a specific mathematical calculation. A neural network is set up with many neurons.
Typically, neural networks are used in supervised learning, in which humans provide a network with training data which contains many examples of features of data, along with labels for the data. Supervised learning is used to teach a machine to perform a specific task (Stergiou and Siganos, 2017). For instance (Figure 7-2), a neural network can be shown many example images of cats and dogs, along with labels specifying whether each image is a cat or a dog, and learn the properties of the images distinguishing cats from dogs. The network can, then, be shown new images without labels and classify each image as a cat or a dog based on the properties it has learned (Dey, 2017).

Neural networks can also be used for unsupervised learning, in which humans simply provide a network with unlabelled data, and the network learns properties of the data. For instance (Figure 7-3), a network can be shown many examples of news articles and can group the articles into different topics based on the similarity in content between the articles (Bansal, 2018).
Hidden layers are where the magic of neural networks happens. Calculations are performed to transform input to output, which allows the network to learn. Neural networks can be either shallow, meaning they possess only one hidden layer, or deep, meaning they possess multiple hidden layers. Deep neural networks are often used because they allow machines to learn more complex information about the data. word2vec, contrarily, is a shallow neural network (Mikolov et al., 2013).

7.4.3 Procedures to analyse interview data with word2vec algorithm

1. Data was formatted based on the pre-processing procedures mentioned in section 7.2
2. Data was read by the word2vec algorithm/Python program to search for the word association (similarity) of the search word and comparison word, for each word pair, within each bracket [ ] in the pre-processed text data from the interview transcripts of each group of participants (those with and without LSE).
3. Similarity comparison, section 7.5.1, was conducted to find out the degree of similarity (association) between the search words and comparison words.

The Python packages were used for data pre-processing and to find degree of similarity (association) between the search words and comparison words. The code used to perform the analysis is provided in Appendix D.

7.5 Model Form two datasets

For this thesis, the author trained word2vec separately on two separate datasets. The first dataset was comprised of the interview data collected from the sixteen project managers who were deemed to possess LSE. The second dataset was comprised of the interview data for the thirteen project managers deemed as not possessing LSE. (See Chapter Five for an explanation of the variable LSE and the transformation applied to obtain binary data.)
7.5.1 Similarity Comparison

A list of search words, base case comparison words, and comparison words was selected by the author to address the research question investigated through the NLP analysis, based on text and frequency and concepts of words and phrases used by the interviewees, and surveys. The similarity between each of the search words and comparison words was calculated using the Python program to execute Google word2vec algorithm.

The purpose of the base case comparison words is to validate the approach. The base case comparison words should be strongly related to the search words if the approach is reliable. For each of the comparison words, the strength of the association is calculated, in degrees of cosine similarity, for the group of project managers possessing LSE and the group not possessing LSE.

**Search words, Base Comparison words, Comparison words**

Following are the lists of search, base comparison, and comparison words selected to explore the factor of LSE in project managers’ perspectives on accountability/ownership of successful and unsuccessful project outcomes and in concepts related to ITPM tool use in the management of each of the four project dimensions discussed in this study.

**Success and Failure**

Search words:
- manager
- managers
- management
- lead
- leadership
- project manager
- project managers
- director

Base Case Comparison words:
- project
- management
Comparison words:
- success
- failure

Search and Base words related to project dimensions:

**Communication Management**
Search words:
- communication
- communicate
- feedback

Base Case Comparison words:
- tool

Comparison words:
- written
- email
- talk
- good

**Requirements Gathering**
Search words:
- requirements
- gathering

Base Case Comparison words:
- tool

Comparison words:
- discuss
- document
- scope

**Risk Management**
Search words:
- risk
• management

Base Case Comparison words:
• tool

Comparison words:
• identify
• mitigate
• checklist

**Project Support Transition**

Search words:
• transition
• support

Base Case Comparison words:
• tool

Comparison words:
• technical
• timeline
• checklist

For the search and comparison words listed above, the similarity was calculated and compared between project managers possessing and not possessing LSE. This direct comparison of the numerical similarity provides an analytical approach to determining the existence of a difference between the two groups.

Only single words, rather than phrases, are able to be used by the algorithm as both search and comparison words. The numerical results do not characterise the relation between the associated words; however, the words have selected to gain insights into managers’ views on tools and ownership of success and failure. The difference in the degree of association between the word pairs in the text from the interviews of each group may confirm LSE as a factor in differences between the groups and may suggest insights regarding the possible influence of LSE on project managers’ views regarding the concepts represented by the words. The cosine similarity results will be considered in the context of the practical situation...
7.5.2 Similarity Metric

**Cosine Similarity**

Cosine similarity is one analytical method for determining the similarity between two vectors. The cosine similarity is the cosine of the angle between the vectors. Two identical vectors have a 0° angle between them. The cosine of zero degrees is one and, thus, the cosine similarity between these two vectors is 1. Two perfectly independent vectors have a 90° angle between them. The cosine of 90 degrees is zero and, thus, the cosine similarity between these two vectors is zero. Two perfectly opposing vectors have a 180° angle between them. The cosine of 180 degrees is -1 and, thus, the cosine similarity between these two vectors is -1. These three cases illustrate the boundaries of cosine similarity. The metric lies between -1 and 1, with negative values representing dissimilarity, positive values representing similarity, and zero values representing independence (Garcia, 2015).

The formula for cosine similarity is derived from the dot product formula. The formula describes the dot product of vectors “a” and “b” is equal to the magnitude of "a" times the magnitude of "b" times the cosine of the angle between vectors “a” and “b.” The formula is represented as follows:

\[ \vec{a} \cdot \vec{b} = \|\vec{a}\| \|\vec{b}\| \cos \theta \]

Solving for cosine in the above equation yields the cosine similarity formula as follows:

\[ \cos \theta = \frac{\vec{a} \cdot \vec{b}}{\|\vec{a}\| \|\vec{b}\|} \]

7.6 Model Testing

Model testing is used to validate the base model using the Base Case Comparison words on the list of the search words shown in Section 7.5.1. The purpose of this test is to make sure both project managers possessing LSE and
project managers not possessing LSE have the same perception of the words “Project” and “Management.”

7.6.1 Base Case for Success and Failure

The terms selected to be tested for association with the terms “success” and “failure” are the following: “manager,” “managers,” “management,” “lead,” “leadership,” “pm” (project management), “pms” (project managers), and “director.” Before calculating the similarity for the concepts of interest, a test was performed to ensure the results are reliable. The relationship between “Project” and all of the terms of interest were explored, as well as the relationship between “Manage” and all of the terms of interest. Both “Project” and “Manage” have strong positive associations with all of the search words. If these search words were not strongly associated with the terms “Project” and “Manage,” it would warrant suspicion of the validity of the approach or data. Also, LSE does not have an impact on the association between these terms. These terms would be expected to have the same meaning regardless of the traits of the interviewees and each of the terms is expected to have approximately the same degree of association with the term “project” in the text data of project managers with and without LSE. This test provides evidence as to whether the approach can be trusted.

Referencing the viewpoints of the participants from the qualitative analysis of the interview transcripts (Chapter 4), the feedback provided from both groups of IT project managers, with and without LSE, shows that they are all experienced professionals and well acquainted with the IT project management profession and what it takes to be an IT project manager. So, in addition to the general definitions of the words being tested for association with the word “project,” the participants also share professional experience and also understand the definitions of these words in their more specific professional meanings.
One interesting observation in Figure 7-4 is the difference in association of the words “Project” and “Lead” for the group possessing LSE and the group not possessing LSE. This is seen, again, in Figure 7-5 regarding the association between “Management” and “Lead.” In both cases, the participants not possessing LSE show a lower association, approximately 0.4 cosine similarity differences, between these two pairs of words than the group of project managers with LSE.
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7.6.2 Project Dimension Base Cases

Mirroring the approach taken for the success and failure association analyses, a base case was created for each of the four project dimensions to assess the validity of the approach. For project managers with and without LSE, the association between the key words indicating the project dimension and "Tool" was calculated.

In Figure 7-6, the base case for communication management is shown. The words being tested in this dimension for common understanding, of all participants, in relation to the term “tool” are: “communication,” “communicate” and “feedback”. “Communication” and “communicate” are both very strongly associated with the word “tool.” “Communication” is clearly a tool that project managers use and one discussed by all of the project managers in their interviews. “Feedback” is slightly less, but still strongly associated with the word “tool.” This is also an intuitive result as “feedback” is a subset of “Communication” and was not explicitly named as a tool in the interview questions.

The association strength being highly comparable between the interviewees with and without LSE gives evidence the results obtained in the project dimension of communication management are reliable. There is less than 0.1 cosine similarity difference between the project managers possessing LSE and the project managers not possessing LSE regarding the association of each
In the dimension of requirements gathering, the words in the interview texts being tested for common understanding in relation to the word “tool” are: ‘requirements” and “gathering”. Both "requirements" and “gathering” are strongly associated with the word “tool,” with less than 0.1 cosine similarity difference between the differences between the two groups. (Figure 7-7).

Many participants pointed out the importance of tools to effectively manage this project dimension. Tools are needed to determine if requirements are gathered correctly and accurately. These comments emphasise the importance of tools in the requirements gathering dimension for both project managers with and without LSE.
For the dimension of risk management, the terms tested for association with "tool" are "risk" and "management". Both "risk" and "management" are strongly associated with the word "tool," with less than 0.1 cosine similarity difference between the calculated association found in the text data from the interviews of the groups of the project managers possessing LSE and those not possessing LSE. (Figure 7-8).

In the qualitative analysis of the interview transcripts, all participants were concerned with risk management and the challenges this dimension poses to the project manager. Risks are often unknown even when attempts are made to anticipate problems, risk identification, anticipation and mitigation are high priorities in any project. So, a variety of tools are needed; it would be very difficult to guide this dimension of a project without predefined and pretested tools; though many effective tools exist, better and additional tools are still needed. Many tools were named specifically in the interviews. it is not unexpected that the word2vec algorithm would find a strong word association between "risk" and “tool,” and "management" and “tool” in the text analysis of both groups of participants.
Figure 7-9 Transition Support Association Base Case

Figure 7-9 shows the word association tests for the dimension of project support transition. The words tested for association with “tool” are “transition” and “support”. Both “transition” and “support” are strongly associated with the word “tool,” with less than 0.1 cosine similarity difference between the project managers possessing LSE and those not possessing LSE in their understanding of “transition” and “support” and “tool”.

The interviewees talked about various types of approaches, tools and interventions that assist in this dimension of project management: using a support transition checklist for details, transition to support questionnaire, documentation and implementation of plans, implementation diagrams, preparation of a training plan for the client support team, to name a few. The participants’ interview comments lend support to the finding of strong association between “support” and tools, and “transition” and “tools” in the analysis of text data from the interviews of IT project managers possessing LSE and the managers not possessing LSE.

The results in all the above cases are in line with expectations; the word2vec algorithm perceived a strong association between each of the words selected to represent each project dimensions with the word “tool” and this association only minimally differs between project managers with and without LSE. These results provide evidence that the approach is valid and can be trusted. Furthermore, the qualitative analysis of the full interview transcripts with complete narratives and complete context shows that these project managers, in real life IT
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Project management, view all four of the dimensions of the study as key dimensions of IT projects and that they are all concerned with tools in every dimension being available, effective and easy to use. The participants talked about existing tools, but they also talked about the need for more and better tools, frameworks of tools and training to use tools. The importance of tools cannot be overstated; as one participant said, “tools, tools, tools.” (See Chapter Four for more details of the qualitative analysis of the interview transcripts.)

Now that the base case associations for the words of interest have been tested and found to be approximately the same in the text analyses of both the group of participants with LSE and the group without, the results obtained with the model used are shown in Section 7.7.

7.7 Model Results

Terms Representing the Project Manager and the terms “Success” and “Failure”

After completing the base case for success. In this section, the procedure is applied, again, to additional selected word pairs in order to answer Research Question Three:

Research Question Three

Is Leadership Self-Efficacy a factor in project managers’ perspectives on IT project management tools and their perspectives on ownership of project success/failure?

It can be seen in Figure 7-10 that the search words, related to the concept of project manager, all have between 0.65 and 0.75 cosine similarity with the term "success" in the analysis of the processed text data from the interview transcripts of the group of participants with LSE. “Director” is the least associated and “pms” (abbreviation for “project managers”) is the most associated; this is expected as directors have less involvement in the project than project managers. This suggests that for these project managers, concepts referring to the project manager and the concept of “success” are closely associated. In the context of IT project management, these two words seem to belong together.
The results for project managers who do not possess LSE, show very low association between all of the search words representing the project manager and the word representing the concept of "success". The values range from 0.05-0.2 in cosine similarity, with “director,” again, being the least associated and “pms” being the most closely associated.

In order to provide further support for the approach, the association of the concept of failure, represented by the term “failure,” with the search terms representing the concept of the project manager was also analysed (Figure 7-11). If the approach is reliable, then the results shown from the search terms “Success” and "Failure" should lead to the same conclusions. This is known as the logical contrapositive.
The results indeed show that analysis of the processed text data from the interview transcripts of the group possessing LSE shows stronger cosine similarity of the words in the word pairs consisting of a concept referring to the project manager and the concept “failure” than results of the analysis of the text data from the group without LSE.

For the project managers possessing LSE, the search words have between a 0.55 and 0.65 cosine similarity to the word “failure,” with “pms” (“project managers”) being the least associated and “pm” (“project manager”) being the most associated. This is slightly weaker than the association with the word “success,” but strong nonetheless. For the project managers not possessing LSE, on the other hand, the search words have between 0.1 and 0.4 cosine similarity to the word “failure,” with “lead” being the least associated and “pm” (“project manager”) being the most associated. In comparison to Figure 7-10, the degree of word associations between the words referring to the project manager and “success” are approximately the same as the degree of association between the same words with “failure” for the group of participants with LSE. For the group without LSE, the word associations in the case of Figure 7-10 and 7-11, show a similar pattern of the degrees of cosine similarity for each word pair from left to right, but the actual degrees of cosine similarity for each word pair is notably higher for the word associations with “failure” than with “success” in all cases except the word “lead” which shows a lower association with “failure.”
The main conclusion to be drawn is that there is a calculated difference between the word associations in the text data of the group of participants with LSE and the group without LSE. This analysis provides evidence that IT project manager LSE has an impact on the degree of cosine similarity of the selected word pairs for the group of project managers with LSE and the group of project managers without LSE. These results also lend support to the existence and influence of LSE as a factor in the results of the logistic regression analysis showing the influence of LSE on the odds of successful outcomes in project dimensions as was shown in Chapter Six. As pointed out previously, the cosine similarity is a numerical result related to the frequency of the words in the word pairs occurring in proximity and does not in itself characterise or explain the reasons for the cosine similarity/association. Nonetheless, in the context of the literature about Leadership Self-Efficacy and the reality of the experience of project management, the results for these specifically selected word pairs may also be suggesting some insight into possible differences between the two groups of participants in regard to perspectives about success and failure in the IT project management. For example, the literature indicated that people with self-efficacy and/or leadership self-efficacy tended to expect successful outcomes from their decisions but also accepted, learned from and recovered from their failures. This might be a possible explanation why the analysis of the texts from the interview transcripts of the group of participants with LSE showed almost the same results for both success and failure. Actually, the case for the project managers without LSE was very similar, although the results of their text analysis showed higher association with failure than with success. Again, considering possible explanations, perhaps these project managers without LSE may not feel that successful project outcomes are due to their management skill and performance, but rather that positive outcomes are due to overall team work, protocols and procedures, while at the same time, they may think that they do have responsibility to prevent failure and they accept responsibility for their part of the failure. In both failure and success, factors other than management and/or factors beyond their own locus of control may be considered to account for the outcome.

In the case if the group of managers possessing LSE, the results of both the association with success and failure are consistent with the idea that LSE involves self-awareness, self-confidence, persistent, self-evaluation and self-
improvement, as indicated by a variety of researchers reviewed in Chapter Two (see Sections 2.6). The literature, however, did not address in detail a comparison of such perspectives on the part of people with high verses low leadership self-efficacy.

The possible explanations for the results expressed in the previous paragraphs need to be further researched in order to be supported qualitatively and statistically. These results of associations of words in texts pose questions about the perspectives of the participants in this study, and also are, in themselves, another research problem. The interview itself did not include explicit questions or topics about the interviewees, although participants often referred or implied the project manager’s responsibility to carefully manage each dimension using available tools and resources effectively in order to avoid problems and failures.

Finally, to conclude this section, an alternative way to observe these results is through a less definitive but more visual manner. A test was performed by the researcher to find all the words associated with the word “success” in the pre-processed data taken from the interview transcripts for both groups of IT project managers (LSE and no LSE). Then results were filtered to find the top 100 words associated with the word “success”. Below, in Figure 7-12, the top 100 words associated with success are shown for the group of project managers possessing LSE in a word cloud diagram. “Project manager” clearly stands out as the most strongly associated word.

![Figure 7-12 Success Association Words - LSE](image)
For project managers not possessing LSE (Figure 7-13), on the other hand, the word “Project manager” does not appear at all. “Implementing,” “solutions,” “planned,” and “define” are all strongly associated with “success.” In the actual practice of project management, there is certainly evidence indicating that implementing planned project methods are correlated with success.

![Figure 7-13 Success Association Words - No LSE](image)

**LSE and Perceptions of Project Dimensions**

After completing the base cases for each dimension, the same data analysis procedures were applied to the search words and selected comparison words for each project dimension.

**Communication Management**

For the project dimension of communication management, the words “communication,” “communicate” and “feedback” were each tested for association with “written,” “email,” “talk” and “good.”
In Figure 7-14, there is a very notable difference in results of the word association analysis of the pre-processed data from the interview transcripts of the two groups of project managers regarding the degree of associations of the word “written” with the concepts “communication,” “communicate” and “feedback.” The degree of cosine similarity between the concepts represented by these word pairs in the pre-processed transcripts of the project managers with LSE are much higher than those for the same word pairs in the pre-processed transcripts of the group of project managers designated as not having LSE. The results of the text analysis of the project managers without LSE show negative cosine similarity with “communication” and “communicate.”

The results are similar for the degrees of cosine similarity with the word “email,” which also represents a concept of written communication, as seen in
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Figure 7-15; however, in Figure 7-15, the direction of association is positive for both groups, compared to the negative direction of the result for the group without LSE in Figure 7-14. As seen in both Figures 7-14 and 7-15, the results of the word2vec analysis of the texts from the interviews of IT project managers possessing LSE show higher cosine similarity between each of the comparison words and the word “written” (Figure 7-14) or “email” (Figure 7-15) than the results found in the analysis for the IT project managers not possessing LSE.

These are interesting results and not per se expected since in the qualitative analysis of the full interview data, participants from both the LSE and no LSE groups emphasised documentation, archives and sharing documentation.

In Figure 7-16, the results of the analyses of the transcripts of both groups of project managers show approximately, the same degree of association between each of the three comparison words with the comparison word “talk.” The cosine similarity for the word pair “feedback” and “talk” is the closest of the three word pairs.

Next, in Figure 7-17, the association strength of “communication,” “communicate,” “feedback” with the comparison word “good” is shown.
The word “good” appeared more often than “positive” in the interview text and was, therefore, chosen for investigation and analysis. In the word2vec analysis of the project managers possessing LSE, word associations of 0.65 to 0.95 between the word “good” and each of the words “communication,” “communicate” and “feedback” were found while the results of the analysis in the transcripts of the project managers without LSE found associations of 0.2 to 0.3 for these word pairs.

As mentioned above, in the qualitative analysis of the full interview transcripts, communication was of the utmost importance for nearly all the participants. So, it was not expected to see such a difference between the groups in the word2vec analysis.

The conclusion that can be drawn is that the degrees of word associations for the same word pairs are different in the transcripts from the participants with LSE compared to those without LSE. This provides evidence of the influence of IT project manager LSE in the cosine similarity results of the selected word pairs. But, the numerical results do not per se indicate anything about the type of influence LSE has or about the concepts in the word pairs involved. However, when the results and the word pairs selected to address concepts aimed at gaining insight into the effect of LSE on tool use are viewed in the context of the literature about Leadership Self-Efficacy, the results seem to suggest that there is a different between the two LSE groups regarding their perspectives on written communication tools, but they do not differ in their perspectives regarding spoken (talk) communication. Further research is needed to further assess how and why
LSE may be affecting the attitudes toward and the use of such tools. The qualitative analysis does not support differences in written and spoken communication tools; all participants emphasised documentation; they also emphasised meetings. Also, the data from the 10 project details survey, indicates similar reported use of weekly status reports and electronic communication for both groups of participants (Table 5-6).

Requirements Gathering

For this dimension, the terms “requirements” and “gathering” will each be tested for association with “discuss” (Figure 7-18), “document” (Figure 7-19) and “scope” (Figure 7-20).
Interestingly, in all three figures (Figures 7-18, 7-19, 7-20), the NLP analysis of the pre-processed text data from the interview transcripts of both project managers with and without LSE do not differ greatly when it comes to requirements gathering.

There is less than a 0.2 difference in association between “discuss” and “requirements gathering.” As indicated by most participants in the interviews, accurate and thorough requirements gathering is crucial to project success and smooth project execution. Requirements gathering involves interacting with team members, stakeholders, technical experts, the client and end users on the part of the project manager. So, “discuss”-ing project details is likely needed frequently. Also, “discuss” can be considered closely related to “talk,” which was tested for
CHAPTER SEVEN: WORD to VECTOR ANALYSIS of SELECTED WORD PAIRS in the INTERVIEW TRANSCRIPTS

association with “communication,” “communicate” and “feedback” (Figure 7-16) where the text analysis of both groups of project managers showed approximately the same degree of association between the word pairs.

There is less than a 0.1 difference in association between “documentation” and “requirements” and “documentation” and “gathering.” In other words, the results, of the text analysis of the data taken from the interview transcripts, of both groups are nearly the same.

Based on the qualitative analysis of the interview transcripts, all project managers, with and without LSE, understand the impact of requirements gathering on the scope of the project. They also emphasise that the project manager needs to be directly involved in requirements gathering, and not try to manage it at a higher level, in order to be able to evaluate the quality of the requirements or to understand how they can impact the project. The calculations of reported use of the two requirements gathering tools of functional decomposition and use case diagram showed similar results for both groups of managers (Table 5-6).

The results of the word2vec analysis of the transcripts for the selected word associations related to the dimension of requirements gathering suggests that LSE is not influential in the perspectives of project managers concerning verbal and written communication and project scope.

**Risk Management**

As shown in Figures 7-21, 7-22 and 7-23, the word associations tested for risk management are “risk” and “management” with each of the words “identify,” “mitigate” and “checklist.”
CHAPTER SEVEN: WORD to VECTOR ANALYSIS of SELECTED WORD PAIRS in the INTERVIEW TRANSCRIPTS

Figure 7-21 Risk Management -- Identification

Figure 7-22 Risk Management - Mitigation
As seen in the figures, the cosine similarity of the two words in the pairs, found in the transcripts of both groups of project managers are similar in the case of the word pair “risk” and “identify” and also the pair “management” and “identify,” but differ when it comes to the pairs of “risk” and “management” with “mitigation” and “checklist.”

The word vector analysis found a nearly 100% cosine similarity of the words “risk” and “management” and the word "identify," regardless of possession of LSE. In the full transcripts of the interviews, participants emphasised that risks need to be anticipated so that they can be identified early.

As illustrated in Figure 7-22, the analysis of the text data from project managers with LSE have a 0.8 cosine similarity between “risk” and “management” and “mitigation,” while the analysis of the text data from the interview transcripts of project managers without LSE have, approximately, a 0.6 cosine similarity for these same two word pairs.

In Figure 7-23, the results for the word pair associations between ‘risk” and “management” with the word “checklist” are shown. The results for the text data from the interview transcripts of project managers with LSE have slightly more than 0.8 association while the results for the text data from the interview transcripts of project managers without LSE have closer to a 0.3 association between these concepts.

In their recorded face to face interviews, participants from both LSE groups made comments regarding early detection of risk and being prepared with plans to control or eliminate risk. In the case of the concept “identify” (Figure 7-21, the results of the word vector analysis of the word pairs reflect the contextual information explained by participants regarding this project dimension. However, the word2vec results for “mitigate” and “checklist” show that LSE is a factor differentiating the groups, but do not reflect the results of the qualitative results of the transcripts. Nonetheless, this analysis gives some support to the existence of LSE as a factor and that LSE may influence the way project managers view their work in this dimension and perspectives on the tools they use.

Another related result is the calculation of means, from the 10 project details survey, for reported use of the risk management ITPM tools, risk management checklist and risk impact assessment found in Chapter Five. The
means for the checklist were 5.1 for the LSE group and 4.4 for the no LSE group; in the case of risk impact assessment, the calculated averages were 3.9 for the LSE group and 4.9 for the no LSE group. The average reported use of the risk management checklist is consistent with the word2vec analysis results, but the risk impact assessment averages are contrary to the word2vec analysis results.

**Project Support Transition**

The word pairs analysed for the project dimension of project support transition are “transition” and “support” with each of the words “technical,” “timeline” and “checklist.” (Figures 7-24, 7-25, 7-26).

In Figure 7-24, the results of the word2vec analysis of the word pair cosine similarity in the transcripts of project managers with LSE show an association of close to 0.9 for “transition” and “support” with the word “technical.” The same word pair cosine associations in the transcripts of project managers without LSE, on the other hand, have an association of less than 0.2.

![Figure 7-24 Transition Support - Technical](image-url)
The analysis of word pair associations in the transcripts of the project managers with LSE show an association between 0.8 and 0.9 for the word pairs “transition” and “timeline” and “support” and “timeline.” The results for the same word pairs for the transcripts of the project managers without LSE, on the other hand, have an association of less than 0.5 (Figure 7-25).

Again, when looking at tools to support the management of this project dimension, a checklist comes to mind as one of the most effective tools (Figure 7-26). In the case of the word pair “transition” and “checklist” as well as the pair “support” and “checklist,” the word association analysis results for the text data
CHAPTER SEVEN: WORD to VECTOR ANALYSIS of SELECTED WORD PAIRS in the INTERVIEW TRANSCRIPTS

from the interview transcripts of project managers with LSE show an association of approximately 0.8. The results for the group without LSE show an association of approximately 0.3. In the case of all six of the word pairs here, LSE is an apparent factor differentiating the degrees of word pair cosine similarity in each group of managers.

Participants in both LSE groups emphasised including project support transition early on in project planning and adding tasks to the project support transition plans as the project advances closer to the transition phase; again, the full interview transcripts are not consistent with the word2vec analysis of the six word pairs selected to represent this dimension of project management. The mean reported use of the support transition checklist tool were 4.7 for the LSE group and 4.8 for the no LSE group; for the knowledge transfer walk through tool, the mean reported use was 5.2 for the LSE group and 4.6 for the non, LSE group. The concepts represented by the words “technical” and “timeline” do not per se imply a tool whereas “checklist” is in the support transition checklist, but means from the 10 project details data indicate almost the same use by both groups. But, from the word2vec algorithms findings, LSE has differentiated the text data of the two groups based on the criteria of the cosine similarities of the selected word-pairs.

Keeping in mind that the word2vec algorithm only searched for the designated word pairs occurrence in proximity, the numerical cosine similarity results indicate influence of LSE as a factor. However, the numerical results do not characterise or specify the influence or reasons for the differences found between the transcripts of the two groups of managers. Also, in the case of the project dimensions, the concepts represented by the selected words in each word pair do not always clearly imply an ITPM tool, but do reflect aspects of project management.

As mentioned in the literature review, Miles and Maurer (2012) state self-efficacy predicts performance and motivation across a wide variety of tasks in corporate environments. The word2vec analysis of text data, taken from the transcripts of the interviews with the twenty-nine participants, shown in this chapter, are along the line of and support Miles and Maurer's claim that self-efficacy could predict the performance and motivation of individuals, IT project managers in this case.
As stated by Hoyt (2005), the self-efficacy factor plays a vital role in both influencing the skills individuals possess and in determining what they do with the skills.

When considered in the context of the background literature on Leadership Self-Efficacy, some inferences can be made and insights drawn based on the ideas that LSE involves self-awareness, self-confidence, self-evaluation, accountability and persistence as well team building and communication skills, as indicated in the details used to evaluate LSE on the measurement survey.

In the case of the word2vec analysis of the word pairs selected with the aim of exploring the possible influence of LSE on project managers’ perspectives on their roles in project outcomes, the selected word pairs were numerous and created a context that provided an image. The analyses of the word pairs aimed at exploring the relationship between LSE and ITPM tools have in many cases found LSE as a factor distinguishing the occurrence of the selected word pairs in interview transcripts of the two groups of project managers.

While taking caution not to attribute these numerical results directly to the actual thoughts, viewpoints or behaviours of the project managers themselves, some suggestions and insights toward finding more direct evidence regarding LSE and project manager behaviour, including tool use, in specific project dimensions are given below.

1. IT project managers with high LSE may see their role in project success and failure as more direct and take more ownership and responsibility for project outcomes, possibly more so than IT project managers with low LSE.
2. Both groups of IT project managers seem to have similar understanding of IT project management tools, but may sometimes differ in their use of such tools.
3. IT project managers possessing high LSE may prefer and/or use more written communication over oral communication.
4. Both groups of IT project managers seem to have approximately the same understanding of the project dimensions of requirements gathering and risk management.
5. IT project managers possessing high LSE may use be more actively aware and involved in the risk management and project support transition dimensions.

The above results answer Research Question Three.

6.8 Conclusion

Chapter Seven has addressed the quantitative analysis of the qualitative data collected from the recorded interviews with the twenty-nine participants of this study. The data analysis was done with a Natural Language Processing word vector technique, *google word2vec*, which requires pre-processing of transcript data. The process was explained in detail, from beginning to end, including calculations and confirmation of the models used. These results provided answers for Research Question Three regarding the possible influence of LSE in ITPM tool use and in project managers’ perspectives on project outcomes.

The purpose of including an analysis with the word vector technique was to include another test to determine if notable differences would be found between the group of project managers with and without LSE regarding perspectives on ITPM tool use and project outcomes. A notable difference in degree of cosine similarity of the words in selected word pairs in the text of the LSE group as compared to the text of the no LSE group, the results of the word2vec analysis may point to: 1) the influence of LSE in project manager views on project success/failure and ITPM tool use. Many of the words used in the word pairs were concepts of or related to ITPM tools, and in many cases, the results of the text analysis from the group with LSE were higher than the results for the group without LSE. This difference suggests that project managers with LSE may view ITPM tools differently than and may use ITPM tools differently, or perhaps more often, than those project managers without LSE.

The results illustrated in the figures of this chapter have shown that results of the word2vec analysis, of text data taken from the interview transcripts, found a numerical difference between the group of participants deemed to have LSE and the group deemed as not having LSE regarding perceived word associations. The following comments summarise the main findings:
CHAPTER SEVEN: WORD to VECTOR ANALYSIS of SELECTED WORD PAIRS in the INTERVIEW TRANSCRIPTS

1. The investigation of the concept of the project manager and the concepts of success and failure showed higher cosine similarity of word pair associations in the text data of the group with LSE than in the group without LSE. These may imply that the factor of LSE increases the individual project manager’s view of his or her involvement and accountability for both success and failure. Possibly, project managers without LSE may view their personal connection to the success and/or failures of their projects differently.

2. Regarding the dimension of communication management, project managers possessing LSE have close to 0.45 cosine similarity of perceived word association for the word “written” with “communication.” However, the results for the text data analysis of project managers who do not possess LSE found a perceived disassociation for this word pair (-0.1). This suggests the possibility that project managers with LSE tend to use more written communication. However, for the case of the degree of cosine similarity for the word association with “talk,” the text analysis of both groups of project managers have similar results, logging 0.33 to 0.42 cosine similarities, respectively.

3. Interestingly, the text analyses for the dimension of requirements gathering found little difference in perceived word associations in the text data of the two groups. This may be suggesting that LSE does not seem to affect project managers' views about and involvement with the dimension of requirements gathering.

4. For the dimension of risk management, the word2vec algorithm found very similar results for “risk” and identification, and found 0.8 cosine similarity for the word pairs “risk” and “management” and “mitigation” in the text data of project managers with LSE while the result found in the data of project managers without LSE is closer to a 0.6 association. The results found in the texts of the two groups do not differ greatly for these word pairs. In the case of “checklist,” the results in the text data of project managers with LSE have approximately 0.8 association between “risk” and “management” and “checklist,” while the result for the same word pairs in the text data of project managers without LSE is closer to a 0.3 cosine similarity. These results
suggest that LSE may influence the approach to choosing checklist as a tool in this dimension.

5. For the word2vec analyses related to the dimension of project support transition, a word association of close to 0.9 between “transition” and “support” and “timeline” was found in the text data of project managers with LSE. The findings in the text data of project managers without LSE, on the other hand, show a lower word association, close to 0.5. Cosine similarity association of approximately 0.8 was found for “checklist” in the text data of project managers with LSE. The results for this word pair in the text data of project managers without LSE is approximately 0.3. The cosine similarity differences found for the word “technical” was the greatest, 0.9 in the text data of the group with LSE and less than 0.2 in the text data of the group without LSE. These results suggest an influence of LSE on the way project managers think about and apply their skills and the tools they tend to use in this dimension.

The word2vec analysis of the text data of participants deemed, for the purposes of this study, to have LSE and those deemed not to have LSE, found that in a large number of the cases, a notable difference in the degree of cosine similarity for each of the perceived word associations was found. As mentioned previously, this supports the existence and influence of LSE, as a factor in IT project success/failure and tool utilisation. Furthermore, the word2vec finding of LSE as a factor distinguishing the text data of the transcripts of the two groups of managers is also supported by the statistically significant findings of LSE’s influence on the odds of project outcomes in the different, but still related, analysis done with logistic regression in Chapter Six.

These results provide insight into and lend support to the idea that the leadership self-efficacy factor (and perhaps also more generally self-efficacy) plays a vital role in both influencing the skills individuals possess and in determining what they do with the skills. Furthermore, the analysis shown here, provides an example of employing one NLP text analysis technique in a mixed research methods study; further research may be able to integrate this and other text analysis techniques, especially as the technology advances. These analyses provide observations and a step toward exploring the relationship between LSE
and ITPM tool use and project managers’ views of their roles in successful and unsuccessful project outcomes.

Next, Chapter Eight will consider the results elaborated in Chapters Four, Five, Six and Seven using the technique of triangulation.
8 CHAPTER EIGHT: TRIANGULATION

8.1 Introduction

Various researchers have discussed the importance of implementing verification strategies throughout a study (Morse et al., 2002) or “constructing evidence within the qualitative project” (Meadows and Morse, 2001, p. 187). Researchers have further noted a number of techniques can be used to ensure the validity of results or the rigor of a study, triangulation being one (Golafshani, 2003). Triangulation implies the use of multiple research methods to study a single problem. Since each research method has its own limits and biases and single research methodologies might result in personal biases, using multiple research methods paves the way for more credible and dependable information (Decrop, 1999, p.160).

Types of Triangulation

**Theoretical triangulation** -- Defined as the use of multiple theories in the same study for the purpose of supporting or refuting findings, since different theories help researchers to see the problem at hand using multiple lenses (Thurmond, 2001). Both related and/or competing theories can be used in formulating hypotheses for the purpose of providing broader and deeper understanding of a research problem (Banik, 1993).

**Investigator triangulation** – Defined as the use of more than two researchers in any of the research stages in the same study. It involves the use of multiple observers, interviewers, or data analysts for confirmation purposes (Denzin, 1989; Thurmond, 2001).

**Analysis triangulation** -- Also referred to by some authors as “data analysis triangulation,” this is defined as the use of more than two research methods of analysing the same set of data for validation purposes (Kimchi et al., 1991). In addition to validation purposes, analysis triangulation can be described further as the use of more than two research methods of data analysis in qualitative and quantitative paradigms within the same study for
both validation and completeness purposes. In other words, whenever a researcher uses both qualitative and quantitative data in the same study, then more than two methods are needed in the analysis to attain data validation within the single paradigm, further extending the analysis between the two paradigms for completeness purposes.

Analysis triangulation was adopted in this study. The research design included the collection of both quantitative data, using two survey instruments (LSE measurement survey and 10 projects details survey, discussed in Chapters Three and Five), and qualitative data, through recording of the semi-guided interview with each participant (the interview guide is discussed in Chapter Three, and the qualitative analysis is detailed in Chapter Four and the quantitative analysis is detailed in Chapter Six). The types of data and data collection are different but concern the same overall topic of project management including the concepts of Leadership Self-Efficacy, project dimensions, success in project dimensions and dimension related ITPM tools. The topics being researched were approached quantitatively and qualitatively using the respective research methods of analysis.

The following summary of triangulation looks at the results of the analyses carried out with logistic regression of the LSE survey and the 10 projects details survey, the results of text data analysis carried out with the NLP word to vector technique of the interview transcripts and the results of the qualitative analysis of the interview transcripts, shown in Chapters Four, Five, Six and Seven. The triangulation perspective considers the results of these three types of analyses in a parallel view to see where quantitative and a qualitative data, that relate to each project dimension and each tool, are such that they confirm, contextualise or complement each other, or not. The results will also be considered within the context of the actual, practical situation of IT project management.

8.2 Summary of triangulation

Below is a summary of the analysis triangulation applied for this study. The details of analysis triangulation can be found in Appendix E.
Communication management dimension

1. Project manager’s LSE and odds of successful dimension outcome

From quantitative analysis with logistic regression, the project manager’s possession of LSE increased the odds of successful outcomes in this project dimension by 53.6% \( (p = 0.076) \).

The results of the text analysis with the word2vec technique of the interview data, indicates that project managers with Leadership Self-Efficacy (LSE) have more cosine similarity of the word association between the concept of “success” and the concept of “project manager” compared to the project managers without LSE. The notable difference between the participants with LSE and those without LSE seems to confirm there is a difference between the two groups. The word vector analysis does not define the nature of the association, but it seems possible to infer that a higher degree of association may imply more awareness of and perhaps involvement in the success of their work in any dimension of a project, including communication management, especially in the context of the aforementioned results of logistic regression regarding LSE and this dimension.

The summary and qualitative analysis of the participants’ comments from the interview transcripts, examined in Chapter Four, showed that all participants see communication management as an absolutely essential responsibility of the project manager. Numerous participants, with and without LSE, indicated communication as the most important skill set and the importance of setting communication plans, whether through the means of written or verbal communication, was essential in the management of a project. The responses regarding communication practice discussed by participants in the interview indicate that 1) communication is among the highest priorities and 2) communication is the activity that occupies most of the project manager’s time. Several participants indicated that communication was 90% of a manager’s activities.

2. Communication management tools

Quantitatively, the utilisation of ITPM communication management tools were shown to favourably impact the odds of successful outcomes, in the project dimension of communication management, by 59% \( (p = 0.070) \) for weekly status report and 59% \( (p = 0.059) \) for electronic communication. This analysis, done with
logistic regression, did not involve the factor of LSE, but rather focused on the impact of the use of a tool on the odds of success in the related project dimension.

In the results of the quantitatively analysed interview transcripts with word2vec, the degree of cosine similarity between the words in the word pairs consisting of “communication,” “communicate” and “feedback” with 1) “written,” 2) “email,” 3) “talk,” and 4) “good” was calculated as shown in Tables 8-1, 8-2 and 8-3 below. (See Figures 7-14, 7-15, 7-16 and 7-17 for related word associations.)

<table>
<thead>
<tr>
<th>COMMUNICATION</th>
<th>LSE</th>
<th>No LSE</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written</td>
<td>0.47</td>
<td>-0.08</td>
<td>0.55</td>
</tr>
<tr>
<td>Email</td>
<td>0.91</td>
<td>0.17</td>
<td>0.74</td>
</tr>
<tr>
<td>Talk</td>
<td>0.37</td>
<td>0.34</td>
<td>0.03</td>
</tr>
<tr>
<td>Good</td>
<td>0.94</td>
<td>0.31</td>
<td>0.63</td>
</tr>
</tbody>
</table>

*Table 8-1 COMMUNICATION word association LSE and No LSE*

<table>
<thead>
<tr>
<th>COMMUNICATE</th>
<th>LSE</th>
<th>No LSE</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written</td>
<td>0.46</td>
<td>-0.08</td>
<td>0.54</td>
</tr>
<tr>
<td>Email</td>
<td>0.91</td>
<td>0.17</td>
<td>0.74</td>
</tr>
<tr>
<td>Talk</td>
<td>0.42</td>
<td>0.40</td>
<td>0.02</td>
</tr>
<tr>
<td>Good</td>
<td>0.89</td>
<td>0.18</td>
<td>0.71</td>
</tr>
</tbody>
</table>

*Table 8-2 COMMUNICATE word association LSE and No LSE*

<table>
<thead>
<tr>
<th>FEEDBACK</th>
<th>LSE</th>
<th>No LSE</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written</td>
<td>0.42</td>
<td>0.02</td>
<td>0.4</td>
</tr>
<tr>
<td>Email</td>
<td>0.58</td>
<td>0.15</td>
<td>0.43</td>
</tr>
<tr>
<td>Talk</td>
<td>0.33</td>
<td>0.32</td>
<td>0.01</td>
</tr>
<tr>
<td>Good</td>
<td>0.63</td>
<td>0.31</td>
<td>0.32</td>
</tr>
</tbody>
</table>

*Table 8-3 Feedback word association LSE and No LSE*

From these results, it is clear that the results of the text analysis of project managers with LSE indicate a higher degree of association of the words in the word pairs representing the two dimension-specific communication management tools, weekly status report and electronic communication, as compared to the results of the text data from the project managers without LSE. The higher degree of concept associations of project managers with LSE possibly indicates they may, in practice, have more association with written communication than project
managers without LSE. In contrast, the results for project managers without LSE show strong word association between the comparison words and “talk.” The results of both groups of project managers show similar degrees of cosine similarity for comparison words with “talk.” The results of the word vector analysis offer insights and possible indication of contextual connections between LSE and tool use.

The difference in the degree of association between the two groups of IT project managers is evident and implies that LSE may be an influential factor. Furthermore, the context provided by text analysis data gives some types of insights that might not be considered without it. This shows that LSE seems to be a factor that distinguishes the two groups of project managers in the case of these concepts related to communication, which contextually supports and is supported by the results of logistic regression showing LSE as a factor that increased the odds of successful outcomes in the dimension of communication management for project managers with LSE.

**Interviews**

In the qualitative interview data, participants described communication practices that they found useful in managing IT projects. These included various combinations of the communication tools selected for the present research. Both participants with and without LSE commented on the importance of using and improving communication tools. The interview data did not indicate that participant views were influenced by LSE.

**Requirements gathering dimension**

1. **Project manager’s LSE and odds of successful dimension outcome:**

   Quantitatively, as shown by the results of logistic regression, the possession of LSE by project managers increases the odds of success in the project dimension of requirements gathering by 55% ($p = 0.070$), holding all else constant.

   As explained above for the case of communication management, the analysis of the interview transcripts included a comparison of the degree of cosine similarity of word associations, as found by the word2vec algorithm, in the pre-processed text of the interview transcripts of managers with and without LSE regarding the concept of “success” and concepts referring to the “project
manager.” The results of that analysis showed that the word associations in the texts of project managers with LSE showed a higher degree of cosine similarity than those of project managers without LSE. This supports and is supported by the results of logistic regression showing that LSE increases the odds of success in the dimension outcome.

In the qualitative analysis of the interview transcripts, both participants with and without LSE indicated that accurate and thorough requirements gathering is crucial to project success and smooth project execution, and that it can be a difficult aspect of project management. If requirements are not gathered correctly and accurately, the project will always be in danger and set for failure. Again, the qualitative analysis of the interviews transcripts did not observe differences in viewpoints about project management and the goal of successful project outcomes in this dimension.

2. Requirements gathering tools:
   Quantitatively, the odds of project success in the requirements gathering dimension is increased by the utilisation of ITPM tools by 38.0% \( (p = 0.180) \) for functional decomposition and 89.5% \( (p = 0.010) \) for use case diagram.

   The NLP word2vec text data analysis determined the cosine similarity of the words “discuss,” “document” and “scope” with the words “requirement” and also with “gathering.” The results are listed in Tables 8-4 and 8-5 below. (See Figures 7-18, 7-19 and 7-20)

<table>
<thead>
<tr>
<th>REQUIREMENTS</th>
<th>LSE</th>
<th>No LSE</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discuss</td>
<td>0.9</td>
<td>0.8</td>
<td>0.1</td>
</tr>
<tr>
<td>Document</td>
<td>0.95</td>
<td>0.9</td>
<td>0.05</td>
</tr>
<tr>
<td>Scope</td>
<td>0.69</td>
<td>0.67</td>
<td>0.02</td>
</tr>
</tbody>
</table>

*Table 8-4 REQUIREMENTS word association LSE and No LSE*

<table>
<thead>
<tr>
<th>GATHERING</th>
<th>LSE</th>
<th>No LSE</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discuss</td>
<td>0.88</td>
<td>0.72</td>
<td>0.16</td>
</tr>
<tr>
<td>Document</td>
<td>0.95</td>
<td>0.84</td>
<td>0.11</td>
</tr>
<tr>
<td>Scope</td>
<td>0.70</td>
<td>0.64</td>
<td>0.06</td>
</tr>
</tbody>
</table>

*Table 8-5 GATHERING word association LSE and No LSE*

The word2vec analysis of the text data from the interview transcripts of both project managers with and without LSE found approximately the same degree of
association with concepts related to requirements gathering. Based on the results of this study, requirements gathering is not a dimension largely impacted by Leadership Self-Efficacy.

**Interviews**

In the expert viewpoints expressed by the participants, the need for industry knowledge in requirements gathering was pointed out. A tool mentioned in the interviews is a set of questions to determine if requirements were gathered correctly and accurately. Some participants outlined a series of meetings with the client and team members; these often included a discovery session using discovery questions, getting approval from clients and reviewing the gathered requirements more than once. Another series of steps that was mentioned included inviting experts from the client side, a workshop to document pain points in the current processes, capturing requirements to solve pain points, reviewing and getting approval. The participants were consistent regarding the importance of tools and the importance of effective work in this dimension of project management; no differences in perspectives were noticed in the LSE and non LSE participants’ narratives.

**Risk management success dimension**

1. **Project manager's LSE and odds of successful dimension outcome**

   The results of logistic regression illustrate that the possession of LSE by project managers has an impact on the odds of successful outcomes in risk management by 63% (p = 0.045), holding all else constant.

   The NLP word2vec analysis of the interview transcripts regarding cosine similarity between the concept of “success” and words representing concepts related to the project manager showed that the result for the group of IT project managers with LSE was notably higher than the result for the group without LSE. As in the cases of the dimensions described above, the word2vec results contextually corroborate that there is a difference between the groups with and without LSE, which supports the results of logistic regression that indicate the project manager having LSE positively affects the odds of successful outcome in the project dimension involved; reciprocally, the logistic regression finding of LSE as an influential factor also supports the idea that LSE is a factor in the word vector analyses.
The analysis of the comments in the interview transcripts show that all participants are concerned with risk management. Some indicated that a framework is needed for risk identification and mitigation planning.

2. Risk management tools:

Quantitatively, the utilisation of ITPM risk management tools increases the odds of success in the project dimension of risk management 65.6% (p = 0.032) for risk impact assessment and 67.6% (p = 0.039) for risk management checklist.

Word2vec analyses results are shown in Tables 8-6 and 8-7 below (See Figures 6-21, 6-22, 6-23.)

<table>
<thead>
<tr>
<th>RISK</th>
<th>LSE</th>
<th>No LSE</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify</td>
<td>0.96</td>
<td>0.94</td>
<td>0.02</td>
</tr>
<tr>
<td>Mitigate</td>
<td>0.79</td>
<td>0.59</td>
<td>0.27</td>
</tr>
<tr>
<td>Checklist</td>
<td>0.85</td>
<td>0.32</td>
<td>0.53</td>
</tr>
</tbody>
</table>

*Table 8-6 RISK word association LSE and No LSE*

<table>
<thead>
<tr>
<th>MANAGEMENT</th>
<th>LSE</th>
<th>No LSE</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify</td>
<td>0.97</td>
<td>0.94</td>
<td>0.03</td>
</tr>
<tr>
<td>Mitigate</td>
<td>0.8</td>
<td>0.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Checklist</td>
<td>0.82</td>
<td>0.27</td>
<td>0.55</td>
</tr>
</tbody>
</table>

*Table 8-7 MANAGEMENT word association LSE and No LSE*

In the word2vec analysis of the interview transcripts both those with and without LSE show approximately the same degree of cosine similarity of the word association between “risk” and “identify” and between “management” and “identify”. This may imply a similar view toward risk identification tools. However, the word2vec analysis of the word pairs in the texts of the two groups of project managers differ somewhat in the degree of cosine similarity of the association of “mitigation” with both “risk” and “management” and more so in the case of the word pairs with “checklist.” Project managers with LSE have a 0.8 cosine similarity in the word association of “risk” with “mitigate” and “management” with “mitigate” while project managers without LSE have closer to a 0.6 cosine similarity for the word association of the same two word pairs.

In the tables, the text analysis results for “checklist” show the largest difference between the groups. And, the word2vec result for “checklist” seems to
support the logistic regression result for risk management checklist since the term “checklist” is the same and is associated with both “risk” and “management.” And since the word2vec results show a notable difference between the two groups with the LSE group being higher, this may be hinting that the factors of LSE and ITPM tool use are related in the case of risk management checklist, and possibly other ITPM tools.

**Interviews**

In the analysis of the comments based on the participants’ expert knowledge, the importance of project risk management tools was emphasised. Use of checklists for each phase of a project, question and answer sheets, risk identification questionnaires in general and by phase were among the tools mentioned. Participants with and without LSE recognise and expressed the importance of risk management, their strategies for managing this dimension and the need for improving tools in this area. So, a large difference in the text analysis results between the groups was not expected; however, considering the results of logistic regression and word2vec analyses for “checklist,” as well as the raw data for tool use frequency (see Figure 5-9) which showed the mean reported use of risk management checklist of 5.1/10 for the LSE group compared with 4.4/10 for the group without LSE, the connection between LSE and ITPM tool utilisation merits exploration in future research.

**Project Support Transition success dimension**

1. **Project manager’s LSE and odds of successful dimension outcome**

   Quantitatively, it is clear that project managers’ possession of LSE has influence on the odds of successful outcome in the project dimension of project support transition. Project managers’ possession of Leadership Self-Efficacy increases the odds of success in this dimension by 53.0% ($p = 0.078$), holding all else constant. This effect is statistically significant.

2. **Project Support Transition tools:**

   Quantitatively, using a support transition check list increases the odds of project success in project support transition by 55.6% ($p = 0.065$), holding all else constant. Qualitatively, using knowledge transfer and walk through sessions
increases the odds of project success in this dimension by 63.4% \((p = 0.041)\), holding all else constant. These effects are statistically significant.

NLP word2vec analysis results are shown in Tables 8-8 and 8-9 below.

(Also, see Figures 7-24, 7-25 and 7-26.)

<table>
<thead>
<tr>
<th>TRANSITION</th>
<th>LSE</th>
<th>No LSE</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical</td>
<td>0.92</td>
<td>0.18</td>
<td>0.74</td>
</tr>
<tr>
<td>Timeline</td>
<td>0.9</td>
<td>0.56</td>
<td>0.34</td>
</tr>
<tr>
<td>Checklist</td>
<td>0.85</td>
<td>0.3</td>
<td>0.55</td>
</tr>
</tbody>
</table>

*Table 8-8 TRANSITION word association LSE and No LSE*

<table>
<thead>
<tr>
<th>SUPPORT</th>
<th>LSE</th>
<th>No LSE</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical</td>
<td>0.92</td>
<td>0.16</td>
<td>0.76</td>
</tr>
<tr>
<td>Timeline</td>
<td>0.91</td>
<td>0.58</td>
<td>0.33</td>
</tr>
<tr>
<td>Checklist</td>
<td>0.84</td>
<td>0.28</td>
<td>0.56</td>
</tr>
</tbody>
</table>

*Table 8-9 SUPPORT word association LSE and No LSE*

The word2vec analysis of the text data from the interview transcripts of the project managers with LSE show a word association of close to 0.9 cosine similarity for “transition” with “technical” and for “support” with “technical.” Project managers without LSE, on the other hand, have an association close to 0.2. This shows a notable difference between the groups based on LSE and may be suggesting a difference in manager perspectives regarding the technical aspects of managing this dimension.

The word2vec analysis of the text data found in the transcripts of project managers with LSE show an association of close to 0.9 cosine similarity for the word pairs “transition” and “timeline” and for “support” and “timeline.” The results for the project managers without LSE, on the other hand, show an association close to 0.5. This is also a notable difference between the group of mangers with LSE and the group without LSE.

The word2vec analysis found an association for “transition” and “checklist” and for “support” and “checklist” of approximately 0.8 cosine similarity. The text data analysis for project managers without LSE shows an association of approximately 0.3 for the same word pairs. This is a very large difference and points to LSE being a factor, and maybe implying that project managers with LSE have more awareness or a different type of perspective about their role and tool use in this dimension.
Interviews

From the comments containing the expert knowledge of the participants, the dimension of project support transition requires planning early on in the project work. The interviewees talked about various types of approaches, tools and interventions that assist in this dimension of project management. Many interviewees concurred that using a support transition checklist for details, transition to support questionnaire, documentation and implementation of plans, implementation diagrams, preparation of a training plan for the client support team, publishing documentation, including project support transition items in weekly status meetings are the tools and techniques used by these participants to manage project support transition. There was not observable differences in the expressions of viewpoints about this dimension among the participants in regard to their LSE scores.

Perspectives on Success and Failure

Word associations between “success” and a series of words (see tables below) referring to the project manager were analysed in the pre-processed text of the interview transcripts as explained in detail in Chapter Seven. The word “failure” and the same series of words referring to the project manager were analysed in the same way.

The results of the analysis of the transcripts of the IT project managers possessing LSE show a higher degree of association between “success” and “failure” with each of the words referring to the project manager compared to the results found in the text of the transcripts of IT project managers who do not possess LSE. These results follow the trends seen in the other word2vec analyses for the project dimensions and tool related terms in that, in most cases, the results for IT project managers possessing LSE are higher than those who do not possess LSE. These results also support and are supported by the results of logistic regression showing that possession of LSE impacts project success at the dimension level.

The word2vec analyses results are shown in Tables 8-10 and 8-11 below (See Figures 7-10 and 7-11.)
The search words all have between 0.65 and 0.75 cosine similarity with the term success," with “director” as the least associated and “project manager” as the most. On the other hand, in the case of the transcripts of the project managers who do not possess LSE, the search words have lower associations with the concept of "success;" the values range from 0.05 to 0.2 in cosine similarity. Also, for the project managers possessing LSE, the search words have between a 0.55 and 0.65 cosine similarity to the word “failure.” For the project managers not possessing LSE, on the other hand, the search words have between 0.1 and 0.4 cosine similarity to the word “failure.”

These results might be suggesting that project managers who possess LSE have a stronger sense of involvement in their successes and failures. These results offer insight into the possible degree of ownership project managers with and without LSE have in the outcomes of their projects.
The results of the analysis of the transcripts for “success” and for “failure” gave the same results in terms of the transcripts of the LSE possessing managers showing more cosine similarity association between the words in the word pairs in the case of both concepts. Possible personal and professional involvement with the results of outcomes, whether successful or not, may be an overarching factor and provides a context for all of the analyses performed in this study. Again, the insights and suggestions posed by these results merit further research toward finding more concrete evidence of the impact of LSE on project management including the use of ITPM tools and perspectives on project outcomes.

8.3 Conclusion

From the research, it is clear the qualitative-quantitative dichotomy can be complementary in the operation of triangulation. This chapter integrates and triangulates findings from the three different components of this research: the LSE survey data; project evaluation outcomes in four project dimensions in the Project Management 10 Project Details survey data, and recorded interviews. All three types of data relate to the concepts of Leadership Self-Efficacy, IT project management, utilisation of ITPM tools and successful/unsuccesful outcomes in four project dimensions. Triangulation can cut across the qualitative-quantitative divide.

By using an adapted version of the triangulation protocol, areas of overlap and difference in the results are identified. Combining these three types of data and three types of data analyses with triangulation helped overcome some of the limitations of each individual research method and provides a more holistic and nuanced understanding of the topic than if only one particular research method or disciplinary perspective had been used.

To summarise, in this study, triangulation was more than scaling, reliability, and convergent validation; it captured a more complete and contextual portrayal of factors involved in achieving successful outcomes in the four project dimensions under study. Therefore, triangulation played a role by bringing an encompassing context that facilitated uncovering possible interpretations of results and possible implications of these results in the practical situation of managing IT projects; such insights may have been missed without this perspective.
CHAPTER NINE: DISCUSSION of RESULTS

9.1 Introduction

This chapter presents a discussion of the results of Chapters Four, Five, Six, Seven and Eight, the interpretations and insights that can be drawn, and possible applications of these results. The bulk of the chapter will focus on the results and their interpretation in relation to IT project management and managers and also as to what can be understood about IT project dimensions and related tools. The results obtained in the previous chapters will be reviewed. The project dimensions and the related tools are revisited, and the factors of project managers’ LSE, the tools themselves, the particular demands of dimensions and common perspectives of practicing professionals will be considered.

The three Research questions posed at the beginning of this work and answered specifically in Chapters Six, Seven and Eight are the underlying guides of the following discussion. The questions are:

Research Question One:
Is there a relationship between Leadership Self-Efficacy and success in particular dimensions of a project?

Research Question Two:
What is the impact of dimension specific ITPM tools on project dimension success?

Research Question Three:
Is Leadership Self-Efficacy a factor in project managers’ perspectives on IT project management tools and their perspectives on ownership of project success/failure?

The research approach and model are explained in detail in Chapter Three and will not be repeated here. However, the following section will comment on some key elements in the background of the results discussion.

9.2 The Setting and Variables of the Study

The next section briefly reviews the context of the sample of the participants' characteristics, the variables of Leadership Self-Efficacy and tools,
the types of data and analyses. These details form the scope and context influencing the results and/or their interpretation.

**Sample Size and Characteristics of the Participants**

The twenty-nine participants are all experience IT project management professionals; there are no novice project managers included. Requiring participants to have at least 10 years of experience is a constant element where the degree of LSE, use of tools and project dimension outcomes can be explored. Also, the qualitative information from all participants is based on a decade or more of IT project management practice. (See Section 5.2.4 for a table of the participants’ characteristics including LSE scores (Table 5-3).)

The number of participants is small and does not realistically allow for analysis by factors of gender, age, and/or specific number of years of experience. The number of quantitative data from the 10 Project Details Survey regarding use of tools and dimension success was more numerous by having each participant provide the details for 10 different projects they had managed, but it should be kept in mind it came from twenty-nine people.

**Leadership Self-Efficacy**

Leadership Self-Efficacy represents a set of traits through which a leader assumes a supportive, service-orientated role among both his or her followers and the stakeholders of a project. Although Leadership and Leadership Self-Efficacy are known concepts, addressing and developing leadership qualities and behaviours has not been a main focus of IT project manager training or of ongoing staff development for project managers.

Leadership Self-Efficacy in this study was measured using the LSE Scale measurement tools of Bobbio and Manganelli (2009), and this source was chosen as the base of the survey to ensure the quality of this self-assessment tool. The scores were calculated and the range was between 2.4 and 6.0 However, for analysis with logistic regression, binary data was needed, so the participants were divided into two groups with the higher score group being deemed as “possessing LSE” and the lower score group deemed as “not possessing LSE.” The value for the group with LSE was “1” and the value for the group without LSE was “0” in the analysis. (See Section 5.2.6 for details of the calculation and transformation.)
The conversion of the scaled LSE scores to binary data does not change the reality that each participant had an LSE score; every participant has LSE. Furthermore, in this small sample LSE was observed to be associated with both age and experience: two characteristics often intricately related. So, LSE was not specifically differentiated from age and length of experience here, and this remains something that should be explored in a larger sample of participants. However, based on the literature review (Anantatmula, 2010; Muller et al., 2012, Berg et al., 2016, Loufrani-Fedida and Missonier (2015), LSE seems to be something that can be developed, so it is expected that age and experience are involved with and possibly parallel to LSE.

Another detail to keep in mind, although LSE seems to be related to leadership skill, the existence of this personal quality/trait does not seem to be, in itself, actual leadership behaviour. (Berg et al., 2016, Anantatmula, 2010, and Mascia, 2012)

**IT Project Dimensions**

The four dimensions chosen as an abbreviated version of an IT project have been thoroughly explained and justified as appropriate through personal professional experience, perspectives of other project managers and IT project management literature.

**IT Project Management Tools**

The tools used in the analyses were selected by the researcher based on experience, interaction with other project managers and project management literature. However, there many more ITPM tools in use and available. Tools may be referred to by different names, and/or there maybe variations of a tool that are referred to differently than the base tool. Furthermore, some tools may be used in combination with other tools, where the combination of the tools becomes viewed as a single complex tool itself. These types of variations in naming, manner of utilisation and combining tools in practice could be an influence in the participants’ answers to the 10 Project Details Survey as to whether or not they used a tool. This may also have influenced how they talked about tools in the interview transcripts (see Chapter Four), and subsequently, also may have influenced the word vector analysis of word associations in the transcripts.
**Success**

Project success, and the concept of success in general, may be defined differently by each participant. Project completion success: this is about defining the criteria by which the process of delivering the project is successful. Essentially this addresses the classic "are we on time, budget, on scope, quality?" It is limited to the duration of the project, and success can be measured as soon as the project is officially completed. However, success at the dimension level, and in regard to particular tasks and milestones along the way, may be defined more diversely than overall project success.

**Data and Analyses**

The qualitative summary and analysis of the interview transcripts provide expert information directly from the experienced practicing professionals who participated (Chapter Four). The study considers this as strong data regarding project manager viewpoints and behaviours.

The preliminary exploration of the raw survey data looked for trends and associations between factors (Chapter Five).

The results of the logistic regression analysis are based on the self-reports of project managers’ actual use of tools and actual evaluations of dimension success in actual projects they have already managed in their careers, using the Project Manager10 project details survey, as explained in Chapters Three and Six. As explained above, the binary LSE scores were needed for use in the logistic regression analyses. Logistic regression of the binary data yielded statistical evidence of relationships between variables, which were already in numerical form, in terms of the independent variable (LSE or an ITPM tool) impacting the odds of successful dimension outcomes. The results were able to be tested for statistical significance to support their validity (Chapter Six). Logistic regression is a well-tested statistical application. These results are considered strong data.

The level for statistical significance was set at 10% (p value ≤ 0.10). The reason for selecting the 10% level was chosen in the design of this research. Standard levels of statistical significance are typically either 1%, 5%, or 10%. With smaller sample sizes, higher levels of statistical significance are more commonly used (Gelman and Stern, 2006). The size of the survey data, with 290 observations, is sufficiently large, but may warrant a higher alpha level. For this reason, the 10% level was chosen.
As discussed in Chapters Three and Seven, and emphasised again earlier in this chapter, the word vector text analysis finds the frequency of the cooccurrence of two words in a word pair in text data that has been pre-processed for the analysis. The results yielded are numerical, in the form of degrees of cosine similarity, and do not per se indicate the character of the association of the words/concepts involved. However, the degree of difference found in the texts of the groups differentiated by their possession or non-possession of LSE, regarding the selected word pairs may offer some confirmation of LSE as a factor in general, which would also be reciprocally supported by the statistically significant results of logistic regression. The word pairs address two main areas: 1) success/failure and 2) dimension related tools/management activity. Though related concepts were purposely selected, he words in the word pairs do not necessarily directly indicate specific ITPM tools or managerial actions. Word vector analysis of the word pairs yielded results in the form of cosine similarity/cosine association of the two words for the text data of each group of participants. It was not possible to determine statistical significance of these results. This is considered data that expands the exploration of the transcripts and takes a step toward finding evidence of the relationship between LSE and ITPM tool use, as well as insights about LSE and project managers’ perspectives on tools, project outcomes and other aspects of project management.

With the setting and variables clarified above, each dimension is discussed in terms of the results of each analysis and in consideration of the combination of these factors in the dimension as whole. Insights and implications about project managers’ LSE, tools and the total situation are discussed.

9.3 Discussion of Dimensions, Related Tools and LSE

A successful outcome of any project is the aggregation of the outcomes in every project dimension. Any factors that affect success in any of the project dimensions, impact the whole project’s possibility for a successful outcome. Project success has been traditionally defined as a project that meets its objectives under budget and under schedule. This standard has remained the most common measure in many industries. But meeting those criteria of success at the overall project level still depends on project dimension outcomes. In a complex and dynamic endeavour such as an IT project, the meaning of success
goes beyond meeting schedule and budget goals; it includes meeting expectations of beneficiaries and stakeholders on an ongoing basis, careful management of processes and tasks to accomplish all required steps in multiple concurrent aspects of projects, and finally delivering a product or system that meets the end client’s needs.

Project success is determined by numerous factors. These factors can usually be measured, and that will define the success of the project. The personality of project managers and the project management tools used by project managers are important factors in defining project success. The framework proposed in this research comprises two streams of performance criteria that support increasing the odds of success in IT projects. The first stream is related to the project manager personal quality, or trait, of Leadership Self-Efficacy and how it impacts project success at the dimension level. The second stream is related to the IT project management tools and their impact on increasing the odds of project success also at the dimensional level.

In actual practice, all of the factors involved at each step of the project interact to accomplish many tasks, steps, and goals on a daily basis in each dimension affect the outcome of the overall project. Understanding this reality, this chapter aims to take a cumulative perspective in considering the results that have been shown in the previous chapters.

Using the starting point of the triangulation procedure presented in the previous chapter which shows the relationships of the various results of the mixed research methods used in the study, the discussion will consider LSE, dimensions and tools as factors in project dimension outcomes, but will also try to understand the results from the perspective of project management in practice.

The following subsections discuss all results related to each dimension. Tables 9-1 to 9-12 display all the numerical results; these tables are duplicates of tables given in previous chapters but are arranged together here for easy reference and to facilitate an overview perspective of the results of this study and the context they create.

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<thead>
<tr>
<th>Effects of Project Manager LSE and Tools</th>
<th>Odds of success</th>
<th>p-Value</th>
</tr>
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<td>Communication Management</td>
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<td></td>
</tr>
<tr>
<td>Project Manager LSE</td>
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</tr>
<tr>
<td>Weekly status report</td>
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</tr>
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</tr>
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<td>Requirements Gathering</td>
<td>LSE</td>
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</tr>
<tr>
<td>------------------------</td>
<td>-----</td>
<td>--------</td>
</tr>
<tr>
<td>Project Manager LSE</td>
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</tr>
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<td>Use case diagram</td>
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<table>
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</tr>
</thead>
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<td>0.078</td>
<td></td>
</tr>
<tr>
<td>Support transition check list</td>
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<td>0.065</td>
<td></td>
</tr>
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<td>Knowledge transfer and walk through sessions</td>
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<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manager</td>
<td>0.73</td>
<td>0.15</td>
<td>0.58</td>
</tr>
<tr>
<td>Managers</td>
<td>0.70</td>
<td>0.09</td>
<td>0.61</td>
</tr>
<tr>
<td>Management</td>
<td>0.73</td>
<td>0.15</td>
<td>0.58</td>
</tr>
<tr>
<td>Bad</td>
<td>0.71</td>
<td>0.18</td>
<td>0.53</td>
</tr>
<tr>
<td>Leadership</td>
<td>0.70</td>
<td>0.09</td>
<td>0.61</td>
</tr>
<tr>
<td>PM (Project manager)</td>
<td>0.73</td>
<td>0.13</td>
<td>0.60</td>
</tr>
<tr>
<td>PMs (Project managers)</td>
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</tr>
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<td>Director</td>
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<td>0.60</td>
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</tbody>
</table>

<table>
<thead>
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</tr>
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<tbody>
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<td>0.27</td>
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<tr>
<td>Managers</td>
<td>0.61</td>
<td>0.30</td>
<td>0.31</td>
</tr>
<tr>
<td>Management</td>
<td>0.62</td>
<td>0.33</td>
<td>0.29</td>
</tr>
<tr>
<td>Bad</td>
<td>0.58</td>
<td>0.10</td>
<td>0.48</td>
</tr>
<tr>
<td>Leadership</td>
<td>0.58</td>
<td>0.27</td>
<td>0.31</td>
</tr>
<tr>
<td>PM (Project manager)</td>
<td>0.67</td>
<td>0.42</td>
<td>0.25</td>
</tr>
<tr>
<td>PMs (Project managers)</td>
<td>0.56</td>
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<td>0.32</td>
</tr>
<tr>
<td>Director</td>
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<th>Difference</th>
</tr>
</thead>
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<tr>
<td>Written</td>
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<td>-0.08</td>
<td>0.55</td>
</tr>
<tr>
<td>Email</td>
<td>0.91</td>
<td>0.17</td>
<td>0.74</td>
</tr>
<tr>
<td>Talk</td>
<td>0.37</td>
<td>0.34</td>
<td>0.03</td>
</tr>
<tr>
<td>Good</td>
<td>0.94</td>
<td>0.31</td>
<td>0.63</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMUNICATE</th>
<th>LSE</th>
<th>No LSE</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written</td>
<td>0.46</td>
<td>-0.08</td>
<td>0.54</td>
</tr>
<tr>
<td>Email</td>
<td>0.91</td>
<td>0.17</td>
<td>0.74</td>
</tr>
<tr>
<td>Talk</td>
<td>0.42</td>
<td>0.40</td>
<td>0.02</td>
</tr>
<tr>
<td>Good</td>
<td>0.89</td>
<td>0.18</td>
<td>0.71</td>
</tr>
</tbody>
</table>
9.3.1 Communication Management Dimension

Communication is key in project management. For a successful project execution, effective communication to all stakeholders is essential. Many projects fail because of a lack of communication or ineffective communication. In the project management context this means the exchange of knowledge, skills and experience. It is very important that the project manager decides the project communication plan from the very beginning of a project. All stakeholders need to have a common understanding of the project status on an ongoing basis. This
can be a challenge as business clients and IT systems experts may not always understand each other’s realities or professional terminology. Communication management can affect every dimension of a project. The two dimension-specific tools selected to be examined are weekly status report and electronic.

**Quantitative findings**

The logistic regression analysis, using the transformed LSE scores and the data regarding successful or unsuccessful outcomes in the risk management dimension from the 10 Project Details Survey found that IT project managers’ LSE increases the odds of success in the IT project communication management dimension by 53.6%. The analysis of the two dimension-specific ITPM tools found that weekly status report increases the odds of project success in the communication management dimension by 59%. Electronic communication increases the odds of success in the communication management dimension by 59.9%. These three results are statistically significant, $p < 0.10$. Overall, the results of the study regarding the positive impact of LSE on the odds of the four project dimension outcomes support the findings of Nawaz, et al. (2016); they found that project manager’s leadership was positively correlated to project success and also to teamwork.

The results for the word pairs containing “success” or “failure” with other words representing or related to the project manager are shown in Tables 9-2 and 9-3. The differences between the cosine similarities for each word pair found in the texts of the LSE group are from 0.53 to 0.61; the results for the no LSE group range from 0.05 to 0.20. For any word pair, the degree of cosine similarity for the LSE group is always higher than the result for the no LSE group, and the differences are large, ranging from 0.53 to 0.61. In the case of the word pairs with “failure,” the differences range from 0.25 to 0.48, also notable differences. Both sets of results follow the same pattern, except that differences are not as pronounced in the case of the word pairs with “failure.” The differences confirm the existence of LSE as factor and are consistent with statistically significant results of the positive influence of the project managers’ LSE on the odds of successful dimension outcomes as found by logistic regression. Though this analysis does not indicate the character of the association, but rather only the mathematical cosine similarity, the combination of closely related concepts in the multiple word pairs tested, the differences found in the texts of the two groups
seem to be consistent with many of the concepts discussed in the early work on self-efficacy by Bandura (1986, 1997 and 1999) and also with other views in the literature implying that the trait/quality of LSE is associated with more self-awareness, self-confidence in making judgements and also performance and accountability. The results of this word vector analysis point to the need for more research and possibly for more focus on LSE related training and development for project managers (and even other team members) as part of leadership training and development. The results for success and failure and the interpretation and discussion here apply not only to the communication management dimension but also to the other three dimensions.

The word vector analysis for the word pairs “communication-writen,” “communication-email,” “communication-talk,” and “communication-good” show cosine similarity difference between the word associations in the pre-processed interview transcripts of the two groups of project managers of 0.55, 0.74, 0.03, and 0.63 respectively. In all cases, the group of managers possessing LSE have the higher cosine similarity result and the group without LSE have the lower result (See Table 9-4). The largest difference in the texts concerns the word pair with “email” and the smallest difference concerns the word pair with “talk.” Though these calculations are based on the interview transcripts, the actual content of the interviews does not indicate differing viewpoints about the importance of communication or ITPM tools; rather, participants in both LSE groups of the study expressed very similar concerns. Communication and communication tools were prominently emphasised in the qualitative analysis of the full transcripts (discussed below).

The notable differences between the two groups points to the existence of LSE as a factor that differentiates the groups. And the large differences in the cases of “written” and “email” (also a written form of communication) may hint at a difference in the views about and/or usage of written communication between the groups; however, this requires further and more specific qualitative and quantitative investigation. The full interview data and the word vector results are not reflective of each other, except in the cases where the word vector algorithm detected minimal or no differences between the texts of the two groups, such the small difference seen here for the word pair “communication” and “talk.”
Qualitative findings

In the interview transcripts, participants expressed that communication management has a very big weight in the project manager’s skill set and role. Project managers spend most of their time—close to 90 percent—communicating in all project dimensions, communication with upper management, project team(s) and client stakeholders. Leadership training (#16, #25, #29) and communication training (participant #13, #14, #23, #26, #29) were mentioned often in the interview transcripts.

The literature also supports the views expressed by the participants; for example, Bruce (2015), considers that every good project starts with a solid communication plan. Carvalho, (2014) reiterated that a common misconception is that such gaps are caused by too little communication, but also that too much communication can be problematic. According to Zulch (2014) communication is required for the leader as well as the organization to be efficient and effective. As discussed by Harrin (2019), clearer communication sees the highest success rates when project managers take a proactive approach to conveying information, listening to feedback, and recognising the need for open lines of communication among everyone involved in an organisation’s projects.

Research conducted by the Project Management Institute (PMI) found that ineffective communication was the main contributor to project failure and had a negative impact on project success more than half the time. These results do not confirm or deny poor communication as a reason for project failure; however, the statistical evidence of the positive impact of project managers with LSE, weekly status report and electronic communication point to the importance of training IT project managers to improve their skills and use of communication management.

Summary Comments

These findings answer Research Questions One, Two and Three for the IT project dimension of communication management.

Considering this dimension as a whole, the project manager and the tools are all shown to be influential in the dimension outcome, but none of these three results stand out from the others, except that the tools have a slightly higher impact than project managers’ LSE. This could pose the question whether these LSE results are due to project managers using weekly status reports and electronic communications, or the reverse.
The analyses with the word vector technique regarding the set of word pairs with “success” and the set with “failure” detected notably higher cosine similarities for all the word pairs in the case of the interview texts of the group with LSE. This lends support to the existence of LSE as a factor and suggests the possibility the LSE may affect the individual project manager’s view of their role in successes and failures of their projects.

The qualitative analysis of the full interview transcripts indicates overall agreement and common concerns with emphasis on tools and leadership, and practical solutions to problems rather than methodological approaches as elements that would help facilitate project managers’ work and advance the profession.

These results show that both project managers’ LSE and ITPM tools contribute to improved odds of successful outcome in the project dimension of communication management.

9.3.2 Requirements gathering Dimension

Requirements gathering is an essential part of any project and project management. Fully understanding what a project will deliver is critical to its success. There are multiple requirements gathering tools that can be used; functional decomposition and use case diagrams are examined in the present study.

The functional decomposition supports simplifying the requirements gathering phase and helps provide clarity and details of the gathered requirements. The use case diagram provides detailed requirements that lead to design and implementation.

Quantitative findings

Project managers’ Leadership Self-Efficacy increases the odds of success by 55% in the requirements gathering dimension, as found by logistic regression, and the result is statistically significant: p < 0.10. Joubert, (2019) claimed that project manager is a key critical success factor to the success of the requirements gathering dimension. This confirms the point of view of Yang et al. (2009) that accurate and complete requirements are the responsibility of the project manager, and he/she needs to make sure the requirements gathering phase is handled
According to the project specifications. Also, this builds on Iqbal and Khan (2012) who indicate that project developers (project manager and project consultant in this case) should also grasp the business requirements of their clients and the high-level requirements typically provided by management and a board of directors.

Logistic regression also shows that the use of the functional decomposition documents increases the odds of success by 38%; this result does not have statistical significance. McIntire (2017) clearly stated that functional decomposition “Helps manage complexity and reduce uncertainty by breaking down processes, systems, functional areas, or deliverables into their simpler constituent parts and allowing each part to be analysed independently.” However, these findings do not strongly agree with McIntire, although the results do not dispute his view, either.

The second dimension-specific ITPM tool is the use case diagram which was found to increase the odds of dimension success by 89.5%; the result is statistically significant: \( p = 0.01 \). This result has the strongest statistical significance of all 12 factors analysed with logistical regression to determine their influence of the odds of successful dimension outcomes These findings are consistent with Gupta’s (2019) view that detailed documentation of an IT project use case diagram provides detailed requirements that lead to detailed design and successful implementation. Additionally, this builds on Niu and Easterbrook’s, 2009 findings that a “requirements-gathering gap” occurs whenever a discrepancy arises between the true user requirements and what has been gathered, so a use-case diagram reduces this discrepancy.

Stieglitz (2012) and Niu and Easterbrook (2009), stated that project failures are attributed to requirements gathering and project requirements gaps. Gupta (2019) stressed that project success is greatly dependent on clear and detailed requirements. The present findings of logistic regression address the impact of each tool on the odds of success, not success or failure directly; however, the finding of the high and favourable impact of utilising the use case diagram tool, which is a tool designed to gather clear detailed requirements, on the odds of dimension success is consistent with the views of Stieglitz, Niu and Easterbrook, and Gupta. Effectively using this, as well as other tools, would be expected to help reduce knowledge gaps in this dimension.

As elaborated in the section above regarding the dimension of communication management, the word vector analyses for cosine similarity of
word pairs including the word “success” and word pairs including the word “failure” detected relatively large differences in the texts of each group of participants; these results are in line with various sources found in the literature review (see above discussion) and lend support to the existence of the influence of LSE.

The word pairs considered in the word vector analyses specific to this dimension were “requirements-discuss,” “requirements-document,” “requirements-scope,” “gathering-discuss,” “gathering-document,” and “gathering-scope.” The differences in cosine similarity for the word pairs found in the text data of the group with LSE and the group without LSE are respectively as follows: 0.1, 0.05, 0.02, 0.16, 0.11, and 0.06. These differences are small.

Looking at the whole picture of these findings, the three results of logistic regression are quite different from each other with the project managers’ LSE being the middle result, functional decomposition the low result, and use case diagram the high result. In contrast, the word vector analyses of the selected word pairs related to this dimension do not show notable differences between the findings in cosine similarity in the word pairs found in the texts of each group of participants. These results do not indicate an influence of LSE in the results of these word pairs in the transcripts of the two groups of project managers.

What the overview does indicate is that the two selected ITPM tools analysed have very different degrees of impact on the odds of successful outcomes in the dimension of requirements gathering. It might be asked if the functional decomposition tool is less effective or difficult to use, requiring more skill on the part of the project manager. The use case diagram has a very high impact, and it might be asked if this is a very refined tool that can be used by any project manager effectively.

Qualitative Findings

The qualitative analysis of the interview scripts several participants commented on the need for practical tools to manage this aspect of projects. Some participants mentioned the need for a requirement gathering framework. Interviewees indicated that accurate and thorough requirements gathering is crucial to project success and smooth project execution, and that it can be a difficult aspect of project management. Some participants stated that “If requirements are not gathered correctly and accurately, the project will always be in danger and set for failure” (participants #10, #21, #22). Successful requirements
gathering makes project management smooth and easy to complete (participant #3, #8). However, there is always a gap, the project manager needs the skill to reduce the gap (participant #14). It is clear from the participants’ input that requirements gathering is key to the success of the project and it is the project manager’s responsibility to make sure accurate and clear requirements were gathered. Both groups of participants expressed the importance of this project dimension and the importance of the manager being directly involved in requirements gathering. There was no indication of LSE affecting the views of the participants. The full interview transcripts, in the case, reflect the results of the word vector analyses, and support the results of logistic regression regarding the positive influence of leadership and good project management and ITPM tools.

**Summary comments**

The findings discussed here answer Research Questions One, Two and Three for the IT project dimension of requirements gathering.

The positive effect of LSE and use case diagram on the odds of successful outcomes in Requirements gathering are statistically confirmed. This dimension has the most variation in the degree of positive impact on the odds of successful dimension outcome in terms of the three factors: LSE, functional decomposition tool, and use case diagram tool. The effect of the functional decomposition tool on dimension outcome is the lowest of all eight tools examined in the study and is the only one that is not statistically significant; the use diagram tool has the highest effect on dimension outcome of all eight tools and is the most statistically significant and the only result, of all 12 factors (LSE in each dimension, two tools in each dimension), that was statistically significant at the 1% level (p = 0.01).

The results of the word vector analyses for the word pairs with “success” and “failure” lend support to the positive influence of LSE on dimension outcomes. For the word pairs specific to risk management, little difference was found in the texts of the two groups; the results do not support the factor of LSE but may possibly suggest a common understanding of the management and tools of this dimension.

The qualitative analysis confirms the participants’ emphasis on tools and leadership, but does not show differentiation of participants’ views in regard to LSE, or any demographic factor.
9.3.3 Risk Management Dimension

Project risk management is the process used by project managers to minimize any potential or unexpected event that might affect the people, processes, technology, and resources involved in a project. Unlike issues, which are certain to happen, risks are events that could occur, and the project manager may not be able to tell when. As Hall (2019) claimed, project risk requires the project manager to identify and get ahead of that risk. Cooper (2006) focused on the ability of project managers to manage a project from the point of view of their ability to manage risk.

Tools are of the utmost importance in managing risk, and there are numerous dimension-specific tools available. The two ITPM tools examined in this study are risk management checklist and risk impact assessment.

Quantitative Findings

The logistic regression analysis shows that project managers' Leadership Self-Efficacy increases the odds of successful outcomes by 63% in the risk management dimension; the result is statistically significant with $p < 0.05$. This supports the view that the project manager is a key critical success factor in the risk management dimension.

The logistic regression of the two tools and dimension outcomes found that using a risk management checklist increases the odds of a successful outcome in this dimension by 67.6%, and using a risk impact assessment increase the odds by 65.6%. Both results are statistically significant; $p < 0.05$. This the statement by Chand (2019) that, “project risk is an uncertainty that cannot be avoided, but it can definitely be managed.” Also, this is parallel to Jun et al.’s (2011) findings that not identifying risk can be fatal to the success of the project in question because unexpected, abrupt problems often arise and must be dealt with on an emergency basis. The risk management checklist and risk impact assessment provide the basis for the IT project manager to detect critical risk early in the process and find corrective and risk mitigation action, which will help increase the odds of a successful outcome of an IT project. The positive impact of both risk management tools, which are designed to identify, classify and anticipate risk, on the odds of successful dimension outcome are consistent with these views emphasising the importance of risk identification.
Similar to the two previously discussed dimensions, the word vector analysis of word pairs with “success” and “failure” show notably higher cosine similarity in the texts of the project managers with LSE compared to the cosine similarity for the same word pairs detected in the texts of the project managers without LSE, and this lends contextual support to the existence of LSE as a factor and its positive effect on dimension outcomes.

The word vector analysis specific to the project dimension of risk management determined the cosine similarity for the following word pairs, each followed by their respective differences between the LSE and no LSE groups of participants: “risk-identify” 0.02, “risk-mitigate” 0.27, “risk-checklist” 0.53, “management-identify” 0.03, “management-mitigate” 0.20, and “management-checklist” 0.55 difference.

Regarding the word vector analyses result, a similar pattern of degree of difference for both sets of word pairs is seen in terms of identify, mitigate, and checklist. The differences in results for the word pairs with “identify” are minimal and do not indicate an influence of LSE on the two sets of interview transcripts. However, there is more difference between the two groups in the case of the word pairs with “mitigate,” and the most difference occurs in the case of the word pairs with “checklist.” Considering the concepts represented by the word pairs, the word vector analysis results seem to suggest at the idea that the project manager’s responsibilities in the dimension of risk management and risk management tools are viewed similarly by all managers, and not influenced by LSE, in the case of identifying risk, although there may be some differences in project manager perspectives regarding risk mitigation and more so in the case of the use of the risk management checklist. The smaller differences seen here might also hint at something about the present status of the guidelines for best practices in this dimension; perhaps the tools and guidelines for risk management are rather refined and using them can smooth the way for any project manager, regardless of LSE. Nonetheless, it must be kept in mind, the word vector analysis is not per se a proof but rather a comparison of the occurrence of selected word pairs in the two groups of interview transcripts.

The findings in this dimension show a situation similar to that of communication management where the effect of project manager LSE and the effects of each of the dimension-specific tools on the odds of successful dimension outcome are similar in impact, and LSE has the lowest impact of the three. Here,
the results range from 63% to 67.6%. The effect of LSE is the lowest; the impact of the risk management checklist is the highest, and that of the risk impact assessment tool, in the middle at 65.6%. The p values in the risk management dimension are all less than 0.05; this is stronger statistically than the significance level of < 0.10 for logistic regression results in the communication management dimension.

The same questions emerge as those for communication management: are the positive effects on the odds of successful outcomes from LSE or from use of tools separately or are they interrelated? And are the present tools honed and standardized to allow any project manager to have similar results.

**Qualitative Findings**

In the full and unprocessed interview scripts, interviewees clearly pointed out that it is the project manager’s responsibility to identify risk. Participant # 5 commented on identification of inconsistency: “For example, if the project manager notices inconsistency in requirements after requirements gathering and identifies it as a change, then this is a risk.”.

Dey (2010) and Zwikael & Ahn (2011) all agreed that risk management is a critical success factor and project managers need to identify the consequences of project risk. De Bakker et. al. (2011) stated that risk management contributes to overall project success. This basically supports the perspective underlying this research, i.e., that success at the dimensional level contributes to the success at the overall project level.

**Summary comments**

The three research questions have been answered. The positive effect of LSE and these ITPM tools on the odds of successful outcomes in risk management are statistically confirmed. The results of the word vector analysis indicate a possible influence of LSE in the case of the word pairs “risk-checklist” and “management-checklist.”

The overall results of risk management are similar, in pattern, to the results for the dimension of communication management. The impact on the odds of successful dimension outcome of LSE and the two tools are all within 10 percentage points of each other. Again, the qualitative analysis confirms the
participants’ emphasis on tools and leadership, but does not show differentiation of participants’ views in regard to LSE, or any demographic factor.

9.3.4 Project Support Transition Dimension

It is the responsibility of the IT project manager to lead one of the last phases of an IT project, project support transition. The IT project manager’s objective is to oversee a smooth transition of the implemented product from the project team to the support team. The two tools examined in this study are the support transition checklist and knowledge transfer walk through sessions.

Quantitative Findings

The results of logistic regression show that project managers’ LSE increases the odds of successful outcome in the project support transition dimension by 53.0 percent; \( p = 0.078 \). The support transition checklist increases the odds of successful outcome in this dimension by 55.6%; \( p = 0.065 \). Knowledge transfer and walk through sessions increase the odds of successful outcome by 63.4%; \( p = 0.041 \).

The three results obtained with logistic regression are within 10 percentage points of each other with the project managers’ LSE having the lowest impact on successful dimension outcomes. This is similar to the situations of the communication management dimension and the risk management dimension.

The word pairs analysed by the word vector technique and, the degree of difference in cosine similarity between the two groups of participants, are: “transition-technical” 0.74, “transition-timeline” 0.34, “transition-checklist” 0.55, “support-technical” 0.76, “support-timeline” 0.33, “support-checklist” 0.56. These differences are noteworthy and seem to corroborate the existence of LSE as a factor.

The word pairs with “checklist” show almost the same results with the LSE group having over 0.80 cosine similarity and the no LSE group having 0.30 cosine similarity or less, both resulting in a difference of 0.50 degrees of cosine similarity or more. The word “checklist” is also in the name of the tool “support transition checklist;” the differences seen between the LSE groups might be considered as suggesting a connection between LSE and the use of this tool. Furthermore, the word vector analysis results for the two word pairs with “checklist” in the project.
support transition dimension are very similar to the results for the two word pairs with “checklist” in the risk management dimension, showing almost the same and same difference between the two LSE groups.

The other words in the word pairs are not directly indicative of knowledge transfer and walk through sessions. The word pairs with “timeline” show a noticeable difference in cosine similarity between the two LSE groups, but the difference is not extreme. In the case of “technical,” the word pairs in the texts of the higher LSE group have 0.74 and 0.76 more cosine similarity than the same word pairs in the texts of the group without LSE. This is the largest difference found, except for the same amount of difference between the texts of the groups in the case of word pairs with “email” in the communication management dimension. This result again corroborates the existence of LSE as a factor that distinguishes the transcripts of the two groups of participants.

**Qualitative Findings**

In the interview transcripts participants in both LSE groups confirmed their views that project support to transition is a very important dimension and that ITPM tools were also essential. In addition, several of them discussed the need for involving someone from the support team. Per participant # 15, “We usually involve our support team in project planning to help define the transition process and support transition requirements. Usually, we have a support transition list defined, but during planning, the support team elaborates on it as needed based on the particular project.” Participant # 1 made similar comments about having a support consultant and also said, “He/she is always asked to provide the training.” Other participants indicated that this consultant can perform documentation, troubleshoot, and provide and document training (see participants #1, #5, #10). The participants’ comments concur with Levin’s (2010) claim of the importance of project knowledge transfer and its impact on project success. The presence of the support consultant, as part of the implementation team, helps the team prepare the transition checklist and simplify the knowledge transfer and walk through session. This also supports the perspectives held by James (2015) and Makar (2018) that even though project support transition is an end stage of the project, project managers need to plan for the transition to the support team in the early stages of the project.
Summary comment

Research questions One, Two and Three have been answered. These results confirm that both project managers’ LSE and these two ITPM tools are factors that positively affect the odds of success in the dimension of project support to transition. A similar distribution, as that observed in the dimensions of communication management and risk management, of the effect of tools and LSE is seen here. All three of the results obtained with logistic regression are within 10 percentage points of each other. As in the case of all three other dimensions, the LSE factor has the lowest percentage impact on increasing the odds of successful dimension outcome. The results are statistically significant.

Word vector analysis of word pairs with “success” and “failure” reciprocally support and are supported by the positive influence of LSE found by logistic regression. The word vector analyses for the dimension specific word pairs also show noticeable differences in cosine similarity between the texts of the two LSE groups for all six-word pairs. This, again, lends support to the existence of LSE as a factor. In particular, the two-word pairs with the word “checklist” might suggest a possible indication of differences between project managers regarding this tool in relation to LSE, especially as the results for the word pairs with “checklist” in the risk management dimension are almost the same.

9.4 Overview of Results

From the detailed discussions above, commonalities and highlights are summarised here.

The results of the LSE effect on the odds of successful dimension outcomes are all statistically significant at the 10% level except in the dimension of risk management where the significance is at the 5% level. Overall, the results of the study regarding the positive impact of LSE on the odds all of the four project dimension outcomes support the findings of Nawaz et al. (2016); they found that project manager’s leadership was positively correlated to project success and also to teamwork. This supports the claim, of this study, that the project manager is a key critical success factor in each of these dimensions. Jacobs and Kamohi (2017) also found the impact of project manager leadership efficacy on project success in their meta-study using a detailed review of previous research; their findings were confirmed statistically by the present research.
Though LSE was expected to be the most influential factor, the results of logistic regression show that the dimension-specific tools have a somewhat higher impact on the odds of successful outcome in the particular dimension than does the factor of project managers’ LSE, except in the case of the requirements gathering tool of functional decomposition. Thamhain (2013) has emphasized the importance of using the right tools in project management, and Nakayama and Chen (2016) found that the use of PM tools is considered a means to counter project management challenges. The present findings are consistent with these views on the essential role of ITPM tools; furthermore, the importance of tools was emphasized by nearly every participant.

Nonetheless, the results of the LSE effect on the odds of successful dimension outcomes are all statistically significant at the 10% level except in the dimension of risk management where the significance is at the 5% level. This supports the claim, of this study, that the project manager is a key critical success factor in each of these dimensions. Furthermore these results are in line with the findings of Nawaz et al. (2016) and those of Jacobs and Kamohi (2017), mentioned above. In particular, the finding of the impact of project manager leadership efficacy on project success in Jacobs and Kamohi’s meta-study has been confirmed statistically by the present research.

The pattern of both tools having a higher impact than LSE is seen in communication management, risk management and project support transition. There is stronger statistical significance in the case of risk management, where the results for all three factors are significant at the 5% level, while the other two dimensions are at the 10% or mixed between 5% and 10%.

The factor with the highest impact and highest statistical significance in the logistic regression analysis is the tool of use case diagram, in the dimension of requirements gathering, which increases the odds of successful dimension outcome by 89% with statistical significance at the 1% level.

These results suggest questions regarding interactions between project managers’ LSE and tools, and regarding the effectiveness of the tools themselves and the degree of skill required by the project manager to use them and achieve the desired results.

The word vector analyses in some cases are consistent with the results of logistic regression results concerning LSE as a factor where large differences in the cosine similarities are found in the text data of each group. The word vector
results are mathematical and do not indicate the character of relationships between the selected words; however, from the practical experience and actual work of project management, the results seem to point to possible viewpoints, related to the selected words in the pairs, that may be influenced by LSE.

The word vector analyses addressing the concepts of “success” and “failure” in word pairs with words representing concepts connected to the project manager is perhaps the most interesting finding of using the word to vector technique. Though the results are mathematical cosine similarity calculations based on frequency of the cooccurrence of selected word pairs, are not per se characterising the relationship between the words, the findings are interesting when considered in the context of the literature regarding Leadership Self-Efficacy. And these results do show that LSE is a factor that differentiates the two groups in the word vector analysis.

The qualitative analysis of the full interview transcripts does not indicate that participants can be divided into groups either by perspectives or by LSE, and only occasionally are the transcripts reflected in the results of the dimension related word vector analyses. The interview data presents a clear field of common viewpoints, approaches to project management, concerns, goals of increasing project success, suggestions for advancing the profession, and for facilitating their own and new project managers’ jobs.

During the interview, numerous participants indicated communication as the most important skill set and setting communication plans as a priority in the management of a project. Numerous participants specifically mentioned leadership skills as high priority skills in project management and as core skills. Leadership training was also mentioned. From the participants’ input, it was clear that communication, leadership, and project execution, including skills related to requirements gathering, risk management and smooth support transition, are some of the most important skills IT project managers should have. These viewpoints are in line with both the findings of the statistical analysis with logistic regression and viewpoints found in the literature review. These views were expressed by participants in both LSE groups.

Success and failure and the project manager’s role in relation to project outcomes were not directly addressed in the interview topics; however, through carrying out this research project, it is evident that understanding these concepts more directly from project managers would add important context to what has
been accomplished in the present study. Overall, the qualitative data collection through interviews could be further developed in the collection and also in the analysis.

Finding a relationship between LSE and tool use has not been within the scope of this study; however, it is clearly a problem for further research.

The strong results for the impact of ITPM tools on the odds of successful outcomes in the dimensions examined here may be suggesting that the IT project management profession take a closer look at the present tools and instructions for using them. Perhaps some strengths and weaknesses of various tools and/or the training on their use might be discovered. While project managers’ skill to effectively use tools will always be an important element, the more effectively tools are honed and their use taught, the easier it will be for project managers to use them effectively. As seen here in requirements gathering, the two tools had vastly different effects on the odds of dimension success, but the understanding the reasons why requires further research. The situation of tools may be one element in the overall preparation and training of IT project managers/team members. Finding ways to enhance training on project management and project work, including Leadership Self-Efficacy and leadership skill might also be suggested by these results that confirm the positive influences of LSE and tools through logistic regression, but also detect differences, through word vectors, between the transcripts of the two groups of participants with higher and lower and LSE scores.

9.5 Reflections on the Model and Research Method

The mixed research methods research model used here has been thoroughly described in Chapters One and Three.

The approach started with in-person interviews with colleagues as well as workshops, personal and shared professional experience, and the literature. The overall framework helped define a realistic direction and create the basic structure for the study based on an abbreviated version of an IT project consisting of four project dimensions: communication management, requirements gathering, risk management, and project support transition.

Interviews were a very essential aspect of the study which helped confirm a common overview of the reality of practice management work. In future research the interviews might be expanded and also guided in a way to include more
personal perspectives of managers that might shed more light on leadership and Leadership Self-Efficacy. Additional open conversation on the topic of tools and their effectiveness could also be helpful.

The instruments created to evaluate LSE levels and to collect data regarding dimension-specific tools and self-report of dimension success was, for practical purposes of analysing the data with logistics regression, quite useful.

Using the word vector technique was one way to apply a specific text analysis with the aim of gaining more insight into the text and creating more context for the quantitative results based on the interviews. This had some interesting results, provided some support for other results, and offered some suggestions for related research. If NLP techniques are used in further research, NLP techniques and applications that assist researchers to search and organise content found in the full texts of interview transcripts with the purpose of understanding the content more fully could provide deeper analysis of and identify more thematic aspects in what participants express and be able to draw out more benefit from their views and expertise. Similarities in viewpoints and relationships for subgroups of participants could then be considered in relation to LSE, demographic, or other factors.

A larger sample of participants would allow for more detailed analyses considering more factors and an expanded profile of the participants and subgroups of participants.

The model and research methods used here produced statistically reliable evidence and the procedures are reproducible.

### 9.6 Conclusion

This chapter has taken a comprehensive look at all the results and has discussed them from various perspectives.

This research provides solid empirical contribution to the practice and theory as it provides statistical evidence of the impact of the IT project manager trait of LSE and eight IT project management tools on the odds of successful outcomes in four project dimensions, using a mixed research methods approach.

The research questions were successfully answered, and some new insights were drawn which offer suggestions for continued work in understanding
critical success factors in project management, in particular leadership, Leadership Self-Efficacy and ITPM tools.

The following and final chapter will summarise the study, briefly revisit these results, comment on the limitations of the study, main conclusions, academic contributions, practical applications and suggest recommendations for further research aimed at moving forward to improve project management and successful project outcomes.
10 CHAPTER TEN: RECOMMENDATIONS, LIMITATIONS AND CONCLUSION

10.1 Introduction

This final chapter concludes the thesis by summarising the background and justification of the study, the literature review, the research design, the data that has been collected and analysed, and the main findings resulting from this research. The contributions of this research to both theory and managerial practices are discussed, the limitations of this study are taken into account, followed by recommendations for future work.

10.2 Highlights of the literature review

The literature provided a background and many insights applicable to the situation of project management, project management methodologies, and efforts to increase positive project outcomes with a focus on increasing project manager effectiveness. Factors that could be considered in increasing the number of successful project outcomes include more emphasis on leadership and motivating project teams and giving more focus to awareness and development of leadership skill in project management. Many authors consider the importance of project management tools, not only using them, but using them effectively in the context of other skills and activities. Most relevant to this study is the concept of Leadership Self-Efficacy as an underlying quality, involving self-awareness, self-confidence and self-evaluation, and the idea that LSE is related to performance, including leadership and success. The full review of background literature is in Chapter Two; following is a brief summary of literature addressing concepts most related to this study.

According to Ahlemann et al. (2013), even though the importance of project management methodologies continues to be emphasised, they still produce limited effectiveness, and they suffer from lack of acceptance in practice and unclear application scenarios. Mir and Pinnington (2014) imply that regardless of the advancements in project management and project management methodologies, project success has not improved. Eskerod and Jepsen (2013) analysed the international standards and bodies of knowledge, among them:
Guide to the Project Management Body of Knowledge (PMBOK Guide), International Competence Baseline (ICB), and PRINCE2. The core argument these authors make is that current forms of project management guidelines are not suited for grasping the increased complexity faced by project managers and project teams today. Another important perspective concerns the overlap of the concept of project methodology for practice and actual practice. Johnston and Wierschem (2005) note that while project management methodologies are helpful for IT project management, research reflects they are not sufficient for successful project completion (see also Vidal and Marle, 2008).

Vaskimo (2011) talks about enhancing the effectiveness of project work and outcomes with a system of recognized project management processes and practices aimed at increasing project effectiveness and the probability of project success. Applying these elements in a coordinated comprehensive manner might result in greater benefit than from employing each element separately. Basically, Vaskimo implies that processes and practices are meant to be synergistic in efforts to increase project success. Along this line of thought, Krahn and Hartment (2006) express more specifically that detailed project management tools supported with core leadership skills will help increase the number of successfully completed projects.

The present study shares these views regarding the interaction of leadership and project management skills interacting with the use of effective project management tools. Project outcomes remain a concern in IT project management, and the need for leadership and for further improved ITPM tools continues to be voiced by practicing IT project management professionals, including the twenty-nine IT project management professionals who participated this study.

In relation to the concepts of leadership and effectiveness, the concept of Leadership Self-Efficacy is of great interest. Over the past few years, the concept of self-efficacy is one area receiving tremendous attention in organisational research (Chen and Bliese, 2001; Paglis, 2010). Earlier research on self-efficacy has widely revealed how the motivational construct of self-efficacy influences the choice of activities, the stated goals and level of goals set, efforts and persistence towards the task to be accomplished, and the subsequent performance (Bandura and Wood, 1989). Bandura (1986) states that self-efficacy is the chief construct
that links ability to performance. The higher the self-efficacy people feel, the more confident they will feel about successfully completing a task (Villanueva and Sanchez, 2007). According to Riggio et al. (2002), high self-efficacy has been shown to lead to increased performance in a wide range of situations. Hence, the self-efficacy factor is seen as playing a vital role in both influencing the skills individuals possess and determining what they do with the skills (Hoyt, 2005).

Bandura (1997), Paglis, 2010 and Ugwu et al. (2013) define the term “self-efficacy” as the “belief in one’s capabilities to organise and execute the courses of action required to produce given attainments.” Other research shows how self-efficacy relates to various forms of performance outcomes. In a meta-analysis conducted by Stajkovic and Luthans (1998a), self-efficacy was found to be strongly and positively associated with work-related performance. As such, self-efficacy is critical in not only influencing the skills an individual possesses but also influencing an individual’s perceived potential (Hoyt 2005). According to Paglis and Green (2002), self-efficacy is an estimate of one’s ability to orchestrate performance by successfully executing the behaviours that are required to produce desired outcomes.

Paglis and Green define Leadership Self-Efficacy as “a person’s judgment that he or she can successfully exert leadership by setting a direction for the work group, building a relationship with followers in order to gain their commitment to change goals, and working with them to overcome obstacles to change.” (Also see Hoyt et al., 2003.) The personal quality, or trait, of Leadership Self-Efficacy has been defined and broken down into components that can be used to measure it. Bobbio and Manganelli (2009) created the Leadership Self-Efficacy Scale, a survey using such components and a Likert Scale for each item. This instrument forms the base of the LSE measurement tool used in the present study.

The concept of Leadership Self-Efficacy, though extremely important, does not seem to have been directly connected to project outcomes or particular project manager behaviours based on the literature reviewed.

Kihlstrom and Harackiewicz (1990), in their review of Bandura’s work on self-efficacy concluded that self-efficacy should be seen as a property of a person, but is not a personality trait, itself, which means it could possibly be developed under the right combination of circumstances, experiences and/or training regardless of the personality of an individual. This type of thinking is also behind the present
study’s concerns and recommendations for leadership and Leadership Self-Efficacy to be included in the preparation of and ongoing development and support of project managers.

The issue of project manager leadership competencies continues to provoke debate with regard to their contribution to project success, which highlights the need for research on leadership competencies to fully understand how they relate to project performance (Anantatmula, 2010; Muller et al., 2012). Past studies focused on analysing and recognizing project manager leadership competencies (Berg et al., 2016) and identified lack of leadership competence as the reason for many project failures. This competency represents one of the main reasons for the inability of project managers to organize available resources, to meet stakeholder expectations, to meet deadlines, and to take corrective actions for improving project performance as indicated by Sunindijo (2015). Hence, the need for training in this area.

Jacob and Kamohi’s (2017) findings influenced the current research regarding the impact of project manager leadership self-efficacy on project success; their approach was through meta-ethnography qualitative analysis of previously conducted research work and their own data collection. Also, Jacobs, and Kamohi and their findings of the impact of project manager leadership efficacy on project success was proved statistically in the present research through the analysis of survey data with logistic regression that showed a positive impact of project managers’ LSE on the odds of successful outcomes in four dimensions of IT projects.

Per Nawaz, et al. (2016), Project manager’s leadership was positively correlated to project success as well as with teamwork. Due to changes in environmental factors in companies, competencies required of project managers will need to continually evolve. Project management is defined as an application of knowledge, skills, and techniques to project activities in order to meet the needs of project requirements, according to Heagney (2011, p. 25). Leadership, in these applications, is required to enhance successful project deliverables. With various leadership styles this can be achieved. Kerzner (2013) states four elements, which are essential when exercising good project management leadership methodologies, namely effective communication, effective co-operation, effective teamwork, and trust. Hall (2019) commented, “I often ask project managers the
reasons for project failure. One of the top responses is a lack of leadership and sustained engagement by the project sponsor. The sponsor paints a fuzzy picture of what they want, throws it over the fence to the project manager, and goes on their merry way."

According to Bruce (2015), the importance of communication in project management cannot be stressed enough. And every good project starts with a solid communication plan. This is a basic strategy that details what effective communication will look like on any given project. Requirements management is a critical part of the project manager leadership skill, not only for software, but for all products. Well-articulated requirements are the underpinning of any project, while poorly expressed requirements produce one of the most challenging situations a project manager may face (Bloch et al., 2012). In many projects, risks are identified and analysed in a random fashion (Jun et al., 2011). Taking a random approach to dealing with risk can be fatal to the success of the project in question as unexpected, abrupt problems often arise and must be dealt with on an emergency basis. Levin (2010) indicated that every organization wants to make use of project management to deliver its products and services with superior outcomes and benefits that can be sustained for its customers and users. If the organization can implement knowledge management effectively, it is the key to success in project management and thus could transform the organization to excellence. Levin argues that knowledge management must become an integral part of each project professional’s daily project work. She suggests that it is necessary to integrate knowledge bases to projects so the people involved in the project can combine individual contributions to those of the project’s objectives and align with the organization’s strategic objectives. Knowledge is created via projects, and continuous creation of innovative knowledge is essential for the survival of organizations. Consideration of these views is consistent with the selection of communication management, requirements gathering, risk management and project support transition dimensions for the abbreviated model of a project used in this study.

Effective project management tools are essential for project managers, and the entire team that is being managed. This is recognized in project management methodology and guidelines for practice and also in academic literature. Some tools are very specific and effective, while others require more active skill on the
part of the user. These factors also enter into the implications for tools and leadership and their connections to project outcomes.

Nakayama and Chen (2016), through their survey of 200 project management professionals in China, found that despite the increasing availability and variety of project management (PM) tools in recent years, projects continue to face challenges. Although Thamhain (2013) has emphasized the importance of using the right tools, it is not clear how much their use can contribute to project success. This study was able to statistically quantify the impact of odds of success of project management tools on project outcomes.

Although no statistical evidence connecting LSE to project success was uncovered, the literature review has assisted in understanding, and provided insight into, the possible implications of LSE on successful project outcomes. The background research, in combination with the author’s practical knowledge and experience in IT project management, has assisted in identifying concepts used in the design of the model of this study.

10.3 Research Aims and Objectives

The explanation of the research aims and objectives has been developed and refined throughout Chapters One of this thesis. The aims of this research are to:

1. Investigate project managers’ Leadership Self-Efficacy and project outcomes;
2. Investigate the role of IT project management tools in project outcomes; and
3. Make recommendations enabling project managers to successfully contribute, in practice and research, to the project management (PM) profession.

The purpose of this research was to measure the impact of IT project managers Leadership Self-Efficacy on the success of outcomes in four dimensions of IT projects. Another objective was to measure the impact of selected IT project management tools that IT project managers frequently apply to minimise knowledge gaps in the four project dimensions under investigation in this study: communication management, requirements gathering, risk
management and project support transition. This study considers that overall project success depends on success in the many component dimensions, or knowledge areas, of the project. The study also aimed to take steps toward assessing the impact of LSE on project managers’ perspectives regarding ITPM tools and successful and unsuccessful project outcomes.

Project management is rapidly progressing as a practical field; current research and practical project management methodologies focus on the functional side of project management and the project manager. This research focused on the leadership aspect of management, by using LSE, a trait related to self-awareness and self-confidence to perform effectively, that a project manager may, or may not, have, and its impact on project success at the dimension level. The investigation of the impact of two project management tools within each of the four knowledge areas/dimensions was also important, as these tools are what project managers depend on to carry out their work of guiding projects through their life cycles.

Objective Three is to make recommendations based on the findings of data analysis and results interpretation. These recommendations are outlined in Section 10.9. They support the project management body of knowledge, suggest ways to help organisations refine the selection of project managers, and anticipate project outcomes based on specific project manager skills and characteristics.

10.4 Research Design

With the research aims in mind and without having uncovered previous studies statistically connecting the factor of LSE and project outcomes or the factors of project management tools and project outcomes in the literature review, as well as the probability of working with a relatively small sample, it was decided to approach the situation at the level of project dimensions. The four project dimensions selected for this study are basic and components of most IT projects; they are: communication management, requirements gathering, risk management and project support transition. Approaching the study at the component level of project dimensions is a more concrete problem, allows for more specific data collection and more specific calculations. Furthermore, it may facilitate the participants’ ability to give more accurate answers in the data collection process.
Research Questions

This study was designed to answer the following three research questions.

Research Question One:
Is there a relationship between Leadership Self-Efficacy and success in particular dimensions of a project?

Research Question Two:
What is the impact of specific ITPM tools on project dimension success?

Research Question Three:
Is Leadership Self-Efficacy a factor in project managers' perspectives on IT project management tools and their perspectives on ownership of project success/failure?

Model

With the aim of answering these questions, a study was designed to collect primary data directly from twenty-nine experienced IT project management professionals who have cumulatively handled 1,000+ projects in 400+ companies across four industries (high-tech, retail, automotive and logistics) regarding the project managers' level of LSE, project managers' ITPM tool use, and ITPM managers' evaluation of successful outcomes in four dimensions of projects they had managed.

Data collection instruments

A mixed research methods of quantitative and qualitative data collections was used employing three instruments:

1. An adapted version of Bobbio and Manganelli’s (2009) Leadership Self-Efficacy Scale which was titled Project Manager Questionnaire for this study.

2. A survey of ten projects, that each participant had managed, that requested binary answers (“yes” or “no” expressed as “1” or “0”) regarding the use, or not, of eight ITPM tools and the successful, or not, outcomes in each of the related four dimensions in each of the
10 projects. This survey instrument was titled Project Manager 10 project details.

3. A guide consisting of open- and closed-ended questions on the topic of project management was used to guide a recorded interview with each participant. (These instruments are found in the Appendices).

Data analysis methods

Quantitative survey data was analysed with Logistic Regression. The qualitative data of the interview data qualitatively analysed; the interview transcripts were also processed for quantitative analysis with word2vec. An Analysis Triangulation perspective was used to gain greater insight into the meaning, implications and possible interpretations of the data. Where possible results were further tested for statistical significance. R and Python packages were used. Full details are described in Chapters Four, Five and Six, Seven, and Eight.

The mixed research methods approach aimed at increasing the validity of the findings through informing the results of one analysis based on one data source with results of a second analysis based on data from a second source. As claimed by Molina-Azorin (2011), use of a mixed research methods approach helps gain a deeper, broader understanding of the phenomena being studied—in the present case the phenomena are the impact of project manager LSE on project dimension success, and the impact of ITPM tools on project dimension success. Using mixed research methods might also provide more insights regarding possibilities for further research (O’Cathain et al., 2010).

Participants

The inclusion criteria for this study were that each individual: a) had served as IT program and/or project manager; b) had been involved in the IT project management field for ten years or more; c) had overseen ten or more projects with spending plans of at least one million dollars; and d) could read and understand English.

This is a non-probability sampling strategy in recruiting participants. A relatively small sample size was considered due to the challenge of finding a large number of IT professionals with the required experience to accept a two-hour interview. Sample size was determined using the principal of theoretical data
saturation which indicated that an adequate sample size would be twenty-nine participants. This sample of participants consists of twenty-nine IT project managers with the required IT project management experience who agreed to participate and who were geographically accessible to the researcher.

The sample appears to be balanced in regard to age, gender and years of experience. A complete set of data was obtained from all twenty-nine participants. The research methodology is described in full in Chapter Three.

10.5 Ethical issues

The important ethical aspects considered in this research are 1) voluntary participation, 2) informed consent, 3) confidentiality and anonymity to support honesty and trust in the relationship between the researcher and the participant. The study adhered to all requirements of the ethics code of the university.

All participants volunteered for the study. Interview appointments were confirmed in advance and participants had the option to reschedule or cancel. Furthermore, in providing responses to the surveys and interviews, the participants had the option to omit answers to any items or questions that they deemed uncomfortable.

The purpose of the study, the data collection procedures and interview process were discussed with each participant, and written consent for the recording of the interview was obtained.

Confidentiality and anonymity were discussed with the interviewees and the management of the organisations to which interviewees belong before the interviews began. It was agreed no information would be revealed or used in publication which might lead to the identification of the organisation or the individual. In this dissertation, no artefacts containing full names of interviewees or their organisations have been used. The original data and the transcripts of the interviews only carry the first name and initials of last name of the interviewees and their job role.

Participants were informed the data would be used for a dissertation research project and possible subsequent academic or professional publications. The data will be kept for a period of two years, after which the original data will be deleted.

Letters of thanks were sent to the participants after the interviews.
10.6 Summary of the Results

This section briefly describes the results of the study. The Tables of all numerical results of the analyses with logistic regression and word vector can be referred to in tables 9-1 to 9-12 in the previous chapter.

The analysis of the LSE and 10 Project Details surveys with logistic regression found that both 1) the IT project manager’s LSE and 2) the use of dimension-specific IT project management tools each favourably influence the odds of successful outcome in the four IT project dimensions selected for this study. The results for tools showed that they have a higher impact than project managers’ LSE in all but one case. All the results for the influence of LSE and ITPM tools on the odds of success in the quantitative analysis of logistics regression were statistically significant \((p \leq 0.10)\), with one exception: the functional decomposition tool which is used in the requirements gathering dimension.

The use case diagram tool, used in requirements gathering, had the highest impact, and highest statically significant result \((p = 0.01)\), increasing the odds of successful dimension outcome by 89%. The LSE impact for this dimension is 55% and is statistically significant at the 10% \((p < 0.10)\) level. Also, in this dimension, the lowest of all 12 factors analysed with logistic regression was the impact of the functional decomposition tool, mentioned above, which was 38% and statistically insignificant.

The overall results of communication, risk management and project support transition are similar, in pattern; the results for the project manager’s LSE and both dimension-specific tools are all within ten percentage points of each other, and the result for the impact of LSE is the lowest. The range of impact of LSE on the odds of successful dimension outcome is 53% to 63%. The range of impact of the 6 tools relevant to these three dimensions is 55.6% to 67.6%. The dimension of risk management has the highest results in all cases with LSE and both tools having impacts of above 60% with statistical significance at the 5% level.

An interesting overall observation is that all logistic regression results of over 60% are statistically significant where \(p < 0.05\), while results lower than that are significant where \(p < 0.10\) or not significant (the functional decomposition tool).

The word vector analysis showed notable numerical differences of cosine similarity for the selected word pairs in the pre-processed interview transcripts of
the group of participants with LSE compared to the transcripts of the group without LSE in many cases. These results indicate LSE has some influence distinguishing the two groups of transcripts regarding these word pairs. The cosine similarity results do not characterise the relationship between involved factors. However, the word pairs were purposely selected to represent concepts related to ITPM tools in the four dimensions and concepts related to the project manager in regard the concepts of success and failure. When considered in the context of the practical situation of IT project management and the literature on Leadership Self-Efficacy, some insights can be drawn as to what these results may be suggesting about the relationship of LSE and IT project managers perspectives on ITPM tools and IT project outcomes. The word2vec analysis of perspectives on success and failure included several word pairs, creating more context, and the literature about LSE is consistent with the idea that persons with higher LSE would be more aware, confident in their work and accountable in regard to both successful and unsuccessful project outcomes. In the case of the ITPM tools, there may be suggestions of a preference for more written communication and more use of checklists on the part of managers with LSE, and that some tools or the protocols for management of some dimensions may require less skill on the part of the user than others to be effective. Overall, the results indicate the influence of LSE, in general, and the results of the selected word pairs offer a context from which to further investigate the specific relationships.

The quantitative analyses, in addition to illustrating the influence of LSE and ITPM tools on project dimension outcomes, also raised questions regarding whether the impacts of LSE and tools worked independently and/or if the results of the impact of LSE were underlyingly interrelated in increasing the odds of successful project dimension outcomes. These results also suggested that some ITPM tools, and possibly methods, are effective regardless of the user while others may require more skill and training.

The qualitative analysis of the full interview transcripts does not indicate that participants can be divided into groups regarding perspectives on project management by LSE score or demographic factors. Rather, the interview data presents overall agreement and common concerns with emphasis on tools and leadership, approaches to project management, goals of increasing project success, suggestions for advancing their profession, and facilitating their own and
new project managers’ jobs. The participants indicated the importance of communication management in managing IT projects and how much of the IT project managers’ time communication requires. Participants also shed light on the importance of detecting project risk in the early stages of the project in order to be prepared to take action to mitigate the impact of risks that do occur. The importance of project support transition was also highlighted by showing the importance of having the support team involved in the project at an early stage to have them support project implementation and documentation. Several participants commented on the need for practical tools to manage the requirements gathering aspect of IT projects. Besides the emphasis on the importance of leadership and IT project management tools, participants voiced the need for training prepared and conducted by experienced project management professionals.

10.7 Research Scope and Limitations

This section explains the scope and limitations of this study.

Scope of the study

The study limited the scope to an abbreviated version of a project (described above) in order to be able to test a more specific research model and obtain statistically reliable results. The participants needed to be seasoned professionals in IT project management (as described above in this chapter and in Chapter Three). Obtaining the needed data would require approximately two hours for each participant. The researcher's professional network clearly included participants with the needed qualifications, so it was decided to recruit participants in this way. Attempting to find such professionals who would offer two hours of their time would likely have had less success without the professional network. The researcher’s network’s geographic area included the US, largely the state of Texas, and Mexico.

The study also defined the requirements for participation to focus on a minimum number of years of project management experience as the main criteria. Therefore, only a few details of demographic information were collected, and as the sample consisted of twenty-nine participants, it was not realistic to use age, sex, and geographic location as factors because sub-groups would be very small. The sample was observed for the distribution of age, years of experience, gender,
and geographical work location, and the sample was found to be balanced for these factors.

The mixed research methods approach determined that both qualitative and quantitative data analyses would be done. A qualitative analysis of the full interview transcripts would be done to determine themes and perspectives of the participants. A quantitative analysis data from two surveys would be done with logistic regression with binary data concerning LSE, tools, and project dimension outcomes. A second quantitative analysis would be done with word vector, an NLP text analysis technique using selected word pairs, of the interview transcripts. Finally, an analysis triangulation was done with all the available results in order to consider comparisons, confirmations and/or complementation of related results. These details are explained in Chapters Three through Eight.

**Limitations**

The following are descriptions of the limitations of the present study.

**Funding**

Since this study was self-funded, the number of interview visits had a limit; especially the travel cost and expenses, and the duration of the data collection period had to be limited based on this researcher’s personal resources.

**Interruptions from participants’ employers**

Particularly in the case of interviews that took place at the participant’s company in Mexico, interviews were sometimes interrupted to consult the participant about work related matters. This was a distraction and sometimes took a few minutes away from the interview.

**Places of Interviews**

The management of the participant’s company sometimes interfered with the original interview plans. More interviews were planned, but some companies did not feel comfortable with individual interviews on the company premises. This resulted in scheduling some interviews at coffee shops, which had the advantage of providing a relaxed informal atmosphere facilitating good conversations; however, from a technical standpoint, it was not always the best place to record an interview.
Not being able to meet at the company also resulted in the loss of a few participants.

**Small Sample Size**

Although a much larger sample size was not in the scope of the design of the study and the sample size of twenty-nine participants was deemed satisfactory by the principle of theoretical saturation, a somewhat larger sample size would have been welcomed. The sample was not skewed in terms of age, gender, or experience, but it did not allow for analyses by factors of age group or specific number of years of experience. The raw data indicated the level of LSE obtained from the survey used was very closely associated with years of experience and with age, which is expected as the LSE survey items are related to skills gained by maturity and experience. However, it was not possible to perform analyses controlling for factors that would clearly separate the effect of LSE from that of age and experience. In a larger study, age groups and groups based on years of IT project management experience could be analysed separately for the effect of LSE.

**10.8 Contributions**

Contributions are categorised into contributions to the academic literature, contributions to research methodology and contributions to project management practice.

**10.8.1 Contributions to the Academic Literature**

LSE is a relatively new field of study in project management, in general, and particularly in IT project management and, thus, is still under-investigated. The present study offers a research design and model which is data based and gives statistical evidence regarding LSE and ITPM tools and the influence of each on the odds of successful outcomes at the project dimension level.

1. This study makes important contributions to the background literature on LSE and project management because it provides a data-based study using a research design that yielded statistically reliable results
that confirm the influences of LSE and IT project management tools on IT project dimension outcomes.

2. To the researcher’s knowledge, no such studies were found in the background literature connecting LSE and project success; this study begins to fill that gap.

3. A contribution regarding the research methodology used in this research was published in the 16th European Conference on Research Methodology for Business and Management Studies (ECRM 2017).⁹

10.8.2 Contribution to Research Methodology

This study addressed the problem of finding statistical evidence to support the existence of the impact of project managers' Leadership Self-Efficacy and the impact of IT project management tools on the outcomes in four dimensions of IT projects. Statistical evidences of these relationships were not found in previous research.

1. This study contributes a mixed research methods research model with data collection instruments and analyses methods which are reproducible. The relevance of the study was ensured by using a base of expert knowledge obtained directly from experienced IT project managers as well as quantifiable data that was able to provide statistical evidence, including tests for the significance of obtained results.

2. This study, the implemented research methodology, and the results obtained plant the seeds for future research regarding the impact of Leadership Self-Efficacy and its impact on project success as a whole.

10.8.3 Contributions to project management practice

Following are contributions of this study to project management practice.

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1. The results of this study showed that project managers’ LSE is an important element in project management and could be added to the Critical Success Factors of project management.

2. This study highlights Leadership Self-Efficacy as a desirable quality in IT project managers. This emphasises the human factor of all team members and the role of the project manager in IT project work and outcomes; this points to possibilities for training and development of people as part of efforts to increase project success.

3. The suggestions from this thesis will lead to improvements in the PMBOK through participation of the author in PMI conferences and by discussing the findings with other researchers. This will lead to the opportunity to actively work on the improvement of the PMBOK and influence the next editions by presenting ideas to the PMI project community.

4. The data collection and analysis instruments will possibly lead to the development of a practical tool to measure the IT project managers’ LSE level. This will help identify more specific aspects of project managers’ LSE training.

5. The results of this study have the possibility to lead companies to design and conduct more effective training for IT project managers regarding IT project management tools and their potential impacts on project outcomes.

6. The results of this study showed the persistent impact of project management tools on the success of the project. According to a Chinese proverb, “to do good work, one must first have good tools.” It is also true for project managers, if they want to deliver good project results, they must first have good project management tools and training on how to utilise such tools effectively to increase the odds of project success.

10.9 Recommendations

Recommendations are categorised into recommendations for future research and recommendations for project management practice.
10.9.1 Recommendations for further research

As discussed in the literature review in Chapter Two, there is relatively little data-based research available in the area of IT project management tools and the impact of Leadership Self-Efficacy on project dimension-specific success. There is a need for further investigations in the areas explored in this thesis. Following are some suggestions for further research.

1. Rerunning the present study with a larger sample; including more participants in each of the various age groups and groups based on years of experience would allow age and experience to be used as factors to observe differences in LSE scores among participants of similar age or with the same amount of IT project management experience.

2. After people with high LSE scores are identified, follow-up interviews could explore their views on leadership, growing experiences, influential mentors, developing self-awareness, self-evaluation, self-confidence, and other skills and aspects of success in various situations.

3. This study limited the focus to four IT PM knowledge areas/dimensions of projects: project communication management, project requirements gathering, project risk management, and project support transition and eight project management tools used to bridge knowledge gaps and manage project activity in each dimension. For a comprehensive IT project management resources and tools framework, future research will need to explore additional IT project management knowledge areas and tools.

4. This study did not directly explore the impact of LSE on tool use with logistic regression or other analysis that would lead to statistical evidence; this is another area needing further research.

5. Further detailed qualitative research addressing project managers’ perspectives on their responsibilities, how they view their roles in the successes and failures of their projects, perspectives on management and leadership, and other factors affecting them and their team members could shed more light on LSE through exploring project
managers’ self-awareness, self-confidence and views about interacting with team members and stakeholders.

6. Further research could explore project managers’ views on ITPM tools in detail, through interviews and surveys. This may facilitate understanding which tools are often used as well as which tools are most effective, and the amount of skill managers need to use particular tools effectively.

10.9.2 Recommendations for Project Management Practice

The following are recommendations for practical application of insights gained from the present research in the actual situation project management work.

1. Evaluate project manager LSE: The survey tool to measure LSE is a very quick and handy tool that enterprises and organisations could use to measure the level of IT project managers’ LSE. It could support executives and leaders by providing a quick indication of a project manager’s likely self-confidence to act and make judgements which may increase the odds of project success. The survey questionnaire used in this study was tailored in a way to capture specific feedback for specific sets of questions in six different dimensions, in addition to capturing the project manager’s preferred leadership styles.

2. Create and implement workshops to help develop LSE related self-awareness and confidence. There is no definition for LSE training because such training is not available. A forum of experienced project managers could design an outline of a two-day LSE training for new or continuing project managers who seek to add and develop such qualities and enhance their personal awareness and skillset. Over time, professionals having experienced LSE training should mature and provide more value to IT project managers.

3. Leadership Self-Efficacy training: A Possible Approach: Bandura (1997) indicated that four kinds of experiences influence the level, or degree, of self-efficacy: (a) enactive mastery, (b) vicarious experiences, (c) social persuasion, and (d) emotional and physical states. With this
in mind, following are a few possible examples where Bandura’s four experiences might be applied.

1. Develop self-awareness as a leadership tool;
2. Enrol in Leadership and Corporate Strategy and Responsibility training. This will help increase an employee’s awareness of the leader’s roles and responsibility and information for developing his or her own leadership skills;
3. Undergo immersive experiences, where participants have the opportunity to practice and refine essential teamwork behaviours serving as the hallmark of effective leaders; and
4. Attend leadership seminars, receive special developmental assignments, and work with mentor co-workers to continue personal and professional development of LSE.

4. Develop and implement leadership training provided by experienced project managers.
5. Develop generic tools and a tool framework as well as trainings taught by experienced project managers on the selection of tools and the effective utilisation of such.

A recommendation will be given to the PMBOK to motivate project management professionals to focus on leadership and LSE specific skills, so they become more mainstream. Although there is a need to carry out more research and work on the reliability of the present findings, many resulting themes showed a strong association on PMBOK knowledge areas.

Simply teaching managers about leadership and leadership styles may not be effective if a manager does not have the self-awareness and self-confidence in their abilities and skills to actually behave and act as such. Since LSE can be learned and developed, it could be a valuable factor and should not be ignored in training any employees, especially those in management positions.

10.10 Conclusion

The study makes contributions within two general categories. First, as a quantitative analysis of the effect of Leadership Self-Efficacy on project dimension
outcome. This research heeds a request for more research on Leadership Self-Efficacy in IT project management and provides practical suggestions regarding improving quality in project execution. Second, this study demonstrated the significance of IT project management tools and their impact on project success.

This study was motivated by a desire to help IT project managers become more effective and have more successful project outcomes. This research provides a base model for further research in this area and also serves as an important step towards understanding LSE, tools and other factors that affect project outcomes.
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IT Project Management Tools and Leadership Self-Efficacy


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8 APPENDIX A

A1 – Thought Process and Steps Leading to the Research Model Design

The research model encompasses the tools used to gather, analyse, and interpret the obtained data, which is guided by the research methodology implemented in this study. However, as few data-based studies to serve as reference points were found in the literature, there was a discover-type process involved in order to design a doable project that would produce statistical results. Following is a description of the thought process and steps leading up to the design and implementation of this investigation of Leadership-Self Efficacy (LSE), ITPM tools, and IT project outcomes.

Stage 1 Background and Identification of Issues Review of Author’s own experience

The background, practical experience of the researcher, and motivation have been elaborated in the previous sections. However, once the decision to become a researcher with the aim to find ways to improve successful outcomes in IT project management, specific research questions had to be determined and a research model in which they could be studied had to be constructed. As a first step of delving into the complicated issue of understanding and improving IT project outcomes and improving IT project management, the researcher reviewed 60 reports of IT projects that he had managed himself to search for factors and behaviours in his own project management that seemed to affect project outcomes, whether successful or not. Most of the project failures identified in the reviewed reports were either due to project manager inefficiency in the use of IT project management tools in the four project management dimensions: Communication Management, Requirements gathering, Risk Management and Project Support Transition. These project dimensions have been mentioned above and are basic elements that are present in and enclose the beginning and end stages of almost any IT project.

Interaction with IT Project Management professionals

The researcher interacted with colleagues and other IT project managers that share the same experience. Almost every professional individual with whom
the researcher interacted expressed the need to enhance the probability of project success. Also, they expressed the need for research to provide evidence of the impact of IT project management tools on project outcomes.

**IT project management conferences and workshops**

The researcher participated in more than 40 national and local IT project and program management conferences and workshops and interacted with IT project and program management professional from the US and outside the US, sharing experience regarding areas of focus that need more research in IT project management. There was always discussion regarding the ability to enhance the probability of project success and the need for practical research to more clearly understand critical success factors as well learning more about how and why project managers impact project success.

In August of 2012, at a workshop arranged by the PMI chapter in Dallas, TX to discuss project management dimensions, the author was a key player and prepared most of the activities and discussion points. Attendees such as Malisa B.\(^{10}\), a VP of project management at a major retailer in the US, concurred with the author that there are 4 major project dimensions in project management that controls the boundaries of project management. 1) Communication management and 2) risk management both require active management throughout the entire project life cycle. 3) Requirements gathering supports the initial stage of the project to make sure that detailed and clear requirements were gathered, documented, reviewed and approved by the project and client teams. 4) Project support transition is key in closing the project and helps ensure smooth free up of project resources for the project team to work on a new project.

In the winter of 2014, the author attended a gathering of IT project management professionals at the AT&T auditorium in Dallas, TX. Close to 400 IT project management professionals from across the US attended this gathering, and the theme of the discussion centred on tool utilisation in project management. Most of the project managers agreed that they do not need more theory but rather more practical experience. Another topic regarded understanding more about how a project manager’s personality and experience affects project success. One of

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\(^{10}\) This workshop attendee, requested that her last name not be disclosed. Several other IT professionals cited in this thesis expressed the same request. Personal privacy is a priority and no last names will be disclosed in the explanations of personal conversations, unless allowed by the person involved.
the conclusions was that the project management profession is in need of a practical framework of practical project management tools and how to utilise them effectively.

This stage of thinking and interacting with other project managers was very important to confirm that the researcher’s perspective was in line with the professional community to facilitate designing a project that would address real priorities and produce results that could be applied in practice.

**Literature Review**

A wide variety of sources were reviewed, including journal and conference papers, books, and published articles regarding IT Project Management tools, IT project managers management and leadership styles and project success. These sources provided a background on project management supporting the practical views of professionals mentioned above regarding project methods and ITPM tools. In the literature pertaining to management and leadership, the sources addressing the personal trait or quality of Leadership Self-Efficacy were influential in the decision to include this element as a variable in the present study. However, it was difficult to find previous research making empirical links between the effect of the project manager’s LSE on project outcomes. The only paper that was found to touch on the relationship between project execution and project manager Leadership Self-Efficacy was published by Jacobs, A. and Kamohi, L. (2017). Their study, also, was based on the literature review of Leadership Self-Efficacy; no statistical evidence of the impact of LSE on the effectiveness of IT project managers was shown. Other background on LSE in the literature review included LSE measurement tools, such as the Leadership Self-Efficacy Scale (Bobbio and Manganelli, 2009), a survey instrument using a Likert Scale.

The literature uncovered, both support for the background issues held by practitioners of IT project management, the element of LSE and project management tools as important factors that could be investigated, and in particular, the need for statistically reliable evidence of the relationships between project managers’ LSE and project outcome and the relationship of tools and project outcome.
Step 2 Identify focus concepts

The focus needed to be narrowed, and the following were chosen as underlying issues that needed to be included. 1) Leadership Self-Efficacy was chosen as the variable to represent the project manager’s effect on project outcomes. 2) Tools and 3) project outcomes also had to be factors. However, including all tools in all dimensions of a project would be beyond the scope of the present study which does not have previous academic research on which to build. An abbreviated version of a project was selected, using 4) the four project dimensions discussed above. Using the abbreviated structure, the number of ITPM tools could be reduced; the researcher selected two dimension-specific tools for each of the four dimensions.

Step 3 Determining research objectives

Next the research objectives needed to become more specific, in essence drafting possible research questions. One objective was to find statistical evidence of existence of the relationship between LSE and project dimension outcomes. The second objective was finding statistical evidence of the impact of using dimension-specific ITPM tools on the outcomes in the related project dimension.

Having a context of viewpoints from seasoned professionals about managing these dimensions of IT projects and about the tools and resources involved was also needed.

Furthermore, the researcher wanted to be able to evaluate and corroborate the data from each analysis with other data analyses in the study. Since this study would be, to the researcher’s knowledge, a first statistical investigation of these relationships, more than one type of evidence would offer support for the validity of findings.

Step 4 Possible analyses techniques

Regression analysis was considered for finding the relationships between LSE and project outcome and the relationship between ITPM tool use and outcomes in the dimensions. Of linear regression and logistic regression, logistic regression was thought to be more appropriate for this study. Logistic regression requires binary data. Binary data is easy to interpret, is objective and avoids the problem of central migration that might occur with scaled data.
LSE scores of each participant would be needed. Data regarding multiple projects that each participant had already managed regarding tool use and dimension outcomes in the four dimensions was also needed.

In person interviews would also be needed to collect first hand data from expert professionals about their perspectives in direct conversation and would require qualitative analysis.

A mixed research methods approach and a triangulation comparison could be used to look for corroboration and/or complementation of results from interviews and statistical analysis.

**Step 5 Types of data needed**

Scaled LSE scored would be needed to determine possible groupings of project managers based on their individual scores.

Logistic regression would require binary data for LSE scores, for each tool and the outcome in each dimension.

Interviews could be recorded, then transcribed and later analysed for overarching themes, commonalities and differences in viewpoints about the topics of management of project dimensions, dimension-specific tools and success.

The size of the sample would need to be determined. The number of data for logistic regression could be increased by including data from multiple projects from each participant.

**Step 6 Research Instruments**

Project managers’ levels of LSE could be measured by a modified version of the Leadership Self-Efficacy Scale (Bobbio and Manganelli, 2009).

A survey instrument was created; “yes” or “no” answers were requested regarding the use of a tool or not and a successful or unsuccessful outcome in the project dimension. This instrument would collect binary data ready to be used in the logistic regression analysis.

A series of questions were prepared to guide the interview through a discussion of each dimension, ITPM tools, views on training, and thoughts on what is needed to facilitate the project manager’s job and to prepare new project managers.
Adjustments and refinement

Further adjustments and refinements were made along the way. Also, later the inclusion of a word association analysis with word vector (a Natural Language Processing technique) was added to further explore the effect of project managers' LSE. And, some exploration of the raw survey data was included to look for trends that might inform the advanced statistical analysis as well as provide additional context for the overall analysis.
A2- Interview Consent Form

Participant/Name ID#: __________________ Date / Time of Interview: __________ / __________
Country/State: _____, Gender: __________, Age: __________, PM Experience (Years): ________

Research project title: Impact of IT project management tools and Leadership self-efficacy on project success

Research investigator: Sameh Shamroukh, PhD Candidate, University of Bolton

The interview will take two hours. We don’t anticipate that there are any risks associated with your participation, but you have the right to stop the interview or withdraw from the research at any time.

Thank you for agreeing to be interviewed as part of the above research project. Ethical procedures for academic research undertaken from UK institutions require that interviewees explicitly agree to being interviewed and how the information contained in their interview will be used. This consent form is necessary for us to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation. Would you therefore read the accompanying information below and then sign this form to certify that you approve the following:

- The interview will be recorded and a transcript will be produced
- You will be sent the transcript and given the opportunity to correct any factual errors
- The transcript of the interview will be analysed by Sameh Shamroukh as research investigator
- Access to the interview transcript will be limited to Sameh Shamroukh and academic colleagues and researchers with whom he might collaborate as part of the research process
- Any summary interview content, or direct quotations from the interview, that are made available through academic publication or other academic outlets will be anonymized so that you cannot be identified, and care will
be taken to ensure that other information in the interview that could identify yourself is not revealed

- The actual recording will be kept for 2 years and then destroyed.

- Any variation of the conditions above will only occur with your further explicit approval.

By signing this form, I agree that:

1. I am voluntarily taking part in this project. I understand that I don’t have to take part, and I can stop the interview at any time;

2. The transcribed interview or extracts from it may be used as described above;

3. I have read the Information survey sheet, and interview questions/guide;

4. I don’t expect to receive any benefit or payment for my participation;

5. I can request a copy of the transcript of my interview and may make edits I feel necessary to ensure the effectiveness of any agreement made about confidentiality;

6. I have been able to ask any questions I might have, and I understand that I am free to contact the researcher with any questions I may have in the future.

Participant Name __________________________
Participants Signature _______________________
Date __________________________
Researchers Signature _______________________
Date __________________________
A3- IT Project Management Resources and Tools

Interview Questions

Participant/Name ID#: _______________ Date / Time of Interview: _______________ Start: __ Finish: __
Country/State: ___________, Gender: ___________, Age: ___________, PM Experience (Years): ___________

Introduction:

Thank you for agreeing to participate in this interview.

My name is Sameh Shamroukh and I am a PhD search student at the university of Bolton, Manchester, UK, in the area of resources and tools IT project managers need utilising their leadership skill-set to succeed project manager journey (Title of research: Impact of IT project management tools and Leadership self-efficacy on project). To remind you, you were asked to participate in this interview because of your experience and the type of project you managed in the last 10 years.

Before we get started I’d like to review some logistics with you -

- **As a reminder the interview will take about two hours and be audio recorded. The information you provide will be published but in a none attributable form that ensures the anonymity of the people and organizations involved.**

- I also encourage you to ask any questions that you may have at any time during the interview.

- As well, I’d like to ask if you have any questions about the consent document that I might answer.

- The first part of the interview is completion of a short questionnaire. Once you complete it we will be ready to begin.

Administer LSE. Ask if have any questions before beginning the interview and **TURNING ON THE RECORDER**
**Interviewer also will take notes on interview guide**

<table>
<thead>
<tr>
<th>Question</th>
<th>PROBE:</th>
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<tbody>
<tr>
<td><strong>Note:</strong> In all below, emphasize 1) business as usual and 2) what are</td>
<td>This is professional/work context; informal and formal leadership</td>
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<td>best practices.</td>
<td>roles/actions. Interviewer will relate this information to later</td>
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<td>question on 4 gaps.</td>
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<td>1. Talk about your current work, project management activities, and</td>
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<td>business environment.</td>
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<td>*If mentions any of the 4 gap areas then probe AND ask if examples are</td>
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<td>included in the material brought to the interview.</td>
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<td>2a. What training or skills do you feel you need to effectively</td>
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<td>accomplish your job?</td>
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<td>2b. <em>If formal training</em> How did the training experience shape or</td>
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<td>influence your business practices?</td>
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<td>3. Talk about your <strong>communication practices.</strong></td>
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<td>4. Please outline project communication tools PM will find necessary.</td>
<td>Meeting agendas, presentations, business reports and project</td>
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<td>communication plans</td>
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<td>5. Talk about your <strong>requirement gathering</strong> practices.</td>
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<td>6. What are some of the techniques PM find necessary to manage the</td>
<td>Techniques you use to accomplish specific project requirements; do</td>
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<td>project requirements phase?</td>
<td>those requirements meet business needs and best practice for your</td>
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<td>business?</td>
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</table>
7. Talk about how you **manage/mitigate risk** in projects. | How you identify risk techniques used to mitigate risks, and tools for best practices.

8. Describe a project in which you've had to **transition from implementation to support**. Use documents when possible. | What does the project manager need to do get support organization familiar with project documentation, what does support team need to get knowledge transfer from project manager?

9. What changes in project management practice do you feel are needed to facilitate the success of project managers?

**Thank you very much for agreeing to participate in this interview.**
### A4- Project Management Questionnaire 2016

**Interviewee Name:** ______________________________________________

<table>
<thead>
<tr>
<th>To what extent do you agree with each of the following statements about your effectiveness as a Project Manager</th>
<th>Strongly agree</th>
<th>Somewhat agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Strongly disagree</th>
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<tr>
<td><strong>Change orientation</strong></td>
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<td>I am able to set a new direction for a group, if the one currently taken does not seem to be working.</td>
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<td>I can usually change the attitudes and behaviours of group members if they do not meet group objectives.</td>
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<td>I am able to change things in a group even if they are not completely under my control.</td>
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<td><strong>Choose followers and delegate responsibilities</strong></td>
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<td>I am confident in my ability to choose group members in order to build up an effective and efficient team.</td>
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<td>I am able to optimally distribute the work between members of a group to get the best results.</td>
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<td>I would be able to delegate the task of accomplishing specific goals to other group members.</td>
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<td>I am usually able to know to whom, within a group, it is better to delegate specific tasks.</td>
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<td>Communication and management of interpersonal relationships</td>
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<td>Usually, I can establish good relationships with the people with whom I work.</td>
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<td>I am sure I can communicate with others in a direct manner.</td>
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<td>I can successfully manage relationships with all the members of a group.</td>
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<tr>
<th>Self-awareness and self-confidence</th>
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<tr>
<td>I can identify my strengths and weaknesses.</td>
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<td>I am confident in my ability to get things done.</td>
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<td>I always know how to get the best out of the situations I find myself in.</td>
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<td>With my experience and competence, I can help group members to reach the group's targets.</td>
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<td>As a leader, I am usually able to assert my beliefs and values.</td>
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<tr>
<th>Motivate others</th>
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<td>With my example, I am sure I can motivate the members of a group.</td>
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<td>I can usually motivate group members and stimulate their enthusiasm when I start a new project.</td>
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<td>I am able to motivate</td>
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and give opportunities to any group member in the exercise of his/her tasks or functions.

**Consensus building**

I can usually make the people I work with appreciate me.

I am sure I can gain the consensus of group members.

I can usually lead a group with the consensus of all members.

What is your primary leadership style?

**RANK the TOP 3 : 1= Primary, 2= Secondary, and 3= Tertiary**

- **COLLABORATOR:** empathetic, team-building, talent-spotting, coaching oriented
- **ENERGIZER:** charismatic, inspiring, connects emotionally, provides meaning
- **PILOT:** strategic, visionary, adroit at managing complexity, open to input, team oriented
- **PROVIDER:** action oriented, confident in own path or methodology, loyal to colleagues, driven to provide for others
- **HARMONIZER:** reliable, quality-driven, execution-focused, creates positive and stable environments, inspires loyalty
- **FORECASTER:** learning oriented, deeply knowledgeable, visionary, cautious in decision making
- **PRODUCER:** task focused, results oriented, linear thinker, loyal to tradition
- **COMPOSER:** independent, creative, problem solving, decisive, self-reliant

Thank you.
A5- IT Project Management 10 Project Details – 2016

Interviewee Name: ________________

Based on the 10 project reports outcome, in a binary format (0 or 1), please provide if project was successful in specific knowledge area, success dimension SDn, and tools utilised within success dimension

SD1: Communication management, Tool1: Weekly status report, Tool2: Electronic communication

SD2: Requirements gathering, Tool3: Functional decomposition, Tool4: Use case diagram

SD3: Risk Management, Tool5: Risk management check list, Tool6: Risk impact assessment

SD4: Project Transition to support, Tool7: Support transition checklist, Tool8: Knowledge transfer and walk through sessions

Ethical considerations:
Another detail concerning ethics is that the participants were volunteers and their answers to each question in the “Project Management Questionnaire” and “Project Management 10 Project Details” were also voluntary. Although the researcher asked each participant to complete all questions, he reminded them it was voluntary and if any question was uncomfortable to answer for any reason the participants had the option NOT to answer questions at their own discretion

<table>
<thead>
<tr>
<th>Project</th>
<th>SD1</th>
<th>SD2</th>
<th>SD3</th>
<th>SD4</th>
<th>Tool1</th>
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A6- Thank you email

Dear *****:

I appreciated the opportunity I had to interview with you last week at *****. I was very impressed with your perspective of Impact of IT project management tools and Leadership self-efficacy on project success. The graduate program at Bolton University, Manchester, UK, and I thank you for taking time to discuss your perception of Impact of IT project management tools and Leadership self-efficacy on project success with me.

Thank you again for your time meeting me and providing valuable feedback. I look forward to sharing the results of my PhD research with you and the IT project management community

Sincerely,

Sameh Shamroukh
B1- Survey statements and specific percentages analysis

Statement #1: I am able to set a new direction for a group, if the one currently taken does not seem to be working.

- 55.2% Strongly agree
- 10.3% Agree
- 10.3% Somewhat agree
- 10.3% Somewhat disagree
- 6.9% Disagree
- 6.9% Strongly disagree

Overall, a total of 75.9% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 24.1% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), making it clear a majority of project managers consider themselves able to set the direction of their teams.

Statement #2: I can usually change the attitudes and behaviours of group members if they do not meet group objectives.

- 27.6% Strongly agree
- 17.2% Agree
- 31.0% Somewhat agree
- 10.3% Somewhat disagree
- 6.9% Disagree
- 6.9% Strongly disagree

Overall, a total of 75.9% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 24.1% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), making it clear a majority of project managers consider themselves able to change the attitude and behaviours of their teams.

Statement #3: I am able to change things in a group even if they are not completely under my control.

- 37.9% Strongly agree
- 10.4% Agree
- 17.2% Somewhat agree
3.4% Somewhat disagree
10.3% Disagree
20.7% Strongly disagree

Overall, a total of 65.5% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 34.5% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to make changes in their groups.

**Statement #4: I am confident in my ability to choose group members in order to build up an effective and efficient team.**

34.5% Strongly agree
3.4% Agree
41.4% Somewhat agree
3.4% Somewhat disagree
6.9% Disagree
10.3% Strongly disagree

Overall, a total of 79.3% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 20.7% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able the members of their teams.

**Statement #5: I am able to optimally distribute the work between members of a group to get the best results.**

37.9% Strongly agree
24.1% Agree
10.3% Somewhat agree
3.4% Somewhat disagree
10.3% Disagree
13.8% Strongly disagree

Overall, a total of 72.4% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 27.6% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to optimally distribute the work among their teams.
Statement #6: *I would be able to delegate the task of accomplishing specific goals to other group members.*

- 34.5% Strongly agree
- 6.9% Agree
- 24.1% Somewhat agree
- 20.7% Somewhat disagree
- 6.9% Disagree
- 6.9% Strongly disagree

Overall, a total of 65.5% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 34.5% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to delegate the work to their team members.

Statement #7: *I am usually able to know to whom, within a group, it is better to delegate specific tasks.*

- 34.5% Strongly agree
- 13.8% Agree
- 24.1% Somewhat agree
- 6.9% Somewhat disagree
- 10.3% Disagree
- 10.3% Strongly disagree

Overall, a total of 72.4% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 27.6% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to decide to whom work should be delegated.

Statement #8: *Usually, I can establish good relationships with the people with whom I work.*

- 31.0% Strongly agree
- 3.4% Agree
- 37.9% Somewhat agree
- 3.4% Somewhat disagree
- 10.3% Disagree
- 13.8% Strongly disagree
Overall, a total of 72.4% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 27.6% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to establish good relationships with team members.

**Statement #9: I am sure I can communicate with others in a direct manner.**

- 44.8% Strongly agree
- 3.4% Agree
- 21.4% Somewhat agree
- 13.8% Somewhat disagree
- 6.9% Disagree
- 6.9% Strongly disagree

Overall, a total of 72.4% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 27.6% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to directly communicate with team members.

**Statement #10: I can successfully manage relationships with all the members of a group.**

- 37.9% Strongly agree
- 3.4% Agree
- 27.6% Somewhat agree
- 3.4% Somewhat disagree
- 13.8% Disagree
- 13.8% Strongly disagree

Overall, a total of 69.0% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 31.0% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to manage relationships with team members.

**Statement #11: I can identify my strengths and weaknesses.**

- 31.0% Strongly agree
- 17.2% Agree
- 24.1% Somewhat agree
- 6.9% Somewhat disagree
13.8% Disagree
6.9% Strongly disagree

Overall, a total of 72.4% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 27.6% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to identify their strength and weaknesses.

**Statement #12: I am confident in my ability to get things done.**

51.7% Strongly agree
0% Agree
20.7% Somewhat agree
3.4% Somewhat disagree
10.3% Disagree
13.8% Strongly disagree

Overall, a total of 72.4% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 27.6% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to get things done.

**Statement #13: I always know how to get the best out of the situations I find myself in.**

48.3% Strongly agree
6.9% Agree
20.7% Somewhat agree
3.4% Somewhat disagree
10.3% Disagree
10.3% Strongly disagree

Overall, a total of 75.9% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 24.1% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to get the best out of their team members.

**Statement #14: With my experience and competence, I can help group members to reach the group’s targets.**

37.9% Strongly agree
10.3% Agree
27.6% Somewhat agree
0% Somewhat disagree
17.2% Disagree
6.9% Strongly disagree

Overall, a total of 75.9% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 24.1% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to help group members meet the group target.

**Statement #15:** *As a leader, I am usually able to assert my beliefs and values.*

44.8% Strongly agree
6.9% Agree
20.7% Somewhat agree
10.3% Somewhat disagree
10.3% Disagree
6.9% Strongly disagree

Overall, a total of 72.4% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 27.6% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to assert their beliefs and values.

**Statement #16:** *With my example, I am sure I can motivate the members of a group.*

34.5% Strongly agree
6.9% Agree
31.0% Somewhat agree
10.3% Somewhat disagree
17.2% Disagree
0% Strongly disagree

Overall, a total of 72.4% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 27.6% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to motivate team members.
Statement #17: I can usually motivate group members and stimulate their enthusiasm when I start a new project.

- 31.0% Strongly agree
- 6.9% Agree
- 34.5% Somewhat agree
- 13.8% Somewhat disagree
- 6.9% Disagree
- 6.9% Strongly disagree

Overall, a total of 72.4% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 27.6% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to motivate team members and stimulate their enthusiasm.

Statement #18: I am able to motivate and give opportunities to any group member in the exercise of his/her tasks or functions.

- 44.8% Strongly agree
- 24.1% Agree
- 10.3% Somewhat agree
- 0% Somewhat disagree
- 10.3% Disagree
- 10.3% Strongly disagree

Overall, a total of 79.3% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 20.7% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to motivate team members and give them opportunities to exercise of his/her tasks or functions.

Statement #19: I can usually make the people I work with appreciate me.

- 31.0% Strongly agree
- 17.2% Agree
- 37.9% Somewhat agree
- 0% Somewhat disagree
- 3.4% Disagree
- 10.3% Strongly disagree
Overall, a total of 86.2% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 13.8% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to be appreciated by team members.

**Statement #20: I am sure I can gain the consensus of group members.**

- 37.9% Strongly agree
- 17.2% Agree
- 20.7% Somewhat agree
- 10.3% Somewhat disagree
- 6.9% Disagree
- 6.9% Strongly disagree

Overall, a total of 75.9% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 24.1% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to gain consensus of group members.

**Statement #21: I can usually lead a group with the consensus of all members.**

- 58.6% Strongly agree
- 3.4% Agree
- 6.9% Somewhat agree
- 6.9% Somewhat disagree
- 6.9% Disagree
- 17.2% Strongly disagree

Overall, a total of 69.0% fell into the “Agree” category, comprised of “Strongly agree,” “Somewhat agree” and “Agree”) and 31.0% fell into the “Disagree” category (“Somewhat disagree,” “Disagree,” and “Strongly disagree”), marking it clear a majority of project managers consider themselves able to lead a group with the consensus of all members.
10  APPENDIX C

C1- Logistics Regression

1. Correlate LSE and Leadership Style code

1.6.1 Reads in survey data and leadership styles data and calculates average LSE for each leadership style. Creates a couple plots

In [1]: %matplotlib inline
   import matplotlib.pyplot as plt
   import seaborn as sns
   import os
   import pandas as pd
   os.chdir('C:\Users\abc\Documents\PHD\Data')

Read in data

In [2]: survey=pd.read_csv('surveyData.csv')

Sort by column names to be consistent with leadership styles data

In [3]: survey.sort_index(axis=1)

Calculate LSE as mean of survey responses. Put into dataframe with proper index.

In [4]: LSE=survey.mean()
   LSE.index=range(0,29)
   LSE=pd.DataFrame(LSE)
   LSE.columns=['LSE']

In [5]: LSE.head()

Out[5]:

<table>
<thead>
<tr>
<th>LSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.333333</td>
</tr>
<tr>
<td>3.428571</td>
</tr>
<tr>
<td>2.952381</td>
</tr>
<tr>
<td>3.333333</td>
</tr>
<tr>
<td>5.714286</td>
</tr>
</tbody>
</table>

Read in leadership styles.
In [6]: os.chdir('C:\Users\abc\Documents\PHD\Data')
leader_pd.read_csv('leadershipStyles.csv')
leader.head()

Out[6]:
<table>
<thead>
<tr>
<th>collaborator</th>
<th>energizer</th>
<th>pilot</th>
<th>provider</th>
<th>harmonizer</th>
<th>forecaster</th>
<th>producer</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.0</td>
<td>2.0</td>
<td>NaN</td>
<td>NaN</td>
<td>NaN</td>
<td>NaN</td>
</tr>
<tr>
<td>1</td>
<td>NaN</td>
<td>1.0</td>
<td>NaN</td>
<td>2.0</td>
<td>NaN</td>
<td>3.0</td>
</tr>
<tr>
<td>2</td>
<td>NaN</td>
<td>NaN</td>
<td>NaN</td>
<td>2.0</td>
<td>1.0</td>
<td>3.0</td>
</tr>
<tr>
<td>3</td>
<td>NaN</td>
<td>1.0</td>
<td>NaN</td>
<td>2.0</td>
<td>NaN</td>
<td>NaN</td>
</tr>
<tr>
<td>4</td>
<td>NaN</td>
<td>NaN</td>
<td>1.0</td>
<td>NaN</td>
<td>2.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Composer

In [7]: reshaped=leader.unstack().reset_index()
reshape.columns=['style','index','rank']
leader["primaryStyle"] = reshaped[reshaped['rank']==1].set_index('index').sort_index
leader["secondaryStyle"] = reshaped[reshaped['rank']==2].set_index('index').sort_index
leader["ternaryStyle"] = reshaped[reshaped['rank']==3].set_index('index').sort_index
leader.head()

Out[8]:
<table>
<thead>
<tr>
<th>collaborator</th>
<th>energizer</th>
<th>pilot</th>
<th>provider</th>
<th>harmonizer</th>
<th>forecaster</th>
<th>producer</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.0</td>
<td>2.0</td>
<td>NaN</td>
<td>NaN</td>
<td>NaN</td>
<td>NaN</td>
</tr>
<tr>
<td>1</td>
<td>NaN</td>
<td>1.0</td>
<td>NaN</td>
<td>2.0</td>
<td>NaN</td>
<td>3.0</td>
</tr>
<tr>
<td>2</td>
<td>NaN</td>
<td>NaN</td>
<td>NaN</td>
<td>2.0</td>
<td>1.0</td>
<td>3.0</td>
</tr>
<tr>
<td>3</td>
<td>NaN</td>
<td>1.0</td>
<td>NaN</td>
<td>2.0</td>
<td>NaN</td>
<td>NaN</td>
</tr>
<tr>
<td>4</td>
<td>NaN</td>
<td>NaN</td>
<td>1.0</td>
<td>NaN</td>
<td>2.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Composer primaryStyle secondaryStyle ternaryStyle

In [9]: leader2=leader.join(LSE)
leader2.head()

Out[9]:
<table>
<thead>
<tr>
<th>collaborator</th>
<th>energizer</th>
<th>pilot</th>
<th>provider</th>
<th>harmonizer</th>
<th>forecaster</th>
<th>producer</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.0</td>
<td>2.0</td>
<td>NaN</td>
<td>NaN</td>
<td>NaN</td>
<td>NaN</td>
</tr>
</tbody>
</table>
Figure 12-1 – Correlate LSE and Leadership Style
2 Log Odds code

1.0.1 Create plots to demonstrate the relationship between log odds and probability

In [7]:
   import matplotlib.pyplot as plt
   import seaborn as sns
   %matplotlib inline
   import numpy as np

   Generate data
   
   In [8]:
   p=np.linspace(0.001,.999,100)
   odds=p/(1-p)
   logodds=np.log(odds)

   Logit Transformation
   
   In [9]:
   sns.set_style('ticks')
   plt.figure(figsize=(8, 6), dpi=80)
   plt.plot(p,logodds)
   plt.xlabel('Probability')
   plt.ylabel('Log Odds')

   Out[9]: <matplotlib.text.Text at 0xbdc00f0>

   Logistic Transformation
   
   In [10]:
   plt.figure(figsize=(8, 6), dpi=80)
   plt.plot(logodds,p)
   plt.xlabel('Log Odds')
   plt.ylabel('Probability')

   Out[10]: <matplotlib.text.Text at 0xbdd5400>
Figure 12-2 – Log Odds Code
C3- Logistics Regression Estimation

3 Logistic Regression Estimation code

Logistic Regression Estimation

Estimate 4 logistic models. Output the model coefficients, standard errors, P values, confidence interval bands, and impact for each of the variables.

Read in data

```r
rm(list=ls())
cwd("C:\\Users\\abc\\Documents\\IEEE\\Data")
df=read.csv('modelData.csv')
```

Estimate 4 logistic models

```r
model1 <- glm(data=df,SE1 ~Tool1+Tool2+LSE, family=binary(link='logit'))
model2 <- glm(data=df,SE2 ~Tool3+Tool4+LSE, family=binary(link='logit'))
model3 <- glm(data=df,SE3 ~Tool5+Tool6+LSE, family=binary(link='logit'))
model4 <- glm(data=df,SE4 ~Tool7+Tool8+LSE, family=binary(link='logit'))
```

Create dataframe of results, add some variables

```r
results=data.frame(rbind(
  summary(model1)$coefficients,
  summary(model2)$coefficients,
  summary(model3)$coefficients,
  summary(model4)$coefficients
))
CI=data.frame(rbind(
  confint.default(model1,level = .9),
  confint.default(model2,level = .9),
  confint.default(model3,level = .9),
  confint.default(model4,level = .9)
))
results$ExpCoeff=exp(results$Estimate)
results$Impact=results$ExpCoeff-1
```

Clean up and rename results

```r
results=cbind(results,CI)
resultsModel1[1:4]="Communication"
resultsModel1[5:8]="Requirements Gathering"
resultsModel1[9:12]="Risk Management"
resultsModel1[13:16]="Transition Support"
names(results)=c("Coefficient","Std Error","Z Value","F Value","ExpCoeff","Impact","CI 5%","CI 95%","Model")
results$Var=c("Tool1","Tool2","LSE","",
  "Tool3","Tool4","LSE","",
  "Tool5","Tool6","LSE","",
  "Tool7","Tool8","LSE")
results=results[,c(1,9:19)]
results$Tool=c("', 'Weekly Status Report', 'Electronic Communication',
  'LSE', '', 'Functional Decomposition', 'Use Case Diagram', 'LSE',
  ''
  'Risk Management Checklist', 'Risk Impact Assessment',
  'LSE', '', 'Support Transition Checklist',
  'Knowledge Transfer Sessions', 'LSE')
```

Export results

```r
write.csv(results,'results211.csv')
```

Figure 12-3 – Logistic Regression Code
C4- Logistics Regression Results

4. Logistic Regression Results code

1 Logistic Regression Results

1.6.1 Generate confusion matrices and model accuracy statistics for each of the 4 models

```python
In [1]: import os
   ...: import pandas as pd
   ...: from sklearn.linear_model import LogisticRegression
   ...: from sklearn.metrics import confusion_matrix
   ...: os.chdir('C:\Users\abc\Documents\PHD\Data')
   ...: df = pd.read_csv('modelData.csv')

Split data into X and Y variables

In [2]: X = df.drop('SD1 SD2 SD3 SD4'.split(), axis=1)
   ...: X.head()

Out[2]:
   LSE  Tool1  Tool2  Tool3  Tool4  Tool5  Tool6  Tool7  Tool8
0   0   0      1      1      0      1      1      1      0
1   1   0      0      0      1      1      1      1      0
2   2   0      1      0      0      0      0      1      0
3   0   1      0      0      0      1      0      0      0
4   0   0      1      0      1      0      0      0      0

In [3]: Y = df['SD1 SD2 SD3 SD4'.split()]
   ...: Y.head()

Out[3]:
   SD1  SD2  SD3  SD4
0   1     0     1     0
1   0     0     1     0
2   1     0     1     0
3   1     1     0     0
4   0     1     1     0

Create separate datasets for each of the 4 models

In [4]: X1 = X[['Tool1 Tool2 LSE'.split()]]
   ...: X2 = X[['Tool3 Tool4 LSE'.split()]]
   ...: X3 = X[['Tool5 Tool6 LSE'.split()]]
```
Figure 12-4 – Logistic Regression Results Code
## 5. LSE Estimation by name code

### 1. Names of LSE Interviewees

Read in survey data which contains LSE for each interviewee. Use it to assign LSE True/False for each interviewee.

```python
In [24]: import pandas as pd
import numpy as np
import os
os.chdir('C:\Users\abc\Documents\PHEData')
df = pd.read_csv('surveyData.csv')

Calculate average of survey responses for each interviewee - This is LSE for each interviewee. If greater than 3.5, the interviewee has LSE. If less, they don't.

In [26]: LSE = df.mean()>3.5
In [26]: LSE = pd.DataFrame(LSE)
In [27]: LSE["Name"] = LSE.index
LSE.columns = ['Value', 'Name']
In [28]: LSE
```

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael</td>
<td>False</td>
</tr>
<tr>
<td>Bistrico</td>
<td>False</td>
</tr>
<tr>
<td>JogoN</td>
<td>False</td>
</tr>
<tr>
<td>DeonJ</td>
<td>False</td>
</tr>
<tr>
<td>Marius</td>
<td>False</td>
</tr>
<tr>
<td>KathyM</td>
<td>False</td>
</tr>
<tr>
<td>Victor</td>
<td>False</td>
</tr>
<tr>
<td>JuanJ</td>
<td>False</td>
</tr>
<tr>
<td>JohnBell</td>
<td>False</td>
</tr>
<tr>
<td>Alannda</td>
<td>False</td>
</tr>
<tr>
<td>BrianC</td>
<td>False</td>
</tr>
<tr>
<td>Ben</td>
<td>False</td>
</tr>
<tr>
<td>Omar</td>
<td>False</td>
</tr>
<tr>
<td>Laura</td>
<td>True</td>
</tr>
</tbody>
</table>

```
```

```python
In [29]: os.chdir('C:\Users\abc\Documents\PHED\Python Output')
In [30]: LSE.to_csv('LSE.csv', index=False)
```

---

**Figure 12-5 – LSE Estimation by Name Code**
11 APPENDIX D

NLP (Natural Language Processing)

D1- Word2Vec estimation

1. word2vec estimation code

1 Word2Vec Estimation

Read in the interview data word documents for all interviewees. Preprocess this data to create clean lists of words, one for LSE interviewees and one for no-LSE interviewees. Calculate word2vec models separately for LSE and no LSE.

Setup

```python
In [11]: import docx
import os
import pandas as pd
import numpy as np
np.random.seed(1234)
import re
from wordcloud import WordCloud
from gensim.models import Word2Vec
import matplotlib.pyplot as plt
import seaborn as sns
from nltk.corpus import stopwords
stopwords = stopwords.words('english')
os.chdir('C:\Users\abc\Documents\PHD\Data\Interviews')
```

2 Read in and preprocess interview data

```python
In [12]: fullList=pd.DataFrame(pd.Series(range(0,50)).rename('index'))
fullList

1 = 0
for filename in os.listdir(os.getcwd()):
    #Read in data
    #Read word doc into list of paragraphs
    doc = docx.Document(filename)
    #Convert to Pandas Series to use apply
    df=pd.Series(doc.paragraphs)
    #Grab text object off of all paragraphs
    df=df.apply(lambda x: x.text)
```
### Pre-processing

- Drop all rows with my data.
- `dropRows=df.apply(lambda x: x.startswith('Sample'))`
- `df=df[~dropRows]`
- # Drop title
- `df=df.iloc[1:]`
- # Remove special characters using regex
- `df=df.apply(lambda x: re.sub('[\#\@\$\:\\]', '', x))`
- # Convert to lowercase. Split sentences into lists of words
- `df=df.apply(lambda x: x.lower().split())`
- # Remove stopwords
- `df=df.apply(lambda x: [word for word in x if word not in stopwords])`
- `df=pd.DataFrame(df.rename(1))`

```python
fullList=fullList.join(df)
```

Replace missing values with empty strings. Drop index column

In [13]: `fullList=fullList.fillna('')`
   `fullList=fullList.drop(['index'],axis=1)`

Change column names to interviewee names

In [14]: `os.chdir('C:\Users\abo\Documents\PHD\Data\Interviews')`
   `names=os.listdir(os.getcwd())`
   `for file in range(len(names)):
     names[file]=names[file].split('.')[0]`
   `fullList.columns=names`
   `fullList.head()`

Out[14]:

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>AALinda</td>
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<tr>
<td>0</td>
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<tr>
<td>1</td>
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<td>2</td>
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<td>3</td>
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<td>4</td>
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<p>| |</p>
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<th></th>
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<tbody>
<tr>
<td>Ben</td>
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<td></td>
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<tr>
<td>0</td>
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<tr>
<td>1</td>
</tr>
<tr>
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<tr>
<td>3</td>
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<td>4</td>
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</tbody>
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<p>| |</p>
<table>
<thead>
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<th></th>
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<tbody>
<tr>
<td>Biatrice</td>
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<tr>
<td>0</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

2
[biatric, years, felt, leadership, core, skill...]

BrianC \n
[]

[brian, program, management, director, biggest...]

ChuckC \n
[]

[chuck, vp, solutions, currently, working, sm...]

Dana \n
[dana, head, project, management, office, fort...]

DavidH \n
[david, project, manager, [title, director, pr...]

DeonJ \n
[deon, head, pmo, one, largest, software, prov...]

DoaaT \n
[doaa, head, project, management, high, tech, ...]

ElizabethL \n
[doaa, project, managers, need, training, skill...]

3
elizabeth, currently, sr, director, program, ...
elizabeth, myself, need, frame, work, provide...

Laura

laura, currently, hold, title, director, proj...
laura, project, managers, need, able, provide...

LouayK

louay, working, one, world, leaders, air, con...
[louay, project, managers, need, training]

Marius

marius, currently, program, management, director...
marius, project, managers, need, training, pr...

Marshall

michaelR

michelle, serve, vp, solutions, program, mana...
michelle, really, looking, training, programs...

Nancy
Read in LSE T/F data and check that when sorted by name, names are exactly equal to column names in fullList. Done as a check to make sure that preprocessing was done correctly.

```
In [15]: os.chdir('C:\Users\abc\Documents\PhD\Python Output')
LSE=pd.read_csv('LSE.csv')
LSE=LSE.sort_values('Name')
LSE=LSE.reset_index()
LSE=LSE.drop(['index'],axis=1)
sum(LSE['Name'])==fullList.columns

Out[15]: 0
```
3 Split data into LSE and no LSE

Calculate the index of the LSE data where PMs have LSE and don’t have LSE. Since the LSE and fullList dataframes are sorted the same way, these row indexes correspond to the columns in the fullList dataframe.

In [16]: YesIndex=LSE.index[LSE["Value"]=='True']
NoIndex=LSE.index[LSE["Value"]=='False']

In [17]: YesIndex

Out[17]: Int64Index([4, 5, 6, 8, 9, 10, 11, 12, 13, 18, 19, 20, 22, 24, 25, 27], dtype='int64')

Segment the fullList into PMs who have LSE and those who don’t based on column number aligning with indexes. Then flatten the lists.

In [18]: LSEList = [fullList.iloc[:,1] for i in np.array(YesIndex)]
NoLSEList = [fullList.iloc[:,1] for i in np.array(NoIndex)]

LSEList = [item for sublist in LSEList for item in sublist]
NoLSEList = [item for sublist in NoLSEList for item in sublist]

Export list of words data

In [19]: #os.chdir('C:\Users\abc\Documents\P4U\Python Output')
   #pd.Series(LSEList).to_csv("LSEList.csv",index=False)
   #pd.Series(NoLSEList).to_csv("NoLSEList.csv",index=False)

4 Calculate word2vec separately for LSE and nonLSE

Estimate word2vec models

In [20]: LSEmodel=Word2Vec(LSEList,min_count=1, size=60, workers=1)
NoLSEmodel=Word2Vec(NoLSEList,min_count=1, size=60, workers=1)

Export model estimations

In [21]: #os.chdir('C:\Users\abc\Documents\P4U\Python Output')
   #LSEmodel.save("LSEmodel")
   #noLSEmodel.save("noLSEmodel")

Figure 13-1 – word2vec Estimation Code
D2 - Similarity calculation

2. Similarity calculation code

1. Similarity Calculation Explanation

1.0.1 Create several plots to compare similarity metrics

In [1]: import matplotlib.pyplot as plt
    %matplotlib inline
    import numpy as np

In [2]: plt.figure(figsize=(8, 6), dpi=80)
    plotx=np.linspace(1,500)
    ploty=100/(plotx)
    plt.plot(plotx,ploty)
    plt.xlabel('Word Ranking Amongst Most Common Words')
    plt.ylabel('Association Level (Inverse Rank)')

Out[2]: <matplotlib.text.Text at 0x8142fd0>

In [3]: plt.figure(figsize=(8, 6), dpi=80)
    plotx=np.linspace(1,500)
    ploty=100/(1+np.log10(plotx))
    plt.plot(plotx,ploty)
    plt.xlabel('Word Ranking Amongst Most Common Words')
    plt.ylabel('Association Level (Inverse Log Rank)')

Out[3]: <matplotlib.text.Text at 0x8142bd0>
Figure 12-2 – Similarity Calculation Code
D3 - Association Graphs

4. Association Graphs code

1 Association Graphs

Reads in word2Vec estimations and calculates the similarity between words for both the LSE and no LSE models. Create plots to compare the similarity between LSE and no LSE.

In [69]:
import os
import pandas as pd
import numpy as np
from gensim.models import Word2Vec
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns

Load estimated word2vec models

In [70]: os.chdir('C:\Users\abc\Documents\MSc\Python Output')
LSEmodel = Word2Vec.load("LSEmodel")
nolSEmodel = Word2Vec.load("nolSEmodel")

2 Compare association with various words between LSE and nonLSE

In [71]:
def similarity(term):
   # Calculate similarity between term and list of words
   LSE2=[]
nolSE2=[]
   for word in words:
      LSE2.append(LSEmodel.similarity(term,word))
nolSE2.append(nolSEmodel.similarity(term,word))

# Format data
LSE2=pd.DataFrame([words,LSE2]).T
LSE2.columns=['word association'.split()]
LSE2["LSE"]='LSE'
nolSE2=pd.DataFrame([words,nolSE2]).T
nolSE2.columns=['word association'.split()]
nolSE2["LSE"]='No LSE'
plotData=pd.concat([LSE2,nolSE2])

# Plot results
plt.figure(figsize=(8,6), dpi=80)
sns.factorplot(x='word', y='association', size=6, kind="bar", hue="LSE", data=plot,
pdat.xticks(rotation=45)
plt.xlabel('Words Associated With ' + term, title())
plt.ylabel('Association Level')

Figure 13-4 – Association Graphs Code
### E1 Triangulation

<table>
<thead>
<tr>
<th>Communication Management</th>
<th>Quantitative Analysis (Chapter 6)</th>
<th>Quantitative analysis of Qualitative Data (Chapter 7)</th>
<th>Interviewees comments (Chapter 5)</th>
<th>Author comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage Increase</td>
<td>Description</td>
<td>Association/Percentage Increase Description</td>
<td>Interviewees comments</td>
<td>Author comments</td>
</tr>
<tr>
<td>It was clear that project managers with LSE have more success in the communication dimension than project managers without LSE. Project managers with LSE communicate more effectively with both verbal and written communication.</td>
<td>Numerous interviewees indicated communication as the most important skill set along with setting communication plans in the project. Participants indicted that communication was 90% of a project manager’s activities.</td>
<td>From the author’s perspective and experience, communication is a key aspect of IT project management in all directions, internal with project team, external with clients, vertical with project</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LSE</strong></td>
<td>Increases the odds of success by 53.6% in the communication management dimension. Possessing Leadership Self-Efficacy increases the odds of project success in the communication management dimension by 53.6%, holding all else constant. This effect is statistically significant.</td>
<td>LSE: 0.63-0.94 word association. No LSE: 0.18-0.31 word association.</td>
<td>Effective project managers (possessing LSE) have a 0.63-0.94 association between the words &quot;good&quot; and &quot;communication.&quot;, &quot;communicate&quot; and &quot;feedback&quot;. Less effective project managers (Not possessing LSE) have a 0.18-0.31 association between the words &quot;Good&quot; and &quot;Communication.&quot;. A lot of interviewees specifically mentioned leadership skills as high priority skills in project management and as a core skill.</td>
<td>The author’s experience showed that IT project managers with LSE are better in communication and in documenting their project communication plan than project managers without the LSE trait.</td>
</tr>
<tr>
<td><strong>Tools</strong></td>
<td>Quantitatively utilising communication management tools increases the odds of success in the communication management dimension. Also, Tools pointed out by interviewees include</td>
<td>The author has always stressed, through his</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
quantitative analysis of the interview transcripts showed that IT project managers possessing LSE and not possessing LSE have a similar understanding of communication as a tool. Both project managers possessing and not possessing LSE clearly understand the importance of project communication tools.

Person and virtual meetings, use of portals and chat rooms, web forums and secure forums, social media, email, whiteboards, escalation communication venue, and calls. Some participants indicated a set of communication practices that they found useful; these sets included various combinations of the aforementioned communication tools.

<p>| Weekly status report | Using a weekly status report increases the odds of project success | Project managers possessing LSE have 0.46 word association between word “written” and word | Project Managers with LSE appear to prefer written communication more so than project managers | Interviewees mentioned different frequencies of communication with the project team, including inter-day, daily, weekly, bi-weekly and monthly, with | career as a project manager, the importance of the utilisation of communication management tools in IT project management. In order to have successful project communication, a set of communication management tools need to be utilised. From the author’s experience, IT project managers with the LSE trait are more into written communication, like emails, to document all project communication for future reference. |</p>
<table>
<thead>
<tr>
<th><strong>Electronic Communication</strong></th>
<th><strong>Electronic Communication increases odds of success by 59.9%.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Using Electronic Communication increases the odds of project success in the communication management</strong></td>
<td>Analysis found 0.58-0.91 word association of IT project managers possessing LSE with written communication such as emails. The results were 0.15 - .17 for IT project managers</td>
</tr>
<tr>
<td><strong>Project Managers with LSE appear to prefer written communication more so than project managers without LSE.</strong></td>
<td>Project managers without LSE do not prefer written communication</td>
</tr>
<tr>
<td><strong>Communication Management tools mentioned by interviewees include: in person and virtual meetings, use of portals and chat rooms, web forums and secure forums, social media, email, whiteboards, escalation communication venue, and calls.</strong></td>
<td>Electronic communication is a key tool in project management to instantaneously interact with the project team and communicate project issues. From the author’s experience, a majority of project communication, especially for IT project managers possessing the</td>
</tr>
<tr>
<td>Requirements Gathering</td>
<td>Quantitatively PMs with LSE are able to increase the odds of project success in requirements gathering dimension by 55%. However, qualitatively through quantitative analysis of the interview transcripts, it seems both have the same understanding of the importance of requirement gathering for project success. Based on the results of this study, requirements gathering are not a dimension largely impacted by self-efficacy.</td>
</tr>
<tr>
<td>------------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>LSE</td>
<td>The LSE trait increases odds Possessing Leadership There is less than a 0.2 difference in Project managers with and without The information from interviewees clearly shows The author’s experience proved that project</td>
</tr>
<tr>
<td></td>
<td>dimension by 59.9%, holding all else constant. This effect is statistically significant. Not possessing LSE with written communication such as emails. and their association is in the negative, disassociated. are mixed type of tools between oral and written communication tools. LSE trait, takes place through electronic communication to document project issues; very little verbal communication takes place.</td>
</tr>
<tr>
<td>of success in requirement gathering dimension by 55.0%.</td>
<td>Self-Efficacy increases the odds of project success in requirements by 55.0%, holding all else constant. This effect is statistically significant.</td>
</tr>
</tbody>
</table>
**Tools**

Quantitatively: requirements gathering tools increase the odds of success in requirement gathering dimension. However, qualitatively, by quantitatively analysing the interview scripts, it seems both those with and without LSE have the same understanding of the importance of requirement gathering tools on project success.

Interviewees pointed out the need for industry knowledge in requirements gathering. One tool mentioned is a set of questions to determine if requirements were gathered correctly and accurately.

From the author’s experience, Tools are very critical in requirements gathering to help make sure requirements are not missing. Ability to reduce project requirements issues helps align the project to the initial project plan. PMs with LSE
Some participants outlined a series of meetings with the client and team members; these often included a discovery session using discovery questions, getting approval of clients and reviewing the gathered requirements more than once. Another series of steps mentioned included inviting experts from the client side, a workshop to document pain points in the current processes, capturing requirements to solve pain points, reviewing and getting approval. Another variation was creating a requirements-gathering check list, validating the requirements listed with the client and having the client always insist on the importance of clear and detailed requirements gathering to align project deliverables.
## Functional Decomposition

<table>
<thead>
<tr>
<th>Functional decomposition</th>
<th>Increases odds of success in requirements gathering by 38.0%.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using functional decomposition</td>
<td>Increases the odds of project success in requirements gathering by 38.0%, holding all else constant. However, this effect is not statistically significant.</td>
</tr>
<tr>
<td>There is less than a 0.2 difference in association between “Discussion” word and “Requirements gathering.” Words.</td>
<td>There is less than a 0.12 difference in association between “Documentation” word and “Requirements gathering.” Phrase.</td>
</tr>
<tr>
<td>Project managers with and without LSE seem to understand the importance of requirements gathering.</td>
<td>Project managers showed that project implementation team should include thorough discussion and documentation with the client. There is less than a 0.2 difference in association between “Discussion”</td>
</tr>
<tr>
<td>Functional decomposition helps simplify requirements by breaking them into small pieces to be more manageable from all aspects, implementation, quality assurance and support. IT project managers with LSE proved their ability to enforce the usage of functional decomposition tools in the requirements gathering phase.</td>
<td></td>
</tr>
</tbody>
</table>

Interviewees stressed that having multiple meetings with the client is a form of the functional decomposition and supports ensuring clear and quality requirements gathering.
| Use case diagram | Use case diagram | Using a use case | There is less than a 0.2 difference, in Project managers with and without Interviewees explicitly mention use case diagrams | The author believes that use case diagram puts the... |

Word and "Requirements gathering." Words. There is less than a 0.12 difference in association between "Documentation" word and "Requirements gathering." Phrase. In other words, the goals and objectives of requirements gathering are clear and consistent across project managers regardless of their LSE level.
increases odds of success in the requirements gathering dimension by 89.5%.

Diagram increases the odds of project success in the requirements gathering dimension by 89.5%, holding all else constant. This effect is statistically significant.

Association between the word “discussion” and the words “requirements” and “gathering.” There is less than a 0.12 difference in association between “documentation” and “requirements” and “gathering.”

LSE seem to understand the importance of requirements gathering. Project managers showed that the project implementation team should include thorough discussion and documentation with the client. There is less than a 0.2 difference, in association between the word “discussion” and the words “requirements” and “gathering.” There is less than a 0.12 difference

As a tool for requirements gathering. However, they mention the discovery document as a tool for requirements gathering, which is close to the use case diagram tool.

Requirement phase into practice and allows the project team to design the final solution based on real operational use cases. IT project managers with LSE are known for replicating operational use cases to get clear and quality requirements gathering through use case diagram tools. PMs with LSE tend to utilise use case diagrams more often.
in association between "documentation" and "requirements" and "gathering." In other words, the goals and objectives of requirements gathering are clear and consistent across project managers regardless of their LSE level.

| Risk Management | Quantitatively and qualitatively, it is clear project managers possessing LSE have more success with risk management than project managers not possessing LSE. | Interviewees mentioned that a framework is needed for risk identification and mitigation planning. Risk management is difficult to teach, and it could be beneficial if experienced project managers could | This author’s experience assures that project risk management helps detect and mitigate unplanned risk. IT project managers, regardless of their LSE level, need to be ready |
| LSE               | LSE increases odds of success by 63.0% in the risk management dimension. | Possessing Leadership Self-Efficacy increases the odds of project success in risk management by 63.0%, holding all else constant. This effect is statistically significant. | Between 0.2 – 0.27 word association difference between IT Project managers possessing LSE and not possessing LSE between words “risk” and “management” and “mitigation” | Project managers with LSE have a 0.79 word association between “Risk management” words and “Mitigation,” word while Project managers without LSE have closer to a 0.59 word association between “Risk management” and “Mitigation.” | Interviewees did not focus on leadership in their comments about risk management. However, they all expressed a high degree of awareness of the importance of risk management tools in managing IT projects. | From this author’s experience, LSE helps IT project managers mitigate unplanned risk by their ability to manage customers and manage their expectations. Possessing LSE helps and supports IT project managers handle such problems skilfully during difficult times. |
### Tools

Quantitatively: utilising risk management tools increases the odds of success in the risk management dimension. Qualitatively, using quantitative analysis, it seems both those possessing and not possessing LSE have the same understanding of the importance of risk management identification tools for project success. However, it appears project managers differ in their understanding of risk mitigation. Project managers possessing LSE have a 0.8 word association between the words “risk” and “management” and the word “mitigation” while project managers not possessing LSE have closer to a 0.6 word association between the two word pairs.

In the interview transcript, regardless of the LSE level, project managers indicated that the use of checklists for each phase of a project. Using risk identification questionnaires in general and by phase, and outlining cost risk factors were indicated by all project managers. Also, participants indicated that predefined risk management and mitigation tools could be helpful. Participants also made comments regarding having risk qualification discussions with the project team.

The author believes that risk management tools for IT project managers, regardless of their level of LSE, are important. It always helps IT project managers to have predefined tools to detect and mitigate risk.

### Risk management check list

Using a risk management check list increases odds

It was observed that there is between 0.53 to 0.55 difference in

In the interview transcripts, regardless of the LSE group, project managers indicate that the use of

The author cannot disagree, use of risk management checklists is very important to detect
of success by 67.6% in the risk management dimension. The odds of project success in risk management by 67.6%, holding all else constant. This effect is statistically significant. The word association between words “Checklist”, “Risk” and “Management”. This shows the impact of LSE on the utilisation of tool like checklist in risk management dimension. The word association between words “Checklist”, “Risk” and “Management”. This shows the impact of LSE on the utilisation of tool like checklist in risk management dimension. Checklists for each phase of a project, risk identification questionnaires in general and by phase, and outlining cost risk factors were indicated by all project managers. Also, participants indicated that predefined risk management and mitigation tools could be helpful. Participants also make comments regarding having risk qualification discussions with the project team.

| Risk impact assessment | Using a risk impact assessment increases odds of success by 65.6% in the risk | A close association of “risk” and “management” with the word “identify” is observed, regardless of LSE | A close association of “risk” and “management” with the word “identify” is observed, regardless of LSE | Interviewees also make comments that it is important to have risk qualification discussions with the project team to assess the risk impact, this falls within the risk assessment category. | The author believes that risk impact assessment is very helpful to measure the impact of IT project risk and increases the ability of the project manager and project team to carry on with the project. |

From his experience, IT project managers with LSE lean more towards using risk management checklist tools to detect risk in its early stages.
| management dimension. | management group. However, there is between 0.2 – 0.27 difference between words “Mitigate”, “Risk”, and “Management”. This shows the impact of LSE trait on risk planning and mitigation. | group. However, there is between 0.2 – 0.27 difference between words “Mitigate”, “Risk”, and “Management”. This shows the impact of LSE trait on risk planning and mitigation. | considering a risk with its measured impact or take corrective actions to correct this risk. Usually IT project managers with LSE have more experience in using risk impact assessment tool than IT project managers without LSE. LSE level increases the effectiveness of IT project management tools utilisation in risk management dimension. |

<p>| Project Support Transition | Quantitatively and qualitatively, using quantitative analysis of the interview transcript, it is clear project managers possessing LSE have more success and effectiveness in “project support transition” than project managers not possessing LSE. | Project support transition, requires planning early on in the project work. The interviewees talked about various types of approaches, tools and interventions that assist in this dimension of project management. | From the author’s perspective, project support transition helps smooth project closure and migration to production operations. IT project managers with LSE know how to plan for this phase early in the project, |
| LSE | LSE increases the odds of success by 53.0% in the project support transition dimension. | Possessing Leadership Self-Efficacy increases the odds of project success in project support transition by 53.0%, holding all else constant. This effect is statistically significant. | There is 0.33 - 0.34 word association difference for project managers possessing LSE and not possessing LSE between the words “transition” and “support” and the word “timeline.” | Project managers possessing LSE seem to understand the importance of time management for project support transition, with an association of close to 0.9 between the words “transition” and “support” and the word “timeline.” Project managers not possessing LSE, on the other hand, have an association close to 0.58 between | Interviewees did not touch on leadership for the project support transition dimension. | The author believes IT project managers possessing LSE understand the importance of project support transition and know how to plan for this phase to make smooth project completion and closure. |</p>
<table>
<thead>
<tr>
<th>Tools</th>
<th>Quantitatively: utilising project support transition tools increase the odds of success in the project support transition dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Interviewees stated that using a support transition checklist for details, transition to support questionnaire, documentation and implementation of plans, implementation diagrams, preparation of a training plan for the client support team, publishing documentation and including project support transition items in weekly status meetings are the tools and techniques used by these participants to manage project support transition. Listing all documents, training and troubleshooting techniques are part of the process.</td>
</tr>
<tr>
<td></td>
<td>The author believes that tools in project transition to support helps document requirements of transition implementation to the support team. Ability of IT project manager to utilise project support transition helps smooth this phase and capture all knowledge to complete successful transition. The transition to support requirements need to be part of the project requirements. IT project managers with LSE will always use project transition to support tools, more than IT project managers without LSE, to smooth out the project</td>
</tr>
<tr>
<td>Support transition checklist</td>
<td>Support transition checklist increases the odds of success by 55.6% in the project support transition dimension.</td>
</tr>
<tr>
<td>Knowledge transfer and walk through sessions</td>
<td>Knowledge transfer and walk through sessions increase the odds of success by 63.4% in the project support transition dimension.</td>
</tr>
<tr>
<td>This effect is statistically significant.</td>
<td>available for transition. Project managers not possessing LSE, on the other hand, have an association close to 0.16. This shows the impact of LSE train of the IT project manager on project management tools such as knowledge transfer and walk through sessions in the project transition to support dimension.</td>
</tr>
</tbody>
</table>
F1. The impact of project communication in project success

Organisation/Location: PMI local chapter, Dallas, TX
Date: Wednesday June 8, 2011.
Title of workshop: The impact if project communication in project success.
Organized by David B. (Director of program management at major food distributor) and Mary S. (project management principle at major automotive supplier).

Workshop agenda:
- Impact of project communication on project requirements gathering.
- Importance of project communication documentation.
- Importance of real-time communication with the project team.

Workshop synopsis:
Impact of project communication on project requirements gathering.
90% of a project manager’s job is spent on communication so it’s important to make sure everybody gets the right message at the right time. Communication impacts requirements gathering. If requirements were not clearly communicated to the internal and external team, it can cause confusion during the implementation of IT projects. It is the IT project manager’s job to make sure project requirements were clearly documented and communicated to the project team. Not only that, it is the responsibility of the project manager to hold project requirements discussion and make sure the final version of the requirements was clearly discussed among the project team and communicated to all project team members.

Importance of project communication documentation and importance of real-time communication with the project team.
It is very important and critical for the IT project manager to document all communication with the project team and keep project communication in an accessible location for project team to access for future reference. In case of any issue or project dispute that might happen in the project, project team and project manager can refer to the documented project communication for clarifications. Real-time communication keeps the project team always informed of the project status. On-line communication tools are, such as online project portals, project blogs and electronic mail communication are good candidate tools to be used for
real-time communication. Such tools will allow project team to subscribe for real time updates.

**F2. Importance of project management training and how it should be conducted**

Organisation/Location: PMI Global Congress conference, Philadelphia, PA, USA.
Day and Date: Saturday October 20, 2012.
Title of workshop: The importance of project management training and how it should be conducted.
Organised by Danial P., VP of Project Management Office at major hardware manufacturer.
Danial’s idea here was to have the IT project management training conducted by an experienced IT project manager with at least 10 years of experience in IT project management. The reason for such profile of project managers would have experienced all types of project management tools and would provide real life experience. Danial’s idea included that experienced IT project managers should get involved and give back to the project management community.

**F3. How the personality traits of project manager would control and drive more success to the project.**

Organisation/Location: PMI Global Congress conference, Philadelphia, PA USA.
Day and Date: Saturday October 20, 2012.
Title of workshop: How the personality traits of project manager would control and drive more success to the project.
Organised by Andy S., Director of program management at major food distributor.
Andy’s opinion was to have IT project managers with track records of project success conduct project leadership training. He mentioned that such training cannot be conducted without individuals who are experienced in project management and project leadership.

**F4. Impact of requirements gathering and how mastering requirements gathering helps align project to move in the path of success.**

Organisation/Location: PMI Global Congress conference, Philadelphia, PA USA.
Day and Date: Sunday October 27, 2013.
Title of workshop: Impact of requirements gathering and how mastering requirements gathering helps align project to move in the path of success.
Organised by Michele M., Principle project manager at a leading provider of supply chain solutions.
Michele discussed the following in this breakthrough session:
Establishing requirements management process brings high value to the project.
In order for requirements management to be effective you must establish and create an agreement with the customer on requirement changes throughout the project. The first is requirements development, which is the process of identifying and creating requirements based on the user inputs and analysis. I found many different outlines when looking for an industry standard of requirements for the management process, but all still focused on the main topics. We will discuss those steps that are most crucial when defining the requirements management process. It is known that some primary reasons that projects fail are because requirements are incomplete, defective, or just lack the details provided by the customer. Incomplete requirements can also produce inaccurate products, unplanned costs, and schedule delays. Requirements must be carefully evaluated through analysis of user requirements and well documented to better understand the client’s needs. It’s important to remember that a requirement must capture what needs to be produced and not how to produce it.
Requirements analysis is an important phase and can be used to identify key stakeholders. Creating a list of key stakeholders ensures their needs are being considered in the risk assessment process. If the client’s requirements are not properly gathered and defined according to the information provided by all stakeholders, then the rest of the project is now off track when trying to arrive at a solution. Requirements define capabilities that a system or a component needs to reach a solution to a defined problem. They can be divided into two categories, functional and non-functional. Functional requirements detail what a system should perform when a specific action is taken. Non-functional requirements are the performance and system constraints that affect development. It’s important when analysing requirements that we reduce uncertainty early on in the project. A possible suggestion to accomplish this is working backwards on the requirement while considering the exact conditions that created the uncertainty.
F5. Developing a requirement gathering model for project requirements.

Organisation/Location: PMI local chapter, Dallas, TX
Day and Date: Monday June 3, 2013.
Title of workshop: Developing a requirement gathering model for project requirements.
Organized by Anant J. (project director at major food and beverage manufacturer)
AS-IS, TO-BE and Requirements Questionnaires were the core of discussion in this workshop

**AS-IS and TO-BE models**
The AS-IS process model describes the current business process flow. He has seen some teams struggle with developing an AS-IS model for the business process, as teams often want to jump to the future TO-BE process. However, it is worth spending the time documenting the AS-IS for major processes or complex processes so the entire team can develop a common understanding of the business process. The TO-BE process model usually adds the system as a swim lane and shows how the business process is adjusted with the system in place. Teams can now validate if the business process still makes sense with the addition of the IT system and supporting workflow.

**Requirements questionnaires**
Requirements questionnaires (discovery documents) help IT project manager and project consultant go through detailed requirements gathering process to be able to handle all aspects of the project requirements. Questionnaires, or surveys, allow an analyst to collect information from many people in relatively short amount of time. This is especially helpful when stakeholders are spread out geographically, or there is dozen to hundreds of respondents whose input will be needed to help establish system requirements. When using questionnaires, the questions should be focused and organized by a feature or project objective. Questionnaires should be not be too long, to ensure that users will complete them.

F6. The impact of project risk management tools on project risk mitigation and identification.

Organisation/Location: PMI Global Congress conference, Phoenix, AZ, USA.
Day and Date: Sunday October 26, 2014.
Title of workshop: The impact of project risk management tools on project risk mitigation and identification.

Organised by Danny J., Project director at major automotive safety products supplier.

Danny discussed the following points:

Impact of project risk management tools on IT projects.

Dealing effectively with risks in complex projects is difficult and requires management of an IT project that go beyond simple traditional approaches. Risk can occur in many different forms, such as known or unknown, quantitative or qualitative, and even real or imaginary. Risk is derived from uncertainty. It is composed of a complex array of variables, parameters, and conditions that have the potential of adversely impacting a particular activity or event, such as a project. At the minimum, three interrelated sets of variables affect the cost and overall ability of dealing with risk:

- Degree of uncertainty
- Project Complexity
- Impact

Understanding these variables is important for selecting an appropriate method of risk management, and for involving the right people and organizations necessary for effectively dealing with a specific risk situation.

The impact of project risk management tools on project risk mitigation and identification

While risk management is often portrayed as one step within project planning, there are It is vitally important that program/project managers and systems engineers utilize the same language, tools and philosophy when discussing project and program risk on an engineering program. Until recently, risk management standards have focused primarily on theoretical risk management process, techniques and tools and not on practical tools that help in identifying risk, such as risk management check list and risk impact assessment tools. There are actually five key components of an effective risk management strategy, as defined by the Project Management Institute (PMI), but they do not include detailed tools to be used for risk identification and mitigation:

- Plan: Outline general risk management approach and execution strategies for both common and project-specific risks.
• Identify: List risks, their characteristics and how they could impact overall project objectives. Assign risks to individual team members to further analyse and track.

• Analyse: This includes both qualitative analysis—assessing risks based on probability of occurrence and potential impact—and quantitative analysis, or prioritizing risks based on their impact on overall project objectives.

• Respond: Plan risk responses (e.g., contingency plans); take action to reduce the possibility of occurrence and/or potential impact of identified risks.

• Monitor and control: Track identified risks, execute risk-response plans when needed and evaluate and record effectiveness. Communicate progress and status reports to stakeholders and clients.

As mentioned, these are strategies but not specific tools to identify and mitigate risk. Recommendations out of the workshop were: Align the language of risk management, establish a cross-discipline risk management process based on an alignment of standards and certification bases, create templates for a coordinated multi-discipline Risk Management Plan and Align risk handling with monitor/control activities.

F7. Project deployment and project transition to support.

Organisation/Location: PMI Global Congress conference, Phoenix, AZ, USA.
Day and Date: Sunday October 26, 2014.
Title of workshop: Deployment and project transition to support.
Organised by Tom W., VP of program management at major food supplier in the US.

In the workshop Tom discussed the following:

Project transition to support needs to be planned within the project planning. It is very important to plan project transition to support as the IT project manager plans the whole project. This will provide better time and cost estimate. This process is usually left until the end. When it is left until the end, all project team members are ready to roll off the project and nobody has the energy to spend more time to review all aspect of the project. However, if project support transition is baked into the project plan and take priority, then rolling off the project at the end will be easy and smooth.
Tom suggested to engage the project support team in the implementation to make sure they understand the project objectives, deliverables, technical architecture and detailed design, which will help facilitate project transition at the end of the implementation.

**F8. Project Management road map, the road for better project management.**

Organisation/Location: PMI local chapter, Dallas, TX
Day and Date: Wednesday December 10, 2014.
Title of workshop: Developing a requirement gathering model for project requirements.
Organized by Krishnamurthy D. (project director at a major Semi-conductor manufacturer in the US)
The discussion was mainly around:
Creating a practical project management framework that will include a set of practical project management tools that will enhance project success. This framework needs to be applicable to all industries of IT project management. It also needs to flexible enough to be customizable to specific IT project.
Focus on project managers leadership trait as it is one of the drivers for project success. IT project manager leadership is a critical aspect of the project manager. He mentioned that IT projects managed by IT project managers that have and are able to utilise their leadership trait experience more success probability than IT projects that are managed by project managers that do not have good IT project manager leadership trait.
Leadership as a general and specific characteristic of a project manager. Leadership becomes an effective trait to drive project success. IT project managers who have the leadership characteristic need to be able to know when and how to utilise it.
Experienced project managers need to be the leaders in providing their experience and expertise to new project managers by arranging for training to share specific use cases of their experience and how they use specific project management tools to interact with specific situations.