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The Impact of IT Project Management Tools and Leadership Self-Efficacy on Project Success

Sameh Shamroukh

University of North Texas

ABSTRACT

This research focuses on improving outcomes in Information Technology (IT) projects, specifically investigating the potential impact of Leadership Self-Efficacy (LSE) and the use of Information Technology Project Management (ITPM) tools. Despite the logical connection of these factors to project success, there is a lack of empirical studies in existing literature directly exploring their relationships with project outcomes. This study aims to fill this research gap by examining the influence of LSE and dimension-specific ITPM tools on project outcomes at the component level.

The research model presented here aims to offer statistically robust evidence of the positive effects of these two factors on project outcomes. The study revolves around a condensed IT project with four crucial dimensions: communication management, requirements gathering, risk management, and project support transition. Each dimension is linked to dimension-specific ITPM tools. Data collection involves a questionnaire measuring participants' LSE levels and a survey assessing tool utilization and outcomes across the four dimensions.

Participants include twenty-nine highly experienced IT project management professionals with a collective track record of managing over 1,000 projects in more than 400 companies across four diverse industries (high-tech, retail, automotive, and logistics). Logistic regression analysis investigates the relationship between LSE, tool usage, and project outcomes. The findings indicate that project managers possessing LSE and utilizing dimension-specific ITPM tools significantly increase the likelihood of successful outcomes across project dimensions, with the exception of one tool.

This research makes a substantial contribution to existing literature on LSE and project management, providing a replicable research design that has yielded statistically reliable results, confirming the influential roles of LSE and ITPM tools in shaping project dimension outcomes.

Keywords: Leadership Self-Efficacy (LSE), Information Technology Project Management (ITPM), Information Technology (IT)

1. Introduction:

While the literature has explored Leadership Self-Efficacy (LSE) in management contexts, there is a notable scarcity of studies focusing on its relationship within the realm of IT project management. Furthermore, no statistical research has been conducted to establish connections between the LSE levels of project managers and project success, or between the utilization of Information Technology Project Management (ITPM) tools and project success. This study seeks to bridge this knowledge gap by utilizing an abbreviated IT project framework, encompassing four fundamental project dimensions essential to most IT projects: communication management, requirements gathering, risk management, and project support transition. Each dimension is complemented by two dimension-specific ITPM tools.

Employing a quantitative research approach, data was collected from a cohort of twenty-nine seasoned IT project management professionals. Statistical analyses have yielded statistically significant evidence underscoring the positive impact of both LSE and ITPM tools on the outcomes of each of the four project dimensions.

The impetus for this study stems from over two decades of practical project management experience and a sincere desire to enhance resources, training, and development opportunities for both novice and experienced project managers. The study's findings not only contribute to the academic understanding of the subject but also enhance the professional knowledge base. Additionally, the study suggests practical applications that can be implemented within project management practice.

As both academic and practical experiences have demonstrated, achieving higher rates of project success involves a complex interplay of numerous factors. The IT project manager assumes a pivotal role in steering the project's direction and outcome. Their preparedness, experience, proficiency in effectively employing project management tools, communication with stakeholders, risk assessment and mitigation, and ability to provide solutions are all instrumental in achieving success. Despite the availability of diverse managerial training programs, IT Project Management Methodologies (PMMs), and project management tools, many projects still encounter difficulties or fail across various dimensions. This study posits that the missing elements often pertain to project managers' leadership competencies.

Effective leadership encompasses self-awareness, the confidence to make assessments, judgments, and decisions, and the ability to manifest behaviours that effectively guide individuals. While leadership and LSE are recognized concepts, their development has not been the central focus of IT project manager training or ongoing support.

The research aims to:

- Investigate the relationship between project managers' Leadership Self-Efficacy and project outcomes.
- Explore the role of IT project management tools in influencing project outcomes.
- Provide recommendations that empower project managers to make meaningful contributions to the project management profession, both in practice and research.

This study's objective is to augment our understanding of LSE in the context of project management, particularly its role in IT project outcomes. By seeking data-driven, statistically supported evidence of the relationship between project outcomes and project managers' Leadership Self-Efficacy, the study addresses existing gaps in Information Technology Project Management (ITPM) practices. It underscores the significance of Leadership Self-Efficacy and ITPM tools as contributing factors to the success of standardized ITPM practices within the dimensions of communication management, requirements gathering, risk management, and project support transition.

Leadership Self-Efficacy (LSE) and IT Project Management (ITPM) tools both play crucial roles in influencing project outcomes, particularly in complex and high-stakes environments like IT projects. Each has a theoretical impact on the success and performance of a project, and when used in combination, they offer complementary strengths.

Leadership Self-Efficacy (LSE)

Leadership self-efficacy refers to a leader’s belief in their own ability to lead effectively, make decisions, and guide their team to achieve project goals. Theoretical frameworks surrounding LSE emphasize that a project manager with high self-efficacy is likely to exhibit stronger leadership behaviours, resulting in better project outcomes. Here are some key ways LSE influences project success:

a. Decision-making and Problem-solving:

Leaders with high self-efficacy are more confident in their ability to make sound decisions and solve complex problems. In IT projects, which are often characterized by uncertainty and rapid changes, strong decision-making is critical. A project manager who believes in their ability to navigate challenges will likely adopt a proactive approach, leading to quicker solutions and more effective project outcomes.

b. Motivation and Team Performance:

Project managers with high LSE tend to inspire confidence and motivation in their teams. According to Bandura’s theory of self-efficacy, people with high efficacy are more persistent and resilient when faced with challenges. In an IT project, where team collaboration is essential, a leader’s self-confidence can foster a positive environment, boosting team morale, commitment, and performance. This, in turn, improves the chances of meeting deadlines and delivering successful outcomes.

c. Risk Management:

LSE theoretically encourages project leaders to take calculated risks and innovate, particularly in the face of ambiguity. IT projects, which often involve cutting-edge technology and uncertain outcomes, benefit from leaders who are not risk-averse. These leaders can balance risk and reward effectively, often leading to more innovative solutions and a greater capacity to adapt to changes during the project lifecycle.

d. Resilience and Stress Management:

In times of stress, leaders with high self-efficacy are more resilient and able to cope with project setbacks. IT projects frequently experience delays, budget constraints, or technical issues. A project manager with high LSE is likely to handle stress better, maintain composure, and lead their team through crises, preventing escalation and keeping the project on track.

IT Project Management (ITPM) Tools

ITPM tools are technologies, software, and methodologies that help manage, organize, and streamline the various phases of an IT project, such as planning, executing, monitoring, and closing. These tools have a significant theoretical influence on project outcomes through several mechanisms:

a. Efficiency in Task Management:

ITPM tools, such as Microsoft Project, JIRA, or Asana, help in organizing tasks, assigning resources, and tracking progress. Theoretical frameworks on project management suggest that clear task delegation and monitoring reduce errors and miscommunication, leading to smoother project execution. When project managers and teams use these tools effectively, they can maintain a clearer picture of the project's status, making timely adjustments to ensure the project stays on track.

b. Data-Driven Decision Making:

Modern ITPM tools offer robust analytics and reporting features, allowing project managers to make data-driven decisions. The theory of evidence-based management suggests that using objective data to guide decision-making improves accuracy and project performance. By using real-time project data, such as resource allocation, timeline progress, and budget consumption, managers can make informed adjustments to avoid project overruns or delays.

c. Collaboration and Communication:

IT projects typically involve cross-functional teams working on different aspects of the project. ITPM tools enhance collaboration by providing centralized platforms where team members can communicate, share files, and track project progress. Theoretical perspectives on team dynamics highlight the importance of clear communication and information sharing for project success. Tools like Slack, Trello, or Microsoft Teams foster more effective communication, preventing misunderstandings or delays.

d. Risk Management and Mitigation:

Many ITPM tools incorporate features that allow for risk identification and mitigation strategies. By tracking project risks, such as technical challenges or resource shortages, these tools enable project managers to pre-emptively address potential issues. This aligns with risk management theories, which emphasize that early detection and mitigation of risks are crucial for maintaining project success.

e. Resource Optimization:

ITPM tools help project managers optimize human and financial resources. By tracking resource allocation in real time, these tools allow managers to ensure that team members are not overburdened and that the budget is used efficiently. Resource optimization is a critical component of project management theory, as effective resource allocation is directly tied to project timelines, quality, and costs.

1.1 Research gaps

The literature review highlights a notable research gap concerning the relationship between project manager leadership self-efficacy and critical success factors (CSFs) within the realm of IT project management. While there is a wealth of literature on leadership, project management, and CSFs, the integration of these topics, particularly in relation to project success, remains underexplored. The lack of a unified approach to understanding how leadership self-efficacy impacts CSFs and, consequently, project outcomes, poses a significant limitation in current scholarship. This challenge is further complicated by the ongoing debate surrounding the very definition of "project success," a topic on which, as [1] observes, there is widespread disagreement. This lack of clarity hinders the development of universally applicable frameworks for measuring success, as different stakeholders may prioritize different outcomes depending on the project's scope, industry, or specific objectives.

One of the key obstacles in assessing project success is the absence of clearly defined critical success factors from the project's inception. Without a consensus on what constitutes project success, it becomes difficult to evaluate the role leadership plays in achieving it. Many scholars argue that defining CSFs early on provides a roadmap for both the project manager and the team, helping to align efforts and resources toward achieving those specific outcomes. However, the failure to do so leaves room for ambiguity and misalignment, making it difficult to assess leadership's contribution to the overall success of a project. This is particularly true in IT project management, where projects are often complex, high-risk, and dynamic in nature. These characteristics demand strong leadership capable of adapting to changing circumstances and guiding teams through challenges, yet the existing literature offers little guidance on how leadership self-efficacy interacts with these factors.

[2] underscores the persistent dearth of research on project leadership, despite repeated calls for more comprehensive studies in this area. This gap is especially problematic given the critical role leadership plays in determining the outcome of projects. In many cases, project managers are not just responsible for ensuring technical execution but also for managing teams, resolving conflicts, and driving innovation—all tasks that require strong leadership skills. As IT projects become more complex, the need for effective leadership becomes even more pronounced. Yet, the literature remains disproportionately focused on the technical aspects of project management, leaving leadership-related factors under-researched. This lack of attention to leadership self-efficacy is a missed opportunity, as the confidence a project manager has in their ability to lead can significantly affect the team's performance and the project's outcome.

[3] suggest that projects should be viewed as social systems encompassing multiple facets of organizational behavior, including leadership, communication, team dynamics, and human resource management. This approach shifts the focus from viewing projects solely as technical tasks to understanding them as complex human-cantered endeavours. In such a framework, the project manager's leadership self-efficacy becomes a critical factor, influencing not only the technical execution but also the team's social dynamics. Leadership plays a key role in fostering collaboration, resolving conflicts, and maintaining team morale, all of which are crucial for the success of IT projects. The social system perspective emphasizes the interconnectedness of leadership with other organizational behaviours, suggesting that project success is as much about managing people as it is about managing tasks.

Moreover, leadership self-efficacy, or the belief in one's ability to lead successfully, has far-reaching implications in project management. Research suggests that leaders with high self-efficacy are more likely to take initiative, persist in the face of challenges, and inspire confidence in their teams. These traits are especially important in IT projects, which are often characterized by uncertainty, tight deadlines, and evolving requirements. A project manager who believes in their leadership capabilities is more likely to navigate these challenges effectively, making strategic decisions that align with the defined critical success factors.

The literature review highlights the critical need for more research focused on the role of project manager leadership self-efficacy in influencing critical success factors in IT project management. While leadership is widely recognized as a key component of project success, the lack of comprehensive studies in this area leaves a gap in our understanding of how leadership self-efficacy impacts project outcomes. Given the increasing complexity and dynamic nature of IT projects, future research should aim to integrate leadership self-efficacy into existing frameworks for critical success factors, thereby providing a more holistic understanding of the factors that contribute to project success.

1.2 Research Focus and Boundaries

In the realm of IT project management, project managers are tasked with overseeing and managing multiple dimensions within each project under their purview. The field of project management offers diverse perspectives on how to categorize these critical component dimensions, each emphasizing different aspects of a project. Regardless of the specific framework employed, effective knowledge sharing across all project stakeholders remains paramount within each dimension. The exact number of dimensions or knowledge-sharing areas may vary from one project to another.

To streamline the focus of this research, an abbreviated project structure comprising four fundamental dimensions has been adopted. These four dimensions, namely: 1) Communication management, 2) Requirements gathering, 3) Risk management, and 4) Project support transition, have been selected due to their foundational and pervasive nature across virtually all projects. [4] underscores the significance of these dimensions, justifying their inclusion in this study's investigation into their individual influences on project outcomes.

This study significantly contributes to the existing body of knowledge in both Leadership Self-Efficacy and practical IT project management. A notable gap in the literature emerges as only a limited number of data-driven studies have attempted to establish a statistical connection between Leadership Self-Efficacy and successful project outcomes. The present research not only identifies such a relationship but also sheds light on the impact of a manager's Leadership Self-Efficacy on the likelihood of success across four dimensions of IT projects: communication management, requirements gathering, risk management, and project support transition. Furthermore, this study provides statistically robust evidence regarding the influence of ITPM tool utilization on the probability of success in these same four project dimensions. As a pioneering effort, the replicable research design employed in this study serves as a foundational model for future investigations in this domain.

The insights garnered from this study offer valuable guidance for shaping project manager training programs and equipping project managers with enhanced skills and tools that can significantly contribute to successful project outcomes within specific dimensions. Ultimately, these efforts increase the overall likelihood of project success.

2. Literature review

Project management involves a comprehensive blend of knowledge, skills, and techniques used to fulfill specific requirements and expectations, establish measurable scopes, create realistic timetables, and delineate roles and responsibilities [5][6]. However, it is evident that existing project management standards are insufficient for the development and assessment of project managers. There is a clear need for empirical-based research to construct models of project manager effectiveness [7].

Effective project managers are those who can cultivate productive, dedicated, and contented team members, resulting in superior project performance. They excel in communication with project stakeholders, adeptly manage conflicts, and actively foster the growth and motivation of their team members. They possess the ability to navigate changes, demonstrate high-quality managerial skills, and inspire their team members to make substantial contributions while earning recognition [8]. Essentially, they proficiently execute both leadership and management functions [9].

Various organizations have experimented with newly developed project management tools in their pursuit of increased project success. Unfortunately, many of these tools tend to focus primarily on symptom identification and score calculation [10]. While Information Technology Project Management (ITPM) generates diverse opinions, knowledge-sharing gaps are often conspicuous in areas such as communication management, requirements gathering, risk management, and project support transition. Consequently, continued research is essential to shed further light on ITPM leadership resources and tools and their effectiveness in driving project success. The present study aims to make advancements in this domain.

The ensuing literature review serves as the cornerstone for the proposed study, providing an overview of the Leadership Self-Efficacy model, its impact on individual performance, and the significance of the IT project manager's Leadership Self-Efficacy trait as a determinant of success.

In a study conducted by [11], it was found that project managers who effectively manage their self-assessment in the context of their projects tend to be more effective, especially in turbulent times. Their research revealed that Leadership Self-Efficacy significantly enhances five specific personal competencies highly valued in contemporary organizations: adaptability/flexibility, the ability to handle ambiguity, persistence/perseverance, emotional intelligence, and resilience. [11] employed an in-depth literature review, synthesizing and translating separate qualitative studies into novel findings. Their research method involved a "light" meta-ethnography, condensing and simplifying qualitative findings from academia regarding self-efficacy effects, competencies that enhance project manager effectiveness, and personal competencies required in modern organizations. They employed the

Critical Appraisal Skills Programme (CASP) to ensure the inclusion of high-quality qualitative research and conducted their own qualitative research via e-interviews with 12 project managers from diverse backgrounds and experience levels to validate their findings. The study underscores the importance of intrinsic qualities for modern project managers, which goes beyond traditional focuses on industry knowledge and leadership skills.

According to [12], there is a positive correlation between project manager leadership and project success, with teamwork playing a pivotal role. Given the evolving environmental factors in companies, the competencies required of project managers need to continually evolve as well. Mere technical or industry expertise, project methodology application, and leadership skills have traditionally been the primary focus of project management competencies. However, they are no longer sufficient for the modern-day project manager. In today's corporate environments, which are increasingly stressful and competitive due to factors like the global recession, modern technology, and the Internet, project managers need deeper, intrinsic, and more personal qualities. These qualities include adaptability/flexibility, the ability to handle ambiguity, persistence/perseverance, emotional intelligence, and resilience [11]. The next generation of project managers must prioritize self-efficacy for increased effectiveness. Self-efficacy represents a person's judgment of their capabilities to organize and execute the actions required to achieve predetermined goals. Their research shows that self-efficacy positively influences personal intrinsic attributes crucial in modern organizations.

Project management is defined as the application of knowledge, skills, and techniques to project activities to meet specific requirements [13]. Leadership plays a pivotal role in enhancing the success of project deliverables, and this can be achieved through various leadership styles and project methodologies. [14] identifies four essential elements in effective project management leadership methodologies: effective communication, effective cooperation, effective teamwork, and trust.

[15] identifies four primary concerns in project management that lead to project failures, including inadequate time allocation for certain tasks, the assumption that no obstacles will arise during the project, rushing projects to adhere to constraints around finances, time, and quality, and overloading project managers or team members with excessive responsibilities.

Currently, the demand for project work far exceeds the limited supply of skilled resources within organizations. In today's economy, companies face financial difficulties while needing to hire more skilled resources to reduce project failure rates.

Leadership is fundamentally about influence, and influence is wielded through power, defined as the ability to influence others. [16]

3. Research methodology

The research design for this study draws upon the author's expertise in IT project management and data analysis methods. The study involves the collection of specific data directly from IT project managers. This data encompasses their perceptions and approaches to leadership, their utilization of specific IT project management tools, and their assessments of project success, particularly focusing on four key project dimensions. The collected data offers a rich dataset that can be examined to uncover potential correlations between Leadership Self-Efficacy (LSE) and the outcomes of IT projects, as well as associations between the use of eight IT project management tools and success within these project dimensions.

The findings obtained by analyzing the relationships between LSE, ITPM tool utilization, and project success at the project-component level of the dimension will also shed light on how project managers' LSE and their use of ITPM tools impact overall project success.

Since prior data-driven studies have not statistically established a connection between LSE and overall project success, this study takes an initial step toward providing statistical evidence. It adopts a practical and reproducible approach, focusing on a manageable subset of four fundamental project dimensions and two commonly employed ITPM tools.

The research model’s design logic is a crucial aspect that helps in framing the study and ensuring that it captures the essential elements that impact IT project success. To begin, selecting and defining the four key dimensions—communication management, requirements gathering, risk management, and project support transition—should be based on both theoretical frameworks and empirical evidence from previous studies in project management. Communication management, for example, is a widely acknowledged critical success factor in project management literature. It deals with how effectively project stakeholders interact, exchange information, and collaborate to resolve issues. By defining this dimension, the research aims to capture how communication flows impact project coordination, problem-solving, and alignment with project goals.

Requirements gathering is the second key dimension, focusing on identifying and documenting stakeholders' needs, which forms the foundation for project planning and execution. Poor requirements gathering is often cited as one of the leading causes of project failure, especially in IT projects where precise specifications are crucial. Defining this dimension involves specifying how thorough and accurate the requirements collection process is, which directly affects the project’s ability to deliver outcomes that meet client expectations. The research should focus on this process from multiple perspectives, including technical and user requirements, to offer a comprehensive view of its impact on project success.

Risk management, the third dimension, plays a pivotal role in identifying, analysing, and responding to potential project risks that could derail progress. In an IT project context, risks might include technical challenges, changing client requirements, or resource constraints. Defining risk management within the research model involves determining how the project anticipates uncertainties and implements mitigation strategies. This dimension is crucial because the ability to manage risks effectively ensures that the project can stay on schedule and within budget, even when unforeseen challenges arise.

Lastly, project support transition focuses on how the project's deliverables are handed over to the client or end users and how well the support mechanisms are established post-project completion. This dimension is relevant as it addresses the long-term sustainability and user adoption of the IT solution. By defining this dimension, the research can examine how well the transition process is managed, including training, documentation, and ongoing support. The inclusion of this dimension recognizes that project success is not just about delivery but also about ensuring that the solution continues to function effectively in its operational environment.

3.1 Research Approach

Quantitative data were gathered through the administration of two survey instruments. The first survey aimed to assess Leadership Self-Efficacy and consisted of 21 questions. Respondents were asked to rate their agreement on a six-point Likert Scale, ranging from "strongly disagree" to "strongly agree." The second survey utilized a binary response format (Yes - 1 or No - 2). It focused on the utilization of two specific IT project management tools within each of the four project dimensions, as well as the success or failure outcomes in each dimension for a total of 10 projects managed by each participant.

The collected data were subjected to Logistic Regression analysis to investigate two primary relationships:

1. The association between Leadership Self-Efficacy (LSE) and the outcomes in each project dimension.
2. The link between each individual IT project management tool and the outcomes in each project dimension.

3.1.1 Recruiting participants

The most effective approach for identifying participants who met the specified criteria was to reach out to professional connections. It's worth noting that all participants were individuals known to the author of this study. While the preexisting relationships with the participants might be viewed as a potential source of subjectivity, it, in fact, fostered an environment conducive to candid information sharing due to shared experiences in confronting challenges. This proved particularly advantageous as the study required participants to discuss both their successes and failures in their IT project management roles.

3.2 implementation and response

All in all, the survey proceeded according to the intended plan. Conducting meetings with the participants in a non-workplace setting appeared to create a comfortable environment and encourage candid discussions during the survey completion. Participants, on the whole, exhibited a genuine interest in the subject matter and recognized the importance of research concerning the role and resources available to IT project managers. Each of the twenty-nine participants successfully furnished a comprehensive set of data, which encompassed both the Project Manager Questionnaire and the Project Management survey detailing information for ten projects.

3.3 Methods of data analysis

A statistical analysis was performed on the data obtained from the LSE survey and the 10-project details survey. Frequencies, means, and standard deviations of participants' responses in each inventory were computed using Logistic Regression, a commonly used technique for predictive modeling when the dependent variable is categorical.

Logistic regression, implemented through R and Python packages, was employed to assess the connection between Leadership Self-Efficacy (LSE) and the likelihood of achieving successful outcomes in four project dimensions: communication management, requirements gathering, risk management, and project support transition. The same model and packages were applied to determine the relationship between each of the two dimension-specific tools and the probability of achieving success in each dimension.

Logistic regression requires binary data. Data from the "10-project details survey" were collected in binary format. For the "Project Manager Questionnaire," which was used to calculate LSE scores, the average of the 21 Likert Scale responses (ranging from 1-6) was computed to derive an LSE score for each participant. Participants were then ranked from highest to lowest scores, and an average score was calculated. Subsequently, participants were divided into two groups: those with high LSE scores and those with low LSE scores. To facilitate binary data entry for logistic regression, the group with higher scores was categorized as having LSE (coded as 0), while the lower-scoring group was designated as not having LSE (coded as 1).

The research design focused on a condensed IT project model comprising four project dimensions (or knowledge areas): communication management, requirements gathering, risk management, and project support transition. Each dimension included two commonly used ITPM tools.

The data were collected from a non-probability sample of twenty-nine highly qualified IT project managers. Participants with the requisite experience and expertise were identified within the researcher's professional network. Each participant willingly completed surveys to assess Leadership Self-Efficacy, report on ITPM tool usage, and provide project dimension outcomes for projects they had managed.

Survey data were subjected to logistic regression analysis to determine the impact of both LSE and the eight ITPM tools on the likelihood of achieving successful outcomes in project dimensions.

Previous background research did not yield data-based studies demonstrating statistical evidence of a relationship between Leadership Self-Efficacy and project success, nor did it establish a connection between ITPM tools and project success. This research aims to bridge this gap by presenting a reproducible research model capable of generating statistical evidence that can serve as a foundational model for future research endeavors.

4. Results analysis

To perform logistic regression for data analysis, it is essential to work with binary data. In the case of LSE scores, a transformation was necessary to prepare the variable for this type of analysis. This transformation involves converting the integer scale, which originally ranged from 1 to 6, into a binary variable that signifies the presence or absence of LSE.

To achieve this transformation, a numerical threshold had to be selected and applied. This threshold distinguishes between positive (presence of LSE) and negative (absence of LSE) cases. While various threshold options were available, we opted for a midpoint within the range. This midpoint was determined through the following calculation:

$$\boldsymbol{LSE\ Threshold = Minimum + \frac{(Maximum - Minimum)}{2} = 1 + \frac{(6-1)}{2} = 3.5}$$

To confirm the suitability of this chosen threshold, we conducted a check on the balance between the sizes of the positive and negative populations after the transformation (as displayed in Table 4-1 below). The relative sizes of these populations were found to be quite similar, approaching 50%. This balance further validates the data for meaningful analysis.

LSE	Population Size	Relative Size
Positive	16	55.2%
Negative	13	44.8%

Table 4-1 Division of participants into LSE and No LSE groups

4.1 Input Gathered

The data collected for this segment of the analysis can be categorized into three distinct groups: Leadership Self-Efficacy, Tools Utilized, and Project Dimension Outcome Success. Each of these elements represents a variable in the analysis.

1. *Leadership Self-Efficacy (Independent Variable)*

The data for this input was not collected independently. Instead, a binary value was derived from the original LSE score, where a positive value indicates the presence of LSE, and a negative value indicates its absence, as explained earlier.

2. *Tools Used (Independent Variable)*

Participants were requested to specify whether they used or did not use eight essential tools that support project management across the four dimensions of IT projects, with two tools designated for each project dimension.

Tool No.	Tool	Project Success Dimension
1	Weekly status report	Communication
2	Electronic communication	
3	Functional decomposition	Requirements Gathering
4	Use case diagram	
5	Risk management check list	Risk Management
6	Risk impact assessment	
7	Support transition checklist	Project Support Transition
8	Knowledge transfer and walk Through sessions	

In this analysis, each binary variable representing the use or non-use of a specific tool serves as an independent variable.

3. Successful Project Dimension Outcome (Dependent Variable)

Survey participants were asked to assess whether each of the ten projects they had managed was successful or not in each of the four project dimensions and whether the overall project outcome was a success or a failure. Instead of providing an overarching summary of project success at the global project level, this approach delves into the granularity of each project dimension, enabling data segmentation by dimension and facilitating distinct conclusions to be drawn for each one. Incorporating this diversity was a crucial aspect of the methodology because projects can often exhibit success in most aspects while encountering challenges in others. Determining project success or failure at the dimension level and with greater granularity allows for a broader spectrum of insights to be gleaned.

In this analysis, the dependent variable is the outcome of the project dimension, whether it was successful or unsuccessful.

4.2 Model Formation

Four logistic models were developed to examine how Leadership Self-Efficacy (LSE) and the utilization of specific tools influenced successful project outcomes within the four project dimensions. Each of the four project dimensions had its own distinct logistic model created. The general model structure is presented below, with "D" representing the relevant project success dimension, followed by the specific model names: communication management, requirements gathering, risk management, or project support transition.

$$\boldsymbol{Project\ Success_D = \beta_0 + \beta_1 * LSE + \beta_2 * Tool\ 1_D + \beta_3 * Tool\ 2_D}$$
$$\boldsymbol{Project\ Success_{Communication} = \beta_0 + \beta_1 * LSE + \beta_2 * Weekly\ Status\ Report + \beta_3 * Electronic\ Communication}$$

$$\boldsymbol{Project\ Success_{Requirements\ Gathering} = \beta_0 + \beta_1 * LSE + \beta_2 * Functional\ Decomposition + \beta_3 * Use\ Case\ Diagram}$$

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

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

4.3 Model Estimate

The R statistical package was used for the estimation of the logistic models.

4.4 Coeffient 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.

4.5 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 4.2. For example, the coefficients have been substituted into the equation for Model 1 below.

$$\boldsymbol{Project\ Success_{Communication} = -0.615 + 0.429 * LSE + 0.464 * Weekly\ Status\ Report + 0.469 * Electronic\ Communication}$$

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.

$$\boldsymbol{Project\ Success_{Communication} = -0.615 + 0.429 * 1 + 0.464 * 0 + 0.469 * 1 = 0.283}$$

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

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. For this analysis, the chosen significance level is 90%. The critical value is fixed for each significance level.

$$\boldsymbol{Confidence\ Interval_\alpha = Coefficient\ Estimate \pm Critical\ Value_\alpha * Std.Error}$$

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

$$\boldsymbol{Confidence\ Interval_{90\%} = Coefficient\ Estimate \pm 1.64 * Std.Error}$$

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 [17].

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.

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

Next, Tables 4-2, 4-3, 4-4 and 4-5 summarize the coefficient estimate and standard error for each tool and LSE in each project dimension.

Model 1- Communication Management

	Coefficient Estimate	**Standard Error**	**CI 5%**	**CI 95%**
Intercept	-0.615	0.222	-0.980	-0.249
Tool 1	0.464	0.256	0.043	0.885
Tool 2	0.469	0.249	0.060	0.879
LSE	0.429	0.241	0.032	0.826

Table 4-2 Communication Management Confidence Interval Model

Model 2 - Requirements Gathering

	Coefficient Estimate	**Standard Error**	**CI 5%**	**CI 95%**
Intercept	-0.671	0.241	-1.067	-0.275
Tool 3	0.322	0.240	-0.073	0.717
Tool 4	0.639	0.247	0.233	1.045
LSE	0.438	0.242	0.040	0.836

Table 4-3 Requirements Gathering Confidence Interval Model

Model 3 - Risk Management

	Coefficient Estimate	**Standard Error**	**CI 5%**	**CI 95%**
Intercept	-0.661	0.240	-1.057	-0.266
Tool 5	0.516	0.241	0.119	0.913
Tool 6	0.505	0.245	0.102	0.908
LSE	0.488	0.244	0.087	0.890

Table 4-4 Risk Management Confidence Interval Model

Model 4 – Project Support Transition

	Coefficient Estimate	**Standard Error**	**CI 5%**	**CI 95%**
Intercept	-0.655	0.243	-1.055	-0.255
Tool 7	0.442	0.240	0.047	0.837
Tool 8	0.491	0.240	0.097	0.886
LSE	0.425	0.241	0.029	0.822

Table 4-5 Project Support Transition Confidence Interval Model

4.6 Statistical Significance of the Coefficent

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 H1 > 2. Statistically significant differences are determined using a chosen level of probability (the “p-level” or α) 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.

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 4-6, 4-7, 4-8 and 4-9 summarize the p values and statistical significance for each tool and LSE in each project dimension.

Model 1- Communication Management

	p-Value	**Statistically Significant**
Intercept	0.006	Yes
Tool 1	0.070	Yes
Tool 2	0.059	Yes
LSE	0.076	Yes

Table 4-6 Communication Management Statistical Significance Model

Model 2 - Requirements Gathering

	p-Value	**Statistically Significant**
Intercept	0.005	Yes
Tool 3	0.180	No
Tool 4	0.010	Yes
LSE	0.070	Yes

Table 4-7 Requirements Gathering Statistical Significance Model

Model 3- Risk Management

	p-Value	**Statistically Significant**
Intercept	0.006	Yes
Tool 5	0.032	Yes
Tool 6	0.039	Yes
LSE	0.045	Yes

Table 4-8 Risk Management Statistical Significance Model

Model 4- Project Support Transition

	p Value	**Statistically Significant**
Intercept	0.007	Yes
Tool 7	0.065	Yes
Tool 8	0.041	Yes
LSE	0.078	Yes

Table 4-9 Project Support Transition Statistical Significance Model

4.7 Discussion

The logistic regression coefficients represent the log odds ratio associated with the presence or absence of the predictor variable. Put simply, these coefficients indicate the change in the log odds of the dependent variable when the predictor is present. To understand the change in the odds of the dependent variable when the predictor is present, we can use Euler's number "e" raised to the power of the coefficient, denoted as "exp(coefficient)."

The computation of each variable's impact is presented in Tables 4-10 through 4-13 below. The coefficient values have been directly extracted from the logistic regression output in R, matching the values previously displayed. These values are then subjected to the transformation using exp(coefficient). To determine the actual impact, we calculate exp(coefficient) - 1.

This approach allows us to quantify the effect of each predictor variable on the dependent variable in a meaningful way.

Model 1- Communication Management

	Coefficient Estimate	**Exp(Coefficient)**	**Impact**
Tool 1	0.464	1.590	59.0%
Tool 2	0.469	1.599	59.9%
LSE	0.429	1.536	53.6%

Table 4-10 Communication Management Odds of Success

Model 2-Requirements Gathering

	Coefficient Estimate	Exp(Coefficient)	Impact
Tool 3	0.322	1.380	38.0%
Tool 4	0.639	1.895	89.5%
LSE	0.438	1.550	55.0%

Table 4-11 Requirements Gathering Odds of Success

Model 3- Risk Management

	Coefficient Estimate	Exp(Coefficient)	Impact
Tool 5	0.516	1.676	67.6%
Tool 6	0.505	1.656	65.6%
LSE	0.488	1.630	63.0%

Table 4-12 Risk Management Odds of Success

Model 4-Project Support Transition

	Coefficient Estimate	Exp(Coefficient)	Impact
Tool 7	0.442	1.556	55.6%
Tool 8	0.491	1.634	63.4%
LSE	0.425	1.530	53.0%

Table 4-13 Project Support Transition Odds of Success

4.8 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 4-1.

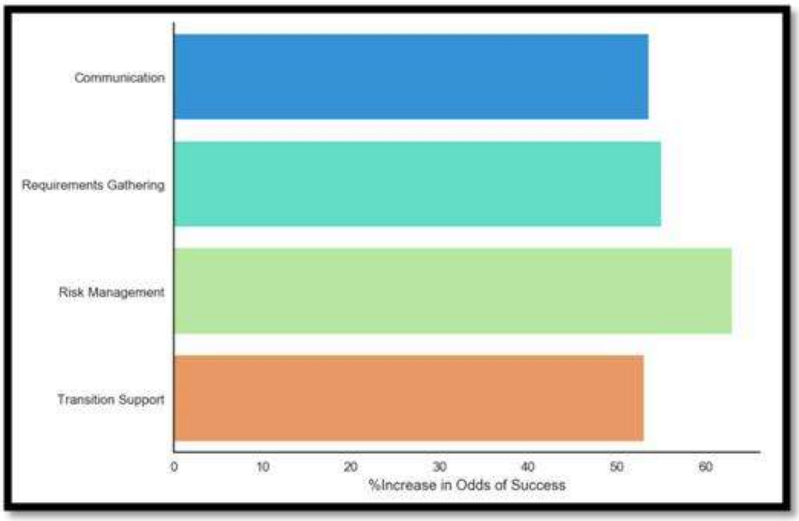

Figure 4-1 Impact of Leadership Self-Efficacy on odds of Project Dimension Success

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 4-2. (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% ($p \leq .10$) 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.

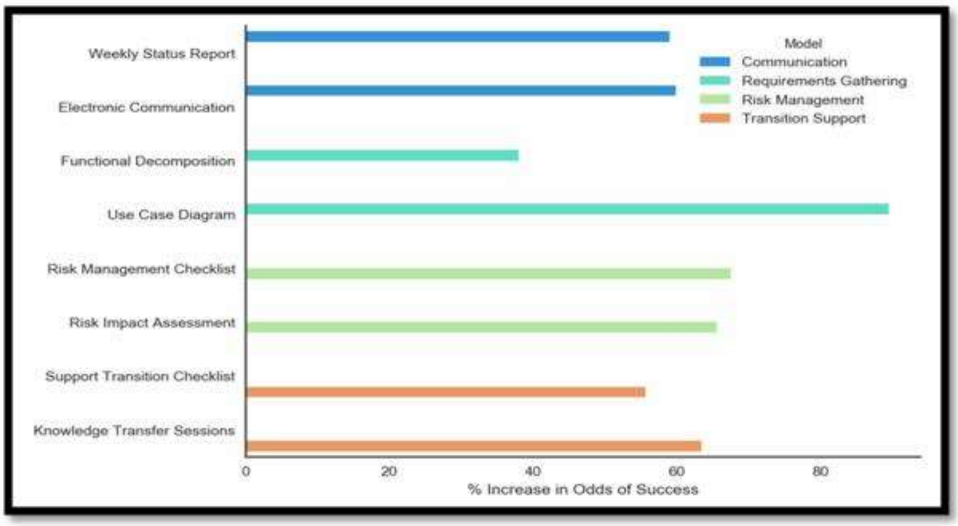

Figure 4-2 Impact of Use of Tools on odds of Project Dimension Success

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.

The practical implications of these research findings for IT project management practices are crucial for improving project outcomes across various dimensions. First, the investigation into the impact of Leadership Self-Efficacy (LSE) on the odds of success in communication management, requirements gathering, risk management, and project support transition highlights the importance of project managers' leadership capabilities. These findings suggest that IT project managers with higher LSE are more likely to achieve successful outcomes in these dimensions. Specifically, LSE significantly influences risk management outcomes, emphasizing that confident, self-assured leaders are better equipped to identify, assess, and mitigate risks. This insight can be applied across industries where IT projects are critical, such as healthcare, finance, or construction, encouraging organizations to invest in leadership development programs for their project managers to enhance their LSE and, consequently, their project performance.

Regarding the use of IT project management tools, the research reveals that certain tools significantly impact project outcomes in specific dimensions. For example, use case diagrams significantly improve requirements gathering success, while knowledge transfer and walkthrough sessions positively impact project support transitions. These findings underscore the need for project managers to carefully select and apply tools suited to the project's specific needs. In industries where requirements are complex and critical, such as software development or aerospace, using appropriate tools like use case diagrams can lead to more accurate and effective requirements gathering. Similarly, industries that require robust post-project support, such as IT services or telecommunications, can benefit from incorporating knowledge transfer sessions to ensure a smooth handover and user adoption.

The research also identifies one exception where a tool did not significantly impact project outcomes. The use of functional decomposition in requirements gathering was not statistically significant, indicating that this tool may be less effective in this dimension compared to others like use case diagrams. This finding prompts IT project managers to critically evaluate the tools they use and adjust their strategies based on the specific needs of the project and the evidence of tool effectiveness. For example, in industries where functional decomposition is traditionally used, managers may want to reconsider its role in requirements gathering or complement it with more effective tools.

The research highlights the statistically significant impact of both LSE and IT project management tools on project outcomes, with most results being significant at the 5% level or lower. This statistical reliability provides strong evidence that LSE and the careful application of specific tools can positively influence project success. By applying these findings across different projects and industries, organizations can enhance their project management practices, optimize tool selection, and focus on leadership development to improve their odds of success in key project dimensions.

5. Conclusion

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 4-1).

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 4-2.)

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 participants, 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.

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.

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