ACADEMIC PAPER

MANAGING TECHNOLOGY PROJECTS IN MEDIUM-SIZED ENTERPRISES: THE ROLE OF PROJECT COMPLEXITY AND PROJECT MANAGER EXPERIENCE IN ACHIEVING SUCCESS OR FAILURE

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Abstract

This study builds on my previous MSc research to explore project complexity, project manager experience and their combined effect on project success in a medium-sized technology firm. Technology projects often fail because of the interactions between complexity and managerial experience that are overlooked. The study uses a mixed-methods approach, including regression analysis, ANOVA, and qualitative interviews, to examine 65 projects from two decades. The research shows that project success decreases as complexity increases. Experienced managers reduced negative effects, especially in high-complexity settings, increasing success by ~30%. However, the benefit of experience declines over time, indicating a non-linear effect. In addition, the success rates of projects increased by 40% when experienced managers implemented structured methods as opposed to laissez-faire project management approaches. Managers with over five years of experience were 57 times more likely to adopt promising project management methods. The research shows that experience and methodological congruence are essential factors that enhance SME project success rates. The research findings provide direction for SMEs to enhance project governance while matching project manager experience to project complexity and developing competencies in line with standards such as IPMA ICB4.

Keywords: Project Complexity, Project Success, Project Manager Experience, SME, Project Management Methodologies

Introduction

Small and medium-sized enterprises (SMEs) are crucial to the economy. They represent 99% of all businesses in the European Union and account for 64.4% of employment (European Commission, 2023). Many of these firms run technology-driven projects to remain competitive. Still, project failure rates remain high. In Germany, for instance, 35% of GDP is generated through project-based work (Deutsche Gesellschaft für Projektmanagement, 2023), underscoring the far-reaching impact of poor project outcomes. So when projects go wrong, the damage spreads. Flyvbjerg et al. (2022) and others further highlight that technology and IT projects frequently overrun budgets and timelines, exacerbating the cost of failure. In SME contexts, such project failures have significant business impact. Hence, improving project success rates is essential for safeguarding SMEs' economic contribution.

Project complexity is a major contributor to project failure, increasing uncertainty and risk (Maylor, Turner & Murray-Webster, 2013), which is equivalently relevant to SME environments. At the same time, the role of project manager experience in mitigating complexity and improving success rates remains underexplored in SME settings. Previous research suggests that experienced project managers can navigate complexity more effectively (Müller & Turner, 2007a), yet the precise nature of this relationship—particularly in SMEs—requires further investigation. How does project manager experience influence the impact of complexity on project success? And how do experienced managers select methodologies that enhance project success?

This paper addresses these gaps by examining 65 projects spanning two decades in a German technology SME. Using a mixed-methods approach with a strong emphasis on quantitative analysis, the study investigates:

1. The direct impact of project complexity and project manager experience on success.
2. How experience influences the complexity-success relationship.
3. How experience influences the selection and effectiveness of project management methodologies and its impact on success.

Findings indicate that project complexity significantly hinders success, but experienced managers can mitigate this effect—though the relationship follows a non-linear pattern.

In addition, experienced project managers are 57 times more likely to select methods tailored to the specific project requirements, which is associated with higher success rates.
This study contributes to both academic discourse and industry practice. It provides evidence-based insights for SMEs, project professionals, and policymakers. The findings underscore the need for structured complexity assessment, experience-based project management strategies, and adaptive method selection, which are critical for SME project success.

Research Problem and Background

Although the role of the complex technology projects in improving the competitiveness of the SMEs is crucial, many of them are not successful. Various studies have shown that project success rates are still low and that they are associated with project dynamics (Butler, Vijayasarathy & Roberts, 2020) and complexity which is not well managed. However, two decades of professional experience in technology contexts of SMEs reveal that many such firms do not perform systematic assessment of complexity and do not include success metrics within the project governance structure. Therefore, many of these unmanaged risks end up turning into project failures.
Although numerous academic works have contributed to the understanding of project complexity and managerial experience, the literature review is inconclusive. Some studies also establish the negative effects of complexity (Hu et al., 2023), others have a wide variability that might be caused by incomplete assessment. Likewise, some authors argue that managerial experience improves outcomes (Müller & Turner, 2007a; Murphy & Ledwith, 2007), while others find experience insufficient absent proper methodology alignment (Pace, 2019). This suggests a significant missing link on how project managers with experience deal with complexity in SMEs and how they select methodologies to achieve project success.
Given technology SMEs' substantial reliance on project-based work, improving project success rates is critical for business success. This study therefore aims to (1) clarify how complexity affects SME project success, (2) assess whether and how managerial experience influences complexity's negative effects, and (3) examine how experienced managers adopt methodologies to optimize project success. Through the application of research-backed theoretical frameworks in the context of actual SME project environments, this research provides practical recommendations for enhancing the effectiveness of project management in SMEs.

Objectives

This study investigates the relationship between project complexity, project manager experience, and project management methodologies in determining project success in SMEs. The aim of this work is to clarify these relationships based on proven assessment methods. The research objectives are:

1. Examining the effects of project complexity and project manager experience on the success of technology projects in SMEs.
2. To establish whether and how project manager experience can alleviate the adverse effects of complexity on success.
3. To find out how project manager experience affects the use and effectiveness of various project management approaches.

These objectives are used to formulate the research questions (RQs) and the hypotheses (HYs) which will be tested in the quantitative and qualitative data collected in the study. Table 1 shows the research questions, hypotheses, and statistical models associated with them.

Table 1 RQs, Related HYs, and Statistical Models

RESEARCH OBJECTIVES	RQ	RESEARCH QUESTION	HYPOTHESIS	STATISTICAL MODEL	MODEL TYPE
Analyze how project complexity and project manager experience influence the success of SME technology projects.	RQ1	How do project complexity and project manager experience impact the success of SME technology projects?	**HY 1.1:** Higher project complexity reduces project success rates.	Model 1.1	Linear Regression
			HY 1.2: More experienced project managers improve success rates.	Model 1.2	Linear Regression
Determine whether project manager experience helps reduce the negative impact of complexity on success.	RQ2	Can project manager experience reduce the negative effects of complexity on project success?	**HY 2.1:** Experienced project managers moderate the negative impact of complexity by using better strategies.	Model 2.1	ANOVA/ Post Hoc Testing
			HY 2.2: The influence of project manager experience is distinct between project management success and product success.	Model 2.2	ANOVA/ Post Hoc Testing
Assess how project manager experience influences the effectiveness of different project management approaches.	RQ3	How does project manager experience influence the link between chosen project management approaches and project success?	**HY 3.1:** Different project management methodologies have varying impacts on project success.	Model 3.1	ANOVA
			HY 3.2: Experienced project managers are more likely to select methodologies, leading to higher success rates.	Model 3.1	ANOVA/ Chi Square

Theoretical Foundation

This study builds upon established theories of project success and project complexity. Though there has been a lot of study in these areas already, not much attention has been given to how complexity, managerial experience, methodology selection, and their combined influence impact the success of projects in medium technology-oriented businesses. In line with IPMA (2015) ICB4's emphasis on bridging "Perspective" (organizational alignment), "People" (leadership, communication), and "Practice" (project design), this chapter clarifies how these theoretical concepts are relevant, in practice.

Project Success and Failure

The concept of project success has changed substantially over time. It goes now beyond the traditional triple constraints of scope, time, and cost. It also includes factors like strategic alignment, stakeholder satisfaction, and long-term organizational impact (Pinto & Slevin, 1988; Baccarini, 1999; Shenhar et al., 2001). Baccarini (1999) argues that there is a difference between the success of project management (efficiency in execution) and product success (the long-term effects of project results), a distinction that's also important, for SMEs (Turner et al.,2012). Nevertheless, the latest study by Ika and Pinto (2022) shows that our grasp of project success is continuously developing and not yet fully comprehensive.

Despite these developments, SMEs rarely adopt such comprehensive success frameworks systematically, based on practical observations over the last two decades. This mismatch between theory and industry practices could potentially limit SMEs from strategically evaluating and improving project success rates. As a result, this study makes an effort to utilize established evaluation frameworks that are simple enough for direct implementation in SME settings. By adopting these frameworks, the study (1) addresses critical gaps in SME-specific literature and (2) also enhances the immediate applicability of its findings for SME practitioners.

Project Complexity and its Impact to Project Success

Project complexity is recognized as a critical barrier to project success, significantly increasing uncertainty and risk in project execution (Geraldi, Maylor & Williams, 2011; Maylor & Turner, 2017; Azmat & Siddiqui, 2023). Initially defined primarily by the number and interdependencies of project elements (Baccarini, 1996), the complexity concept has evolved towards more multidimensional interpretations. Geraldi et al. (2011) introduced a framework comprising structural, uncertainty, dynamic, pace, and socio-political complexities. Thereby, the inclusion of human and dynamic aspects broadens the perspective regarding complexity.

Sudden changes of conditions are challenging, as emergent complexity introduces unpredictable conditions that frequently undermine conventional management practices (Maylor & Turner, 2017). According to Hu et al. (2023) different aspects of project complexity have impacts, across success metrics. Maylor et al. (2013) condensed the concept of project complexity into three critical dimensions: structural complexity, socio-political complexity, and emergent complexity. Their Complexity Assessment Tool (CAT) provides a practical and systematic method for identifying and managing complexity drivers. This enables project managers and organizations to proactively gauge project complexity and facilitate managerial discussions. Thus, this tool supports the stakeholder alignment process. This also aligns with IPMA´s Practice Domain, specifically Key Competence Indicator 4.5.1.3, "Determin complexity and its consequences for the approach" (2015, p. 104).

The detrimental impact of complexity on project success has been repeatedly documented. Specifically, unmanaged complexity directly correlates with increased project failure rates (Maylor & Turner, 2017). They further highlight that socio-political complexities, involving relational and communication challenges, are among the most difficult to handle. This underlines the importance of employing experienced project managers in complex projects. By applying a standardized and proven framework (CAT), this study aims to address the "lack of comparability", noted in prior research and provide SME managers with implementable tools.

Role of Project Manager Experience

From an IPMA (2015) ICB perspective, experience is defined as the practical integration of knowledge, skills, and abilities in real project environments. While knowledge and skills can be formally assessed, experience grows through repeated application and contextual learning (Flyvbjerg, 2024), making it crucial for achieving competence.

Project manager experience is often identified as a critical factor of project success, especially in managing complex projects (Gaddis, 1959; Müller & Turner, 2007a; Salvador et al., 2021). Experienced project managers typically demonstrate enhanced leadership, effective stakeholder management, and stronger decision-making capabilities. This allows them to manage project challenges effectively (Müller & Turner, 2010a, 2010b; O'Sheedy & Sankaran, 2013). However, the literature presents also mixed evidence regarding whether and how experience predicts project success (e.g. Hoxha & McMahan, 2018) or if its effectiveness depends on the appropriate application of project management methodologies (Murphy & Ledwith, 2007; Pace, 2019; Gemino, Horner Reich & Serrador, 2021).

This is particularly relevant in SMEs, where project managers often handle projects in addition to other operational duties. At the same time, Murphy and Ledwith explicitly argue that "Project success is more likely in firms that have full-time identifiable project managers and that apply project planning techniques" (2007, p. 164). Thus, SMEs often have limited capacity for systematic project management practices. This underscores the critical role of project manager experience in compensating for methodological and procedural gaps in the organization.

This research aims to fill these gaps by investigating not only the direct influence of project manager experience on SME project success but also its moderating role in the relationship between project complexity and success. Furthermore, this study examines how the project manager's experience influences the choice of project management methods and thus the project success.

Project Management Methodologies

Project management methodologies can significantly influence success, ranging from traditional (predictive) approaches emphasizing control and predictability, to agile methods prioritizing adaptability (Gemino et al., 2021; O'Sheedy & Sankaran, 2013). **Studies such as by Serrador and Pinto (2015) highlight positive effects of agile methodologies on project success.**

More recently, hybrid methodologies have been discussed, combining the strengths of predictive and agile elements to better respond to complex project environments (Reiff & Schlegel, 2022)**. Such models are also relevant to SMEs, because they balance formal governance and the agility needed to adapt to changing conditions (Žužek et al., 2020).**

SMEs often cannot use large-scale, rigid frameworks, relying instead on project managers' judgments and experience to implement or adapt methods. **Effective methodology adoption in SMEs is highly context-dependent. This points to the necessity for tailoring project management practices to organizational size, project complexity, and available resources (Turner, Ledwith, & Kelly, 2010; 2012). Consequently, the project manager's ability to select and flexibly adapt methodologies to project demands is crucial to achieving project success in SMEs.** Geraldi et al. (2011) emphasize that complexity, particularly its socio-political and emergent forms, demands adaptive project management approaches rather than rigid planning methods.

Despite these aspects, empirical evidence remains limited concerning how project manager experience specifically affects the selection and effectiveness of different methodologies within complex technology-oriented SMEs. This study addresses this gap by examining the linkage between experience, methodology selection, and project success. Thereby, this work expands our understanding of methodology choice within IPMA ICB4's "Practice" domain.

Methodology

Overview and Purpose

This chapter outlines the research design, data collection methods, and analytical techniques used to examine the relationship between project complexity, project manager experience, and project success in SME technology projects. It describes the quantitative and qualitative components of the study, the sample selection, and the statistical models applied to test the hypotheses. The approach ensures rigorous empirical validation while maintaining practical relevance for SME project management.

Research Design

This study deliberately employs established project success frameworks by Pinto & Slevin (1988), Baccarini (1999), and Shenhar et al. (2001) due to their comprehensive yet adaptable criteria, effectively reflecting SMEs' practical realities and organizational relevance. Additionally, the Complexity Assessment Tool (CAT) developed by Maylor et al. (2013; Maylor, 2024) was specifically selected for its practical usability, ease of application, and suitability for integration into existing project management processes. Its structured yet straightforward approach makes it feasible to apply regularly as part of the company's ongoing project governance.

Regression analysis was chosen to quantify the direct, predictive relationships between project complexity, managerial experience, and project success, enabling precise estimation of their individual impacts (Frost, 2019). ANOVA was chosen to examine differences in success across defined groups, such as methodologies and complexity levels, due to its robustness in handling categorical independent variables and continuous dependent variables (project success), suitable for exploring interaction effects (Goss-Sampson, 2020). Additionally, the chi-square test was used to assess whether experienced project managers significantly differ in their methodological choices compared to less-experienced managers, given its suitability for association testing (Goss-Sampson, 2020).

While these methods are suited to the dataset and research questions, certain limitations exist. Regression and ANOVA analyses assume normality and homogeneity of variance, which were partially violated. Therefore, non-parametric validations were conducted to mitigate this limitation. Additionally, the chi-

square test indicates associations but cannot infer causality. Moreover, the dataset's retrospective nature might introduce biases related to archival data quality, though high representativeness mitigates this concern.

Project Sample

The research draws its data from a German technology company that operates in complex industrial product development and global supply chain management. The dataset contains 65 technology projects from a medium-sized German technology company which represents 85% of all major technology projects conducted by the firm between 2000 and 2024. The remaining projects were excluded due to incomplete data. The high coverage rate minimizes selection bias while making the dataset representative of all projects managed by the company throughout its history.

The research includes multiple project characteristics such as different project types and two distinct industries alongside cross-functional and international teams and diverse stakeholder environments. The project teams consisted of between 5 to 75 core members who worked on projects that lasted from months to multiple years. Project sponsors within the settings included internal and external stakeholders while most projects needed to meet strict delivery deadlines. Real-world project environments receive complete coverage from these conditions.

The exclusive use of data from a single company restricts the generalization of findings to different extreme SME settings. The detailed dataset enhances internal validity specifically for technology-focused SMEs with comparable structures but future studies should validate generalizability by including data from multiple firms and industries.

Quantitative and Qualitative Analysis

This study employs a non-experimental, correlational design to examine the relationships between project complexity, project manager experience, and project success in SMEs. The research framework is structured to assess direct impacts, moderating effects, and methodology-based influences on project success. Independent (IV) and dependent variables (DV) are defined. Based on the descriptive analysis, the skewness in the dataset necessitates careful interpretation, because all outliers were retained in the analysis, as they represent key projects rather than anomalies. Correlation analysis is used to identify basic associations between project complexity, managerial experience, and project success (Velleman & Wilkinson, 1993). Hypothesis testing is conducted at a 95% confidence level ($p < 0.05$) to validate the findings (Frost, 2020). The statistical models and accompanying hypotheses (HY) employed are visualized in Figure 1.

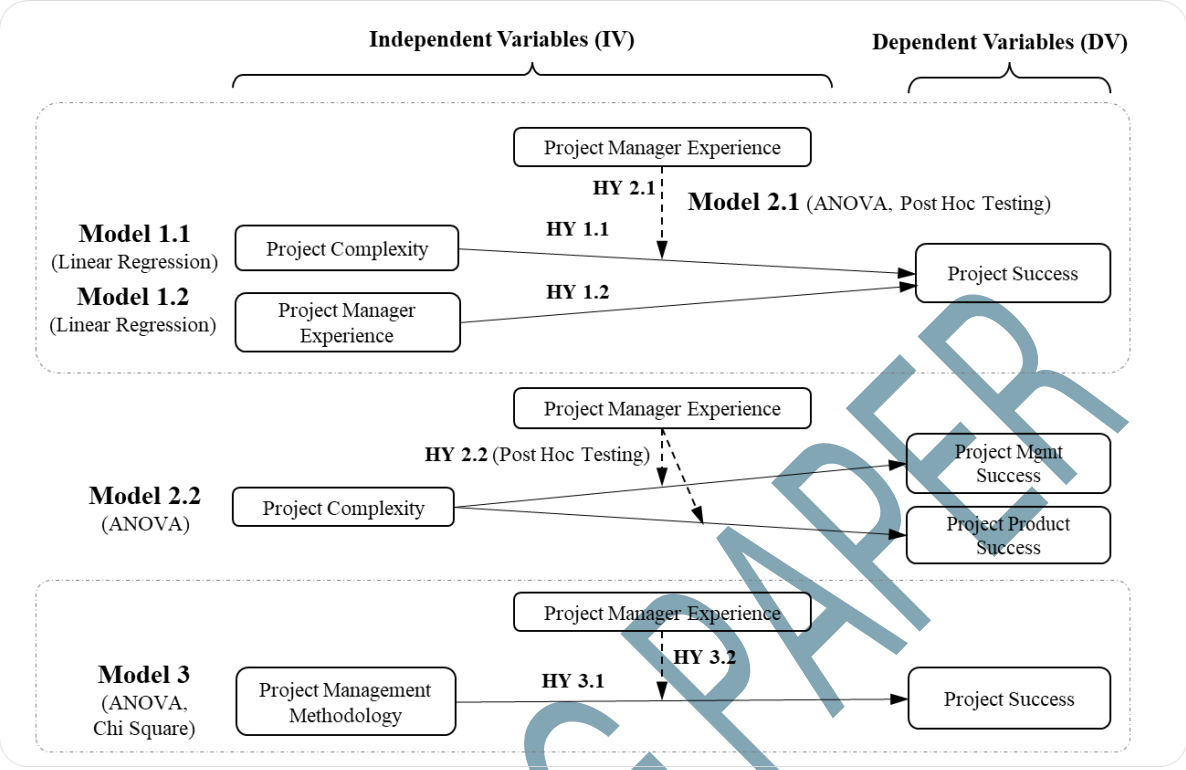

Fig. 1 Research Model

Linear regression Model 1.1 and Model 1.2 assesses the isolated direct effect of project complexity and project manager experience on project success to gain insights into fundamental relationships.
Model 2.1 (ANOVA) categorizes complexity and experience into two distinct groups to enable a comparative analysis using post-hoc testing (Goss-Sampson, 2020). Building on Model 2.1, Model 2.2 splits the dependent variable into project management success and product success, targeting to provide an in-depth view into how complexity and experience affect each dimension of success.
Model 3 (ANOVA) examines the impact of project management methodology on project success, complemented by a chi-square test to analyze the association between project manager experience and the selection of methodologies contributing to project success.

To contextualize the statistical findings, a qualitative component was added. This allows better exploration into how experienced managers interpret complexity and how they apply practices that may not be fully captured through quantitative data alone. For this, a purposeful sampling strategy (Patton, 2015) was employed, targeting project managers with 15 to 25 years of experience in managing technology projects within the firm (overall work-experience goes beyond these numbers). This focused approach maximizes the depth and relevance of interview content. The interview questions specifically centered on complexity management, methodology selection, and the role of managerial experience. By selecting highly experienced individuals, the study taps into managerial perspectives on how they navigate socio-political, technical, and emergent complexities. These topics are addressed through both closed and open-ended questions.
Although the sample size (n=4) is small, it is suited to this exploratory objective, prioritizing deep, context-specific data over broad generalization. Drawing on professionals who handle multiple real-life complexities ensures that their responses reflect field-tested learnings. This should reinforce the study's aim to derive practical applicability for project management in SMEs. This method aligns with established qualitative research standards, where in-depth expertise is assumed more valuable than a larger but

shallower participant pool (Creswell, 2014). Hence, despite its modest scale, the qualitative input provides substantial managerial perspectives, complementing the quantitative findings.

Data Collection Methods and Procedure

The first phase of quantitative data collection involved consolidating and structuring project records from the firm into one dataset. This dataset was used to define and measure the independent variables (IVs) and dependent variables (DV).

- **Project Success (DV)** is measured using established frameworks by Pinto & Slevin, (1988), Baccarini (1999), and Shenhar et al. (2001), considering both in-project performance and long-term outcomes relevant to the company. The 10 selected success criteria are sub-divided into 2 groups:
    - **Project Management Success (DV):** Scope, time and cost
    - **Project Product Success (DV):** Business benefits, project outcome is being used, long-term impact to the organisation, project team satisfaction, degree of innovation, functional performance, and contributes to market share/avoids erosion.
- **Project Complexity (IV)** is assessed using the Complexity Assessment Tool (CAT) developed by Maylor et al. (2013) and Maylor (2024).
    - Each complexity criterion was assigned to all 65 projects using a binary score: absent (0) or present (1), with a total complexity score ranging from 0 to 66.
    - The overall complexity score includes structural, sociopolitical and emerging complexity dimensions, which are not analyzed separately in this paper. Rather, the total complexity score is measured.
- **Project Manager Experience (IV)** is defined as the total number of years of experience in technology project management at the start of each project. This variable was chosen intentionally because its simplicity is preferred over more complicated choices, such as a competency-based assessments.
- **Project Management Methodologies (IV)** is classified into three categories based on the firm's project management practices:
    - **Laissez-Faire Project Management** is characterized by minimal or inconsistent use of project management tools and methods, lacking formal project governance.
    - **Waterfall (Classic) Project Management** is focused on predictive planning and may contain minor adaptive elements, with projects executed within a structured governance framework.
    - **Hybrid Project Management** combines predictive approaches with substantial agile elements (e.g., Scrum for software components of the projects or iterative prototype builds and learning cycles), operating within a formal governance structure.

The quantitative data were analyzed using the statistical software JASP (Version 0.18.3). The dataset consists of continuous interval data, which is suitable for the selected statistical methods and aimed pattern recognition (Wilkinson, 1999), as the number of ordered categories exceeds five (Newsom, 2021). For each statistical model, assumptions were systematically tested to ensure validity. Additionally, qualitative data were examined to identify patterns and contextual information that complement the quantitative findings.

Findings

Overview

This section presents the key findings from the quantitative and qualitative analyses, focusing on the relationships between project complexity, project manager experience, project management methodologies, and project success. The results provide empirical support for the study's hypotheses and contribute to a deeper understanding of how project complexity is managed in SME technology projects.

Quantitative Findings

Correlational Results

The correlation analysis confirms strong relationships among the key variables. Project complexity shows negative correlation with success while project manager experience shows positive correlation with success. The results show that higher complexity levels result in lower success rates and that higher experience leads to better success scores (also for sub-dimensions of project success) which confirms **RQ1** and its related hypotheses. Table 2 shows specific details about relationships with their corresponding statistical values.

Table 2 Correlation Analysis of Key Variables

				Pearson		Spearman	
			n	r	p	rho	p
Project Success	-	Experience	65	0.481 ***	< .001	**0.428 *** **	**< .001**
Project Success	-	Project Complexity	65	-0.490 ***	< .001	**-0.543 *** **	**< .001**
Project Management Success	-	Experience	65	0.586 ***	< .001	**0.588 *** **	**< .001**
Project Management Success	-	Project Complexity	65	-0.379 **	0.002	**-0.381 ** **	**0.002**
Project Product Success	-	Experience	65	0.340 **	0.006	**0.262 * **	**0.035**
Project Product Success	-	Project Complexity	65	-0.431 ***	< .001	**-0.475 *** **	**< .001**

* p < .05, ** p < .01, *** p < .001

Complexity-Success Relationship (Isolated Influence)

The Linear Regression Model 1.1 shows how project complexity affects project success. The results show that higher complexity has a strong negative impact on success (β = -0.49; t = -4.458; p < .001) which supports **HY 1.1.** This result underscores that complexity is a critical risk factor in SME technology projects. This finding also supports the idea that complexity needs to be actively managed to prevent adverse effects.

Project Manager Experience-Success Relationship (Isolated Influence)

The second regression model (Model 2) is used to examine the relationship between project manager experience and project success. Since this relationship is nonlinear, a logarithmic transformation was used to improve the fit of the model. As Frost (2019, p. 238) states, "Transformations of the independent variable allow you to model nonlinear relationships that you could not otherwise model using linear regression." The original experience data was fit to the function

$$y = 1.3608 \ln(x) + 4.7332$$

This improved the fit of the model as shown in Figure 2.

Fig. 2 Experience-Success Relationship

This finding is consistent with the theoretical expectations regarding learning from experience (Müller & Turner, 2007a, p. 307). Project managers become better leaders as they gain experience (Müller & Turner, 2010a) and, consequently, their projects become more successful (Müller & Turner, 2010b). However, the relationship is one of diminishing returns where learning is rapid at first but then levels off over time, consistent with Newell and Rosenbloom's (1981) findings.
There is no way that further increases in experience can exceed the maximum defined success score of 10, and the model must therefore approach this limit asymptotically. It was also established that the logarithmic function fits better than the original model, with an R^2 of 0.340 compared to 0.231, which means that the logarithmic model explains a greater proportion of variance in project success. The results of the regression show that experience has a large positive and statistically significant effect on project success ($\beta = 0.583$; $t = 5.698$, $p < .001$). This strong positive effect confirms **HY 1.2**, which states that more experienced project managers get higher overall success rates, which is also seen in the correlation analysis.

Impact of Experience to the Complexity-Success Relationship
Model 2.1 (ANOVA) provides deeper insight into whether experience moderates the negative relationship between complexity and success, answering **RQ2**. In order to divide the complexity variable into two groups (low and high), the median split method (Iacobucci et al., 2015) was employed, and the experience variable was divided into low (≤ 5 years) and high (> 5 years) based on the significant differences found in previous regression analyses. However, the overall interaction effect was not statistically significant, but subgroup analyses show that more experienced project managers performed better than less experienced managers under both low and high complexity. The difference is most pronounced in high-complexity settings, in line with **HY 2.1**. This means that experience to some extent reduces the adverse effects of complexity by reducing the variability of outcomes and stabilizing performance. Further, post-hoc comparisons are used to explain how experience affects success at different levels of project complexity:

- **Low complexity projects** show that experienced managers perform better than inexperienced managers with success improvement of 19.6%.
- **High complexity projects** show an even greater effect of experience, where experienced managers achieve significantly higher success scores, with success improvement of 32.06%.

These findings are visualized in Figure 3 and show that while experience improves success in all projects, it does so more significantly in high complexity projects, consistent with **HY 2.1.** This means that project manager experience partially moderates the complexity-success relationship.

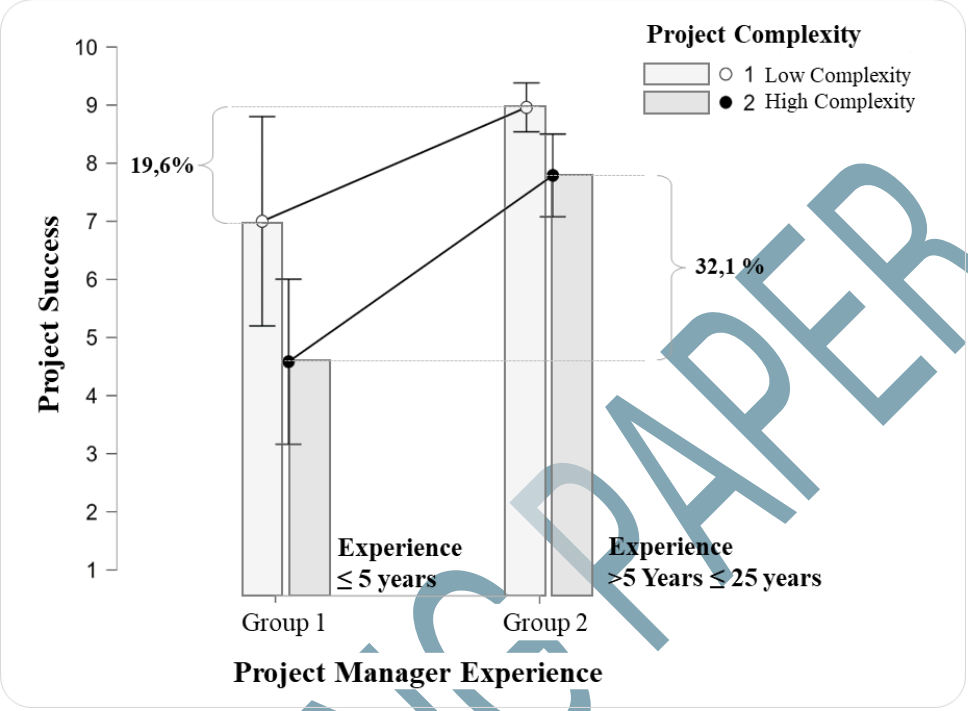

Fig. 3 Impact of PM Experience on the Complexity-Success Relationship

Moreover, Figure 3 also indicates that the spread of success scores is lower for experienced managers in both complexity groups, indicating that experienced managers not only improve success rates but also decrease the chances of failures. This means that experience leads to more consistency in project performance especially in complex environments.

Impact of Experience to Project Management Success vs. Product Success

Model 2.2 (ANOVA) investigates project management success (scope, time, cost) in contrast with product success. Post Hoc Testing reveals that the difference between both success dimensions differs, also in both experience groups, confirming **HY 2.2**. Project management success is more significantly affected by the level of managerial experience. This is because the change-rate of success in both complexity groups (related to project management success) is larger than in the product success dimension. Moreover, the obtained success rates are higher than in product success. Finding suggests that product success (sum of metrics beyond the Tripple-Constraint) may be dependent on other external or market factors which may be less controllable by the project manager. Interestingly, in high complexity conditions with low managerial experience, success rates on both dimensions (product success and project management success) are below 50% (Figure 4), which means that the project is considered failed. This finding underscores the significance of experience in countering the adverse effects of complexity.

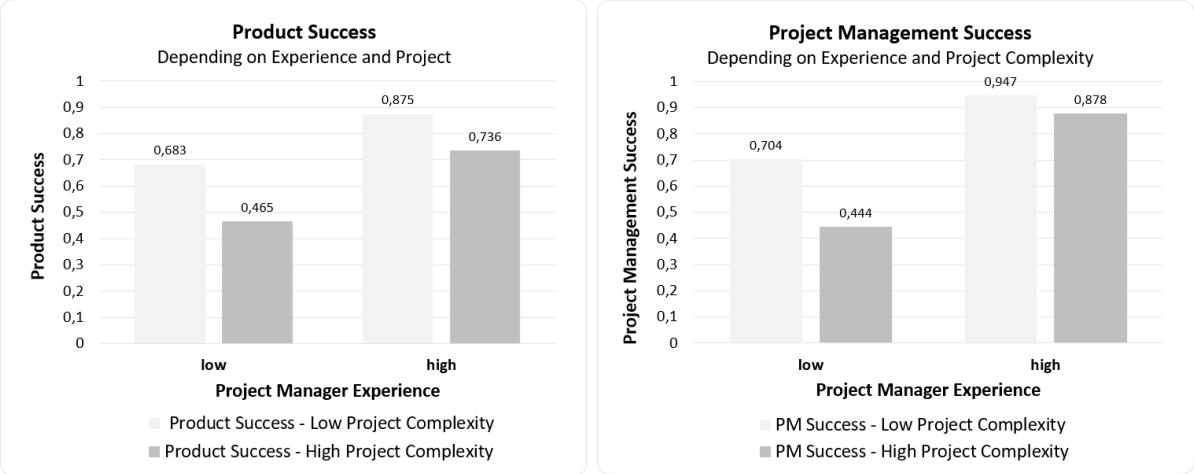

Fig. 4 Project Management Success & Product Success depending on Complexity and Experience

Impact of Experience on the Methodology-Success Relationship

Model 3 checks the effect of project management methodologies on project success and tests **HY 3.1** which posits that PM methodologies are significant predictors of project success in SMEs. An ANOVA analysis was employed to compare project success among three project management approaches; laissez-faire, hybrid and traditional.

The results showed that there was a significant effect of project management methodology on project success ($F(2, 62) = 32.109$, $p < .001$, $\eta^2 = 0.509$). The post-hoc comparisons indicated that both hybrid and traditional (classic) approaches outperform laissez-faire approaches ($p < .001$) showing large mean differences. However, no statistically significant difference was found between hybrid and traditional methodologies ($t = -0.721$, $p = 0.752$). In total, these findings confirm **HY 3.1**, which shows that PM methodology has a direct effect on project success. The mean success scores of the three groups are shown in Figure 5.

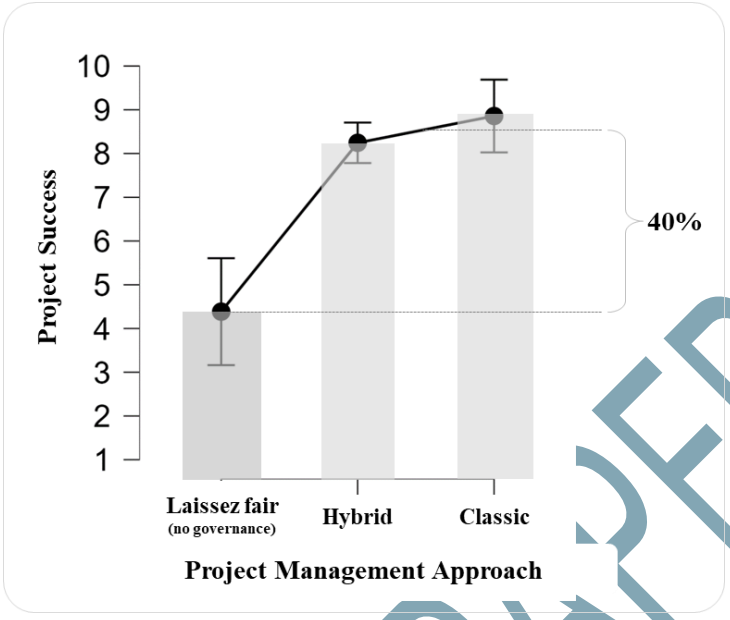

Fig 5 PM Methodology Impact on Project Success

Inevitably, the question arises as to whether there is a pattern between the choice of method and the PM experience. The chi-square analysis together with Fisher's exact test demonstrated a strong statistical relationship between project manager experience and methodology selection (Fisher's p <.001). The log odds ratio was −4.049 (95% CI: [−6.212, −1.886]), indicating that experienced project managers were far less likely to use laissez-faire approaches. The calculated raw odds ratio reaches 57.33 which shows that project managers with more than five years of experience chose hybrid or traditional approaches over laissez-faire methods by a factor of 57. The methodology choice by project manager experience is visualized in Figure 6.

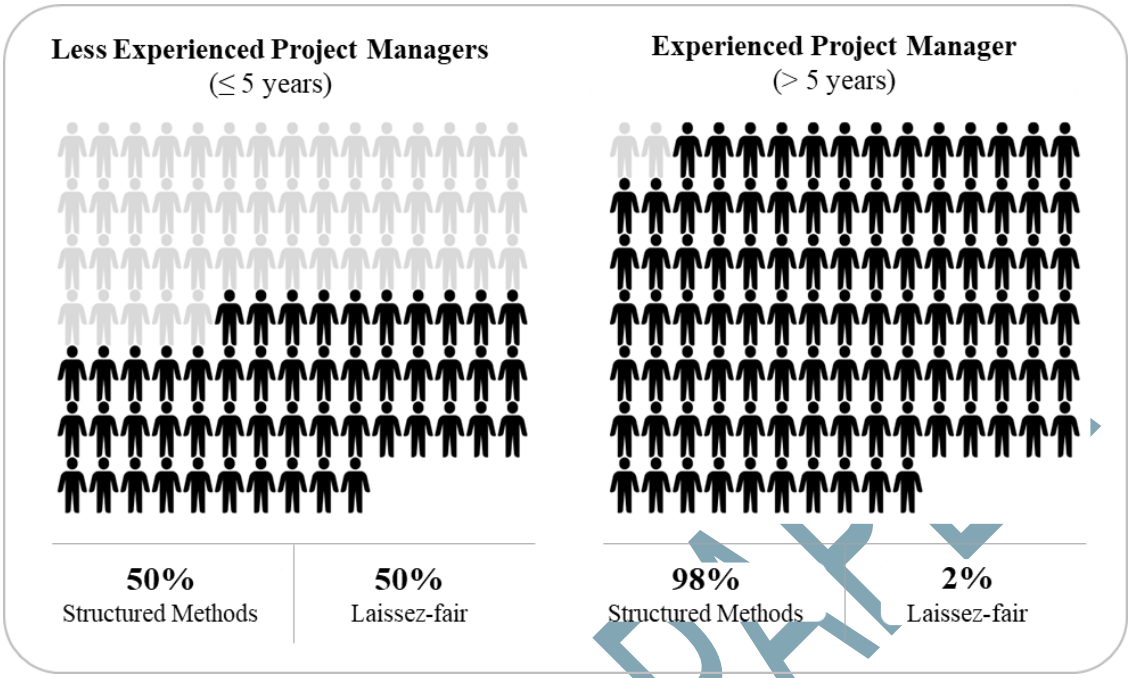

Fig 6: Methodology Choice by Project Manager Experience

Thus, the results support hypothesis **HY 3.2** and demonstrate how experience serves as a crucial factor for selecting appropriate methodologies. The discovery does not imply that hybrid or traditional approaches automatically result in better success rates. Rather, the findings show that experienced project managers demonstrate better capability to choose methodology-sets that suit project requirements which leads to higher chances of project success.

Qualitative Findings

Semi-structured interviews with project managers provided qualitative data which enriched the results and presented real-world examples of complexity management in SME technology projects. Respondents emphasized that experience plays a key role in managing project complexity through better decision making and risk management and stakeholder handling.

Understanding Complexity in Practice

Participants linked complexity mostly to stakeholder expectation changes, technical requirement modifications, and new technologies along with political and social factors. The provided descriptions also showed an incomplete perception of project complexity as a concept. Complexity assessments following formal procedures were incomplete (if applied at all) and managers based their assessments mostly on personal intuition. Formally implemented risk assessment included only minimal evaluation of specific aspects according to one manager who indicated the necessity for structured yet practical assessment methods.

The interviews showed that project complexity theoretical frameworks described by Baccarini (1996), Geraldi et al. (2011), or Maylor et al. (2013) remain absent in practical project applications. “Conflicting stakeholder expectations” and “rapid, unexpected changes” represented the main challenges that interviewees associated with complexity rather than multiple complexity dimensions such as structural, socio-political, and emergent complexities.

The Role of Experience in Managing Complexity

Managing complexity depends heavily on practical experience according to the interview data. According to interviewees the ability to prioritize tasks, make rapid decisions, and detect upcoming risks matures through the accumulation of professional experience. One interviewee emphasized the following point: "Experience helps prioritize decisions and clearly distinguish critical from less important issues," implicating the essential role of practical knowledge in identifying project risks before they occur. The survey results support this since statistical data indicates that managers with extensive experience perform better in handling complex projects. However, project managers with more than 15 years of experience still managed complexity based on instinctive reactions toward specific situations rather than using systematic frameworks. Their practical methods show an ongoing theory-practice divergence within SME projects, which indicates potential for improvement.

Adaptive Methodology and Governance Practices

All interviewees reported using flexible, adaptive methodologies tailored to the evolving needs of each project. Project managers frequently adjusted their governance structures together with communication processes and planning routines without following a strict framework. The team member noted that methodological adjustments took place "constantly" during the project development phase. A second project member explained that adaptive planning alongside continuous stakeholder alignment helped maintain control when unexpected changes occurred.

The results confirm the statistical finding which shows that project managers with experience base their methodology selection on project-specific conditions. The ability to adapt tools and practices appears essential in SME settings where unpredictability and resource constraints are common.

Interpersonal Competence and Socio-Political Management

Several managers pointed out that the socio-political aspects of project complexity require better communication and interpersonal abilities for their management. Communication abilities gained through prior projects enabled the participants to better deal with complex situations. This demonstrates that soft skills developed through experience become essential competencies when managing relational complexities (socio-political complexities) between internal and external stakeholders. SMEs in particular benefit greatly from these skills, as their limited formal structures offer important freedom for experienced managers. Interpersonal abilities function as a connecting link that enables successful stakeholder relationships alongside project technical execution according to the interview data.

Summary

The qualitative results enhance the quantitative findings to show how experienced project managers tackle complexity in SMEs through real-world practical approaches. Their effective approaches function largely autonomous from established theoretical structures. The research demonstrates how organizations rely on personal experience combined with adaptable approaches and communication excellence to manage complexity. The study reveals an essential disconnect between academic models and SME project management practice that indicates the need for research-backed and simple complexity management tools for SMEs.

Discussion and Conclusion

Discussion

The study results show how project complexity, managerial experience, and project management methodology influence project success in SME technology environments with resource constraints. Most studies in this field have analyzed larger organizations (e.g., Flyvbjerg et al., 2022; Hoxha & McMahan, 2018). However, the research evidence shows that firms gain major advantages through proactive complexity management together with experience-based decisions despite their restricted formal

governance capacity. The results show that unmanaged complexity functions as a major barrier to success which aligns with Azmat and Siddiqui's (2023) study about complexity effects across various industries.
This research proves that experience demonstrates a non-linear learning pattern in SME operations. SMEs need to pay special attention to this research because SMEs commonly use part-time project managers who handle various duties simultaneously (Murphy & Ledwith, 2007). The situation requires experienced project managers to handle dynamic and resource-constrained environments.
The data show that experienced managers demonstrate better abilities to foresee risks, tailor methodologies and maintain stakeholder alignment resulting in reduced success rate variance and project failure risks. Such adaptability finds its basis in the hybrid or context-tailored methodology recommendations (Gemino, Horner Reich & Serrador, 2021). The study supports theoretical evidence that fixed frameworks fail to handle the real-world complexities as emphasized by Geraldi, Maylor & Williams (2011).
This research establishes how experienced managers select methodologies because they choose methods that lead to higher success rates. The study does not prove that any particular methodology automatically leads to positive results, but it shows how essential experienced judgment becomes in SME contexts.
Project managers who lack formal education about project complexity use their practical abilities and intuitive approaches to address unforeseen project problems. This finding support Flyvbjerg's (2024) argument about how experience functions as a critical element in decision-making processes. By leveraging accumulated knowledge and adaptive leadership, project managers can better manage complexity effectively, even in the absence of a comprehensive theoretical framework.

Conclusion

This research confirms that project complexity is an important risk factor in SME technology projects, and that managerial experience can mitigate its negative impact, especially in highly complex projects. The empirical demonstration of a diminishing returns pattern on experience offers new perspective to the existing literature, that experience is crucial, but does not provide a complete protection against project failure. Moreover, the observed methodological preferences of the experienced project managers indicate context-dependent decision making, which highlights the need for a customized project management approach. Overall, the results of this research have three major implications:

1) SME leaders and policymakers should appreciate the real advantages of systematic complexity measurement and should focus on improving project management skills of their employees through specific training and mentoring.
2) The level of experience of the project manager should be proportional to the level of complexity of the project to increase the chances of success. However, this requires that project complexity is systematically measured.
3) The use of flexible yet formal governance structures throughout the project life cycle ensures that rapid changes are in line with the organizational objectives, thus confirming the importance of approach adaptation.

Also, the results of this study confirm several of the key competence elements identified in the IPMA (2015) ICB4 Practice Domain, specifically in relation to complexity management, choosing the right project approaches, and delivering towards success criteria. The influence of project complexity on success, and the capability of experienced managers to neutralize these effects, directly confirm the importance of key performance indicator:

- KPI 4.5.1.3: "Determine complexity and its consequences for the approach" (IPMA, 2015, p. 104).

Despite the lack of theoretical understanding of complexity by the interviewees, their experience allowed them to sense and react to the complexity factors. Also, the finding that experienced project managers are more likely to use the right mix of structured methodologies in their projects is in line with the following key performance indicators:

- KPI 4.5.1.4: "Select and review the overall project management approach" (IPMA, 2015, p. 104).
- KPI 4.5.1.5: "Design the project execution architecture" (IPMA, 2015, p. 104).

These managers changed their approaches in response to context-specific changes, as expected by IPMA´s ICB4, that project approaches should be regularly assessed and adjusted. In conclusion, the study reveals that experience of project managers is one of the key factors that determine project success in SMEs, because:

1) Experience has a strong impact on project success.
2) Experience helps to reduce the negative effects of complexity through the active and context-oriented management.
3) Experience provides the skills that enable the selection of a tailored methodology in order to increase the likelihood of project success. Conversely, not using a suitable project management methodology is not a good idea, as its absence predicts a 40% lower success rate.

Hence, experience is an important enabler of project success in complex SME environments, validating core principles of the IPMA ICB4 standard. By linking the findings to the IPMA ICB4, this study provides actionable recommendations for both researchers and practitioners seeking to elevate project success under constrained conditions.

References

Azmat, Z. & Siddiqui, M.A. (2023) "Analyzing Project Complexity, Its Dimensions and Their Impact on Project Success", *Systems (Basel)*, 11(8), pp. 417. DOI:10.3390/systems11080417

Baccarini, D. (1999), "The logical framework method for defining project success", *Project Management Journal*, 30(4), pp. 25-32. https://doi.org/10.1177/875697289903000405

Butler, C.W., Vijayasarathy, L.R. & Roberts, N. (2020) "Managing Software Development Projects for Success: Aligning Plan- and Agility-Based Approaches to Project Complexity and Project Dynamism", *Project management journal*, 51(3), pp. 262-277. DOI:10.1177/8756972819848251

Creswell, J. W. (2014). "*Research design: Qualitative, quantitative, and mixed methods approaches"*, 4th edition, international student edition. SAGE.

Deutsche Gesellschaft für Projektmanagement (2023) „Projektifizierung 2.0, Zweite Makroökonomische Vermessung der Projekttätigkeit in Deutschland". *UVK Verlag*. DOI:https://doi.org/10.24053/9783381102624

European Comission (2023) "*SME Performance Review. Annual Report of European SMEs 2022/2023"*. [Online]. Available from: https://single-market economy.ec.europa.eu/smes/sme-strategy/sme-performancereview_en#paragraph_885 [Accessed 4 June 2024].

Flyvbjerg, B. (2024) "Heuristics for Better Project Leadership: Teasing Out Tacit Knowledge", *Project Management Journal*, 55(6), pp. 615–625, DOI: 10.1177/87569728241300307

Flyvbjerg, B., Budzier, A., Lee, J. S., Keil, M., Lunn, D. & Bester, D. W. (2022) "The Empirical Reality of IT Project Cost Overruns: Discovering A Power-Law Distribution", *Journal of Management Information Systems*, 39(3), pp. 607-639, DOI: 10.1080/07421222.2022.2096544

Frost, J. (2019) *"Regression Analysis: An Intuitive Guide for Using and Interpreting Linear Models"*. Statistics By Jim Publishing, pp. 1-343. ISBN 1735431184, 9781735431185

Frost, J. (2020) *"Hypothesis Testing: An Intuitive Guide for Making Data Driven Decisions"*. Statistics By Jim Publishing, pp. 1-369. ISBN 173543115X, 9781735431154.

Gaddis, P.O. (1959) *"The Project Manager"*, Harvard Business Review, 37(3), pp. 89–97. [Online]. Available from: https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=6770508&site=ehost-live&scope=site [Accessed: 4 June 2024].

Gemino, A., Horner Reich, B. & Serrador, P.M. (2021) "Agile, Traditional, and Hybrid Approaches to Project Success: Is Hybrid a Poor Second Choice?", *Project management journal*, 52(2), pp. 161-175. DOI:10.1177/8756972820973082

Geraldi, J., Maylor, H. & Williams, T. (2011) "Now, let's make it really complex (complicated): A systematic review of the complexities of projects", *International journal of operations & production management*, 31(9), pp. 966-990. DOI:10.1108/01443571111165848

Goss-Sampson, Mark A. (2020) *"STATISTICAL ANALYSIS IN JASP. A GUIDE FOR STUIDENTS"*. 4th Edition JASP v0.14, pp. 1-172. DOI:10.6084/m9.figshare.9980744

Hoxha, L. & McMahan, C. (2018) "DOES A PROJECT MANAGER'S WORK EXPERIENCE HELP PROJECT SUCCESS?", *International journal of construction project management*, 10(2), pp. 155-172. [Online]. Available from: https://www.proquest.com/docview/2275028368/abstract/9E9F3C113CE94736PQ/1?accountid=14565&sourcetype=Scholarly%20Journals. [Accessed 17 June 2024]

Hu, Z., Wu, G., Zheng, J., Zhao, X. & Zuo, J. (2023) "UNRAVELLING EFFECTS OF PROJECT COMPLEXITY ON PROJECT SUCCESS AND PROJECT MANAGEMENT SUCCESS: A META-ANALYTIC REVIEW", *Journal of civil engineering and management*, 29(6), pp. 542-560. DOI: 10.3846/jcem.2023.19553

Iacobucci, D., Posavac, S. S., Kardes, F.R., Schneider, M.J. & Popovich, D.L. (2015) "The median split: Robust, refined, and revived", *Journal of consumer psychology*, 25(4), pp. 690-704. DOI: 10.1016/j.jcps.2015.06.014

Ika, L.A. & Pinto, J.K. (2022) "The "re-meaning" of project success: Updating and recalibrating for a modern project management", *International journal of project management*, 40(7), pp. 835-848. https://doi.org/10.1016/j.ijproman.2022.08.001

IPMA (2015) *"Individual Competence Baseline for Project, Programme & Portfolio Management"* International Project Management Association. Version 4.0 (IPMA ICB®), pp. 1-431. ISBN (pdf): 978-94-92338-01-3

Maylor, H., (2024) "***Updated Complexity Assessment Tool".*** Executive education course material. Oxford Leading Strategic Projects Programme. University of Oxford Said Business School.

Maylor, H. & Turner, N. (2017) "Understand, reduce, respond: project complexity management theory and practice", *International journal of operations & production management*, 37(8), pp. 1076-1093. DOI:10.1108/IJOPM-05-2016-0263

Maylor, H.R., Turner, N.W. & Murray-Webster, R. (2013) "How Hard Can It Be?: Actively Managing Complexity in Technology Projects", *Research technology management*, 56(4), pp. 45-51. DOI:10.5437/08956308X5602125

Murphy, A. and Ledwith, A. (2007), "Project management tools and techniques in high-technology SMEs", *Management Research News*, 30(2), pp. 153-166. https://doi.org/10.1108/01409170710722973

Müller, R. & Turner, R. (2007a), "The Influence of Project Managers on Project Success Criteria and Project Success by Type of Project", *European management journal*, 25(4), pp. 298-309. DOI:10.1016/j.emj.2007.06.003

Müller, R. & Turner, R. (2007b), "Matching the project manager's leadership style to project type", *International journal of project management*, 25(1), pp. 21-32. DOI:10.1016/j.ijproman.2006.04.003

Müller, R. & Turner, R. (2010a) "Leadership competency profiles of successful project managers", *International journal of project management*, 28(5), pp. 437-448. DOI:10.1016/j.ijproman.2009.09.003

Müller, R., & Turner, J. R. (2010b). "Attitudes and leadership competences for project success". *Baltic Journal of Management*, 5(3), 307-329. DOI:10.1108/17465261011079730

Newsom, J. (2021) *"Levels of Measurement and Choosing the Correct Statistical Test"*. [Online]. Psy, pp. 525/625, Categorical Data Analysis, pp. 1-3. Available from: https://web.pdx.edu/~newsomj/cdaclass/ho_levels.pdf [Accessed 06 August 2024].

Newell, A. & Rosenbloom, P.S. (1981) *"Mechanisms of Skill Acquisition and the Law of Practice"* in Cognitive Skills and their Acquisition, ed. J.R. Anderson, 1st edn, Psychology Press, pp. 1-55.

O'Sheedy, D. & Sankaran, S. (2013) "Agile Project Management for IT Projects in SMEs: A Framework and Success Factors", *The International Technology Management Review*, 3(3), pp. 187-195. DOI:0.2991/itmr.2013.3.3.4

Pace, M. (2019) "A Correlational Study on Project Management Methodology and Project Success", *Journal of Engineering, Project, and Production Management*, 9(2), pp. 56-65. DOI:10.2478/jeppm-2019-0007

Patton, M. Q. (2015) *"Qualitative Research Evaluation Methods: Integrating Theory and Practice"*, 4th Edition, Ringgold Inc, Beaverton. [Online]. Available from: https://link.gale.com/apps/doc/A397618969/AONE?u=ull_ttda&sid=summon&xid=abf83176 [Accessed 12 Sep 2024].

Pinto, J. K. & Slevin, D. P. (1988). *"Project success: definitions and measurement Techniques"*. *Project Management Journal*, [Online]. 19(1), 67–72. Available from: https://www.pmi.org/learning/library/project-success-definitions-measurement-techniques-5460. [Accessed 4 June 2024].

Reiff, J. & Schlegel, D. (2022) "Hybrid project management – a systematic literature review", *International journal of information systems and project management*, 10(2), pp. 45-63. DOI:10.12821/ijispm100203

Salvador, F., Alba, C., Madiedo, J.P., Tenhiälä, A. & Bendoly, E. (2021), "Project managers' breadth of experience, project complexity, and project performance", *Journal of operations management*, 67(6), pp. 729-754. DOI:10.1002/joom.1140

Serrador, P. & Pinto, J.K. (2015) "Does Agile work? — A quantitative analysis of agile project success", *International journal of project management*, 33(5), pp. 1040-1051. DOI:10.1016/j.ijproman.2015.01.006

Shenhar, A.J., Dvir, D., Levy, O. & Maltz, A.C. (2001) "Project Success: A Multidimensional Strategic Concept", *Long range planning*, 34(6), pp. 699-725. DOI:10.1016/S0024-6301(01)00097-8

Turner, J.R. & Müller, R. (2005) “The Project Manager's Leadership Style as a Success Factor on Projects: A Literature Review”, *Project management journal*, 36(2), pp. 49-61. https://doi.org/10.1177/875697280503600206

Turner, R., Ledwith, A., & Kelly, J. (2010). Project management in small to medium-sized enterprises: Matching processes to the nature of the firm. *International Journal of Project Management*, *28*(8), pp. 744–755. https://doi.org/10.1016/j.ijproman.2010.06.005

Turner, R., Ledwith, A. & Kelly, J. (2012) “Project management in small to medium-sized enterprises: Tailoring the practices to the size of company”, *Management decision*, 50(5), pp. 942-957. DOI:10.1108/00251741211227627

Velleman, P.F. & Wilkinson, L. (1993) “Nominal, Ordinal, Interval, and Ratio Typologies are Misleading”, *The American statistician*, 47(1), pp. 65-72. DOI:10.1080/00031305.1993.10475938

Wilkinson, L. (1999) “Statistical Methods in Psychology Journals. Guidelines and Explanations”, *American Psychologist*, 54(8), pp. 594-604. https://doi.org/10.1037/0003-066X.54.8.594

Žužek, T., Gosar, Ž., Kušar, J. & Berlec, T. 2020, "Adopting Agile Project Management Practices in Non-Software SMEs: A Case Study of a Slovenian Medium-Sized Manufacturing Company", *Sustainability*, 12(21), pp. 9245. DOI:10.3390/su12219245