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Evolving Competencies and Methodological Preferences in IT Project Management: An Industry 4.0 Perspective

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Abstract

The rapid advancements in technology and the digital transformation ushered in by Industry 4.0 have significantly impacted IT project management practices, reshaping the skills required for successful project execution. This study explores the evolving competencies and methodological preferences of IT project managers, focusing on the South African IT sector. Through a quantitative research approach, data was collected from 50 IT project managers with diverse professional backgrounds. The findings indicate that cybersecurity awareness and ethical decision-making are the most critical competencies, highlighting the growing importance of data protection, compliance, and responsible leadership. Agile methodologies, particularly Scrum, emerged as the preferred project management approach, reflecting the need for flexibility and adaptability in dynamic environments. Additionally, the study reveals a preference for hybrid methodologies, combining traditional and agile methods to balance stability with responsiveness. While technical skills remain essential, there is a noticeable shift towards prioritizing ethical and security-related competencies. These insights contribute to understanding the skill dynamics in modern IT project management and provide valuable guidance for organizations, educational institutions, and project managers to align their practices with Industry 4.0 demands. Further research is recommended to examine the long-term impact of these evolving competencies and to explore their applicability across various global contexts.

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Introduction

The rapid evolution of the IT sector has drastically transformed project management practices, particularly within the context of Industry 4.0, characterized by digital integration, automation, and the use of advanced technologies such as artificial intelligence (AI), big data, and cloud computing [1,2]. However, these advancements have altered the competencies

necessary for IT project managers to possess technical skills in addition to cybersecurity and ethical decision-making [3,4]. With the nature of IT projects being dynamic in nature, agile and adaptive approaches are required to address them instead of classical project management models like waterfall [5,6].

While agile practices like Scrum and Kanban are becoming more and more popular, the tendency towards hybrid project management approaches that accumulate conventional and agile practices is on the rise as an alternative to balance stability and responsiveness [7]. This hybridization is required for the management of the complex IT projects, with a structured planning as well as iterative development and stakeholder engagement. The reason they like to use agile methods is because they crave continuous feedback, collaboration, and the ability to adapt quickly to a rapidly changing technological environment [8].

On the other side, a new challenge to adding these new approaches is the resistance to change and the necessity of having specialized training in agile practices [6,9]. Moreover, the COVID-19 pandemic brought about a rapid transition towards remote work, resulting in the need for the IT project managers to acquire new skills required for remotely connected collaboration, digital communication, and the management of associated cybersecurity threats of the online project management tools [4]. This emphasizes the importance of overall training programs that can handle technical as well as managerial skills in order to prepare IT project managers for current issues.

This paper acts as an investigation into the changing competencies and methodological preferences of IT project managers in the industry of 4.0. In this research, the perspectives of IT professionals are analyzed to offer understanding on how modern project management practices are reacting to the need for technological changes in the workplace.

Methodology

Research Design

Quantitative research was used in the study since it is most appropriate to work with numbers, revealing frequencies and establishing the likelihood of observed outcomes [10]. Analytical and numerical techniques are most appropriate when data is collected from a large group of participants and is structured, as in this research work. The reason why this methodology had to be chosen is as follows: The assessment of the skills and competencies was identified as significant by the IT project managers in the military sector. Also, the study sought to identify specific preferences of the project management method as well as the matching technology advancement.

This sort of questioning was useful for determining both the specific project management competencies highly regarded by the participant IT project managers and the extent to which the different approaches are implemented. The deductive approach was used because the bulk of the research was developed after analyzing prior theories and hypotheses and collecting data to test the hypotheses. This holds the essence of the research in understanding the applicability of the traditional and new competencies in today's dynamic IT project management environment. Saunders assert that the deductive approach is suitable when there is the aspiration to return to it with hypotheses [11].

Data Collection

To extract all the necessary information, the set of questions was composed, including the use of close-ended and a few open-ended questions. Most of the issues raised were in the form of closed-ended questions, hence offering a quantitative study, while only a few open-ended questions gave a qualitative backdrop when necessary. The questions comprised three major parts: demographic, importance of skills ratings, and self-preferences of the project management methodologies

Another important aspect of the study was sampling, since the choice of the participants had to be prompt for the targeted population. The screened population involved the IT project managers who worked in the military sector with not less than three years' experience in managing IT projects. This criterion made sure that the persons could offer their views insightfully on the skills and approaches related to Industry 4.0 given that they had adequate professional experience.

The sample size comprised 50 IT project managers. This size was deemed appropriate based on the Central Limit Theorem, which suggests that a sample of at

least 30 is sufficient for statistical analysis in quantitative research [11]. This sample size allowed for comprehensive data analysis while accommodating the study's time and resource limitations.

The research questionnaire used was a structured questionnaire. A Likert scale was used in part of the questionnaire to assess the respondents' perceptions about the importance of certain skills and competencies in IT project management.

The questionnaire was piloted using a small group of 10 IT project managers to check the comprehensiveness and validity of the questions posed. From the discussions and what was observed in the pilot phase, the following changes occurred, including refining the formulation of questions to reduce their ambiguity. The finalized questionnaire was then sent electronically to the participants.

To increase the response rates, the follow-up reminders were sent two weeks after the invitation. It did help in enhancing the response rate to the targeted 50 participants with a complete response rate of 100%. Measurement: To preserve the validity of the data gathered, all the answers were recorded properly and kept confidential.

The data was then collected and cleaned in order to remove any outliers or missing data in the survey results. Data cleaning was also carried out in order to detect cases of missing values as well as cases of data inconsistency, which enabled the corrections to be made where necessary. The cleaned data were then transferred to statistical analysis software for the analysis.

Measurement relied on simple quantification, specifically, descriptive and inferential statistics for data analysis, which aimed to describe the findings and test hypotheses, respectively. Frequency and percentage analysis were adopted to describe the participants' characteristics and their ratings on the ten reporting skills. RII and weighted average were used to determine the ordinarily of these skills as perceived by human resource professionals. There was also analysis done to determine the variability in responses, that is, the interquartile range (IQR), which gives a perception of the evidential unanimity of participants. To address the research question of the article, the frequency of the actual utilization of Scrum, Kanban, Lean, and Six Sigma methodologies was examined.

Result and Discussion

The outcomes of this research provide an understanding of the changes in competencies and research methods of IT project managers concerning the Industry 4.0 environment. From the gathered survey results of 50 participants, who are mostly from the military IT domain, it is possible to understand the project management context in detail.

The majority of participants belonged to middle management (26%), followed by junior management (22%) and entry-level positions (20%). Senior managers accounted for 18%, while executive or C-level roles made up 14%. This distribution reflects a balanced representation of various management levels within the IT sector, offering insights into how competencies and methodology preferences may differ across hierarchical structures.

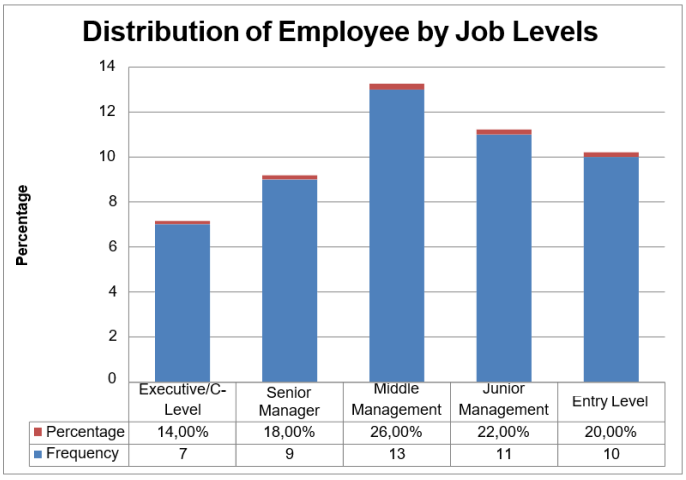

Figure 1: Job Levels

In terms of age distribution, the sample showed diversity across different age brackets. The most represented age groups were 20-25 years, 41-45 years, and those aged over 50, each comprising 16% of the sample. The least represented groups were those aged 36-40 and 46-50, each accounting for 8%. This variation in age indicates that the study captured perspectives from both younger professionals and more experienced project managers. Regarding educational qualifications, the majority of participants held post- graduate degrees (32%), while 22% had qualifications below Grade 12. Grade 12 and post-matric diploma holders constituted 20% and 14%, respectively, indicating a

diverse range of educational backgrounds. Additionally, the respondents' industry experience varied significantly, with the largest group having 6-10 years of experience (32%), while those with over 20 years made up 16%. Participants with less than one year of experience accounted for 14%, reflecting the inclusion of both seasoned experts and newer professionals in IT project management. This demographic diversity ensures that the study's findings are relevant across different experience levels and educational backgrounds, providing a well-rounded understanding of the evolving competencies in the field.

Looking at its importance in the Australian construction industry, cybersecurity took the top position with an RII of 0.868. This has found support from the unfolding trends where information security is becoming a major cause of concern due to the implementation of IT projects such as artificial intelligence, cloud computing, and big data analysis. As far as the Industry 4.0 environment is concerned, characterized by the dominance of data-oriented activities, data purity and protection against cyber threats are critical aspects. The fourth was ethical decision-making, which scored an RII of 0.840, giving a hint that project managers need to practice and demonstrate ethical decisions and professionalism. Such an outcome demonstrates the growing demand for ethical actions in handling the data and construction of systems that govern automated decision-making processes. These ideas align with findings by as well as, especially posing that in an enhanced IT project environment, adding cybersecurity and ethical skill sets is vital [1,3]. Technological advancement requires that cybersecurity be approached in a preventive manner because a vulnerability can lead to project failure, loss of stakeholder confidence, and damage to business reputation, respectively. Therefore, the concern of enhancing cybersecurity awareness as an organizational imperative is in line with the notion of risk management in Industry 4.0.

Table 1: Critical Competencies in IT Project Management

Competency	RII	Ranking
Cybersecurity Awareness	0.868	1
Ethical Decision-Making	0.840	2
Proactive Risk Management	0.832	3
Time Management	0.788	4
Stakeholder Engagement	0.788	4
Emotional Intelligence	0.788	4
Negotiation and Transparency	0.756	5
Financial Management	0.752	6
Machine Learning & Big Data	0.752	6
Cloud Computing	0.720	7

The heightened concern towards cybersecurity and ethical decision-making points to the fact that IT project managers are no longer oblivious to the dangers of digital transformation. It has become very critical to anticipate potential ethical problems and look into security threats in line with the trends being embraced under Industry 4.0 in the management of projects. Furthermore, the ranking of proactive risk management (RII = 0.832) emphasizes the importance of managing risks in virtual settings and early challenge identification. These competencies are not restricted to technical skills but include leadership and strategic decision-making. That goes further to explain the operational roles and responsibilities of IT project managers in the current dynamic organizations. This also implies that while project managers have to possess technical skills, knowledge, and understanding of the projects, they must also have adequate skills

in management, ethics, risk management, and decision-making as guided by organizational culture and the expectations of the stakeholders.

On the other hand, the old-style competencies, such as time management and financial management, are ranked as less significant compared to technological ones. In this it unwraps from the traditional practice of project management to such a system implemented through innovative technology. In the present day, and especially with the advent of more flexible methodologies that are more cyclical and iterative, risk management of digital projects has become more relevant rather than solving problems with box-ticking calculations of time and financial cost. In the paper, this viewpoint is supported, underlining the actual need for focusing on both the technical and the managerial elements of the IT project management [12]. But time management and financial literacy cannot be underestimated at all, as they reflect the basic elements of effective work in the projects required for the synchronization of digital solutions with the organization's budget and time.

Yet another striking result is that of iterative development rated relatively low (RII = 0.656). Remarkably, iterative practices, which have been enshrined in every agile framework, failed to be adopted as a priority in the respondents' organization. Perhaps this deviation from typical agile practices is a result of the rigid tendency of the overall organizational culture to conform to agile frameworks completely, especially in the military IT sector. Works like the one by stress the significance of iterative development for developing adaptability; however, this research shows that there is not much use of increasing it in practice [6]. There might be cases where an organization cannot adapt to this aspect of iterative practices because of the set goals, policies, or lack of knowledge in agile practices. There is a need to define how the presence of iterative development can be applied as an additional feature into the current paradigm and how this move would not result in the weakening of the structure paradigm.

Another significant finding was that there is a preference for agile methodologies of work, of which the most used is Scrum since 40% of the respondents said they used it. This is in response to the flexibility and responsiveness adopted across different fields as depicted by the agile style in handling projects. Scrum's structured and cycle-based framework as well as the strong focus on the team, would make it suitable for projects with vague and constantly shifting conditions. In the following, other techniques were also used where Kanban was implemented by 22%, followed by Lean by 20% and Six Sigma by 18%. Such distribution can be attributed to the use of agile working combined with structured methodologies as employed in the management of projects in organizations. This is in alliance with the trend of escalating concerns on simple techniques that allow for timely decision-making, the engagement of the stakeholders, and advances in the improvement programs.

Table 2: Preferred Project Management Methodologies

Methodology	Frequency	Percentage
Scrum	20	40.0%
Kanban Project Management Methodology	11	22.0%
Lean Methodology	10	20.0%
Six Sigma	9	18.0%

The repetitiveness of the two competency clusters concerning the job level of executives, senior and middle management, speaks to the importance of the topics covered in general. This suggests that both levels of Industry 4.0 require similar skills, irrespective of the managerial rank. Woschank also noted that the use of digital competencies is not limited to some employees but is required by employees at all levels of the organization [12]. This may be because digital transformation initiatives are associated with certain risks that need to have security and ethical knowledge among managerial levels. Besides, it implies that competency frameworks should be developed, taking into account the similar levels of skills all across the

organization to coordinate the approach to the digital risks and ethical questions.

When comparing these findings with studies carried out earlier, it is clear that raising demands in the area of digital competencies and competencies in terms of ethics are in line with trends worldwide. In their papers, Litvinenko and Toxic explain the importance of the effective use of technology and a responsible approach to data by the IT project manager [13,14]. Niederman has also pointed out that advanced actions like AI, big data, and cloud computing are increasing the challenges of project management and stated that managers need to be efficient in applying these solutions [1]. This is why the aspects of the ad hoc project management prefer a hybrid approach in this study, revealing an adaptive approach to blend the traditional and the agile methodologies. This hybrid style provides credence to what many experts have been arguing, that is, IT project management is not a vocation that responds well to prescriptive strategies, while at the same time, it is not right to suggest that there is no right methodology.

This points to the fact that IT project managers need to engage in ongoing professional development, especially on issues of cybersecurity and ethics in the emerging Industry 4.0 environment. Organizations need to promote the responsible and sustainable use of technology, superior leadership to enhance the adoption of different forms of project management, and a full hybrid approach. In the same way, the educational sector should also offer a curriculum that would respond to the needs of the potential managers in terms of technical and ethical competencies for the ever-dynamic technological environment.

The research also established that the flexibility-oriented approach is best complemented by correcting with the more formal framework, particularly when high stability is a matter of primary importance in a certain sector. Therefore, the need to understand both the digital competencies and ethical concerns that need to be incorporated into the IT project management to fully address the challenges of project management in Industry 4.0 will continue to be relevant in the future.

Conclusion

The study investigated how IT project management competencies and methodologies are evolving in the Industry 4.0 context, and the incursion of AI, cloud computing, and big data raises the need for management of cybersecurity and ethical decision-making. The methods ranged from Agile methods like Scrum to traditional methods such as Waterfall, based on their flexibility, yet the usage of traditional approaches demonstrated challenges to fully adopt some aspects of Agile. This study shows the importance of lifelong learning and including the advancements of Industry 4.0 in the training. In this regard, future research should be broadened to include larger geographical contexts to be able to address some of the emerging global challenges as well as utilize sustainable project management practices.

Future Research and Implications

Further research should extend the geographical scope of the study to varied regions and industries rather than limiting the study to IT project management in one particular context. Comparisons between developed and developing countries will provide some insight into the differences in levels of adoption of Industry

4.0 competencies and agile methodologies. Additionally, longitudinal research is suggested to follow changes in the competency requirements over time as new technologies, such as AI, machine learning, and blockchain, become further adopted into project management practice. Moreover, studying the problems that organizations that try to switch to agile or hybrid methodologies from traditional ones will help too. Further enrichment of the discourse would arise from an investigation regarding the integration of sustainability practices with IT project management in the context of global environmental challenges. Finally, qualitative studies of IT project managers' lived experiences during digital transformation will enrich quantitative results.

References

1. Niederman F (2021) Integrating AI and big data analytics in project management practices. Journal of Project Management 39: 102-111.
2. Cabeças J (2022) Project management skills for the digital age: Adapting to Industry 4.0. International Journal of Project Management 40: 38-47.
3. Kerzner H (2022) Project management: A sys-

tems approach to planning, scheduling, and controlling (13th ed.) John Wiley & Sons. Open Journal of Business and Management 12.

4. Wu J (2022) Project management in the post-pandemic world: Remote work and digital transformation. Journal of Project Management Research 43: 323-331.
5. Xu J, Liu S, Gao Y (2018) Agile methodologies in IT project management: A comparative analysis. Journal of Project Management 36: 88-99.
6. Hoda R, Noble J, Marshall S (2018) Agile project management in software development: Success factors and best practices. Journal of Systems and Software 145: 46-58.
7. Conforto E C, Salum F, Amaral D C, da Silva S L, de Almeida L F M (2014) Can agile project management be adopted by industries other than software development?. Project Management Journal 45: 21-34.
8. Serrador P, Pinto J K (2015) Does agile work? A quantitative analysis of agile project success. International Journal of Project Management 33: 1040-1051.
9. Leybourne S A (2016) Hybrid project management: Combining agile with traditional approaches. International Journal of Project Management 34: 856-867.
10. Creswell J W (2014) Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.). Sage Publications.
11. Saunders M, Lewis P, Thornhill A (2015) Research methods for business students (7th ed.). Pearson Education.
12. Woschank M, Rauch E, Zsifkovits H (2020) Industry 4.0 competencies for IT project managers. Procedia Manufacturing 43: 48-55.
13. Litvinenko V (2020) Digital transformation of project management: An Industry 4.0 perspective. Journal of Project Management 34: 28-35.
14. Toxic A (2022) The impact of digital tools on project management practices. Journal of Digital Project Management 41: 23-31.