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Dissertation Topic:

The Competency Framework of Knowledge Workers in the Age of Digital Transformation

Mgr John Teboh Muzam

(Summary of the dissertation)

Supervisor:

dr hab. Jacek Bendkowski Prof. AWSB

Reviewers:

prof. dr hab. Czesław Zająć (Uniwersytet Ekonomiczny we Wrocławiu);

dr hab. inż. Anna Saniuk, prof. UZ (Uniwersytet Zielonogórski)

dr hab. inż. Waldemar Jędrzejczyk, prof. PCz (Politechnika Częstochowska)

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1. Topic Motivation, Knowledge Gap, and Problem Statement

Many studies show that we live in the age of digital transformation. Digital transformation refers to the comprehensive integration of digital technologies into all aspects of business operations, fundamentally altering how organisations operate and deliver value (Brynjolfsson & McAfee, 2014). This transformation involves adopting digital tools and platforms, automating processes, and leveraging data analytics and artificial intelligence (AI) for strategic decision-making (Evangelista et al., 2014; Rainnie & Dean, 2020; Tapscott, 1996). The goal is to improve efficiency, enhance customer experiences, and foster innovation. Digital transformation is a continuous and dynamic process that requires organisations to be agile and responsive to technological advancements and market changes. As organisations evolve into network organisations with fluid or boundaryless structures, digital transformation enables them to stay competitive and relevant in an increasingly complex and interconnected business landscape (Hamel & Zanini, 2020).

However, while much has been written on how digital transformation affects organisations, a significant gap remains in understanding the specific competencies that knowledge workers must develop to thrive in this evolving landscape. Digital transformation has shifted the landscape of work, resulting in the creation of new roles and the obsolescence of others (Autor & Dorn, 2013; O'Dell & Hubert, 2012). Its impact on the competencies of knowledge workers is not yet fully understood. While organisations are adapting to the changing environment, there remains a significant gap in identifying and developing the specific competencies required for knowledge workers. This dissertation seeks to address this gap by developing a comprehensive competency framework tailored to the needs of knowledge workers in the digital age. As organisations evolve into dynamic, networked entities (Ruostela et al., 2015), the competencies required of knowledge workers continue to change. However, traditional competency models are no longer sufficient to meet the demands of digital transformation (Ruostela et al., 2015; Schreurs et al., 2019; Seidman, 2014, 2023). The absence of a comprehensive framework that aligns knowledge worker competencies with the rapidly advancing technological landscape represents a critical shortfall. This research aims to develop a competency framework that reflects the skills and attributes necessary to thrive in the digital era. The competencies needed in this new landscape extend beyond traditional technical skills to encompass transversal competencies such as problem-solving, critical thinking, and collaboration (Hernandez- de Menendez et al., 2020).

The emphasis on continuous learning and adaptability becomes so crucial, as employees must continuously update their knowledge and skills to remain effective in the face of rapid technological change (Eisler, 2015; Reese, 2021). The development of these competencies is not solely dependent on formal education; individuals can also acquire them through experience, on-the-job, and informal learning (Faller et al., 2022a; Kittel et al., 2021). The ability to effectively leverage these competencies, both technical and transversal, is what distinguishes knowledge workers in the digital age, enabling them to contribute to the creation and utilisation of knowledge that drives innovation and growth (Prusak & Davenport, 2013). The shift towards learning organisations and network organisations underlines the strategic importance of knowledge as a source of competitive advantage (Jennings, 2013; Kerosuo et al., 2015; Senge, 1990). Knowledge management in these structures requires a new type of employee equipped with the skills to navigate and thrive in this dynamic environment (Nonaka & Takeuchi, 1995). The proposed dissertation titled "The Competency Framework of Knowledge Workers in the Age of Digital Transformation" seeks to explore further and elucidate these critical themes, offering valuable insights for individuals, organisations, and policymakers navigating the complexities of the digital age.

This study's motivation arises from the pressing need to redefine and realign the competency frameworks of knowledge workers amidst the relentless advent of digital transformation. As organisations strive to remain competitive and innovative, there is a growing demand for new skills and competencies to meet today's market environment, along with the recognition that traditional competency models are inadequate. Therefore, this study is driven by the urgent need to address this gap by systematically identifying the key competencies required for knowledge workers to perform effectively and thrive in the era of digital transformation. The research aims to provide empirically grounded and relevant competency models that align with the realities of the current workplace.

2. Research Objectives, Hypotheses, and Questions

As detailed in the dissertation, the accelerating nature of digital transformation is fundamentally reshaping work environments. This study addresses the gap in identifying specific competencies required for knowledge workers to thrive in this dynamic landscape. The primary objective is to construct a comprehensive competency framework validated by empirical data from the Silicon Mountain tech cluster. Organisations increasingly rely on these professionals to navigate complexity, drive innovation, and leverage technological advancements (Korczynski & Wittel, 2020; Baptista et al., 2020). Despite recognising that knowledge work in the digital era requires competencies distinct from those emphasised in traditional routine-based roles, a significant gap persists in the precise identification, conceptualisation, and structuring of these essential competencies (Hecklau et al., 2016; McKee & Gauch, 2020; Ritter & Pedersen, 2020; Muzam, 2022). This gap is evidenced by the potential inadequacy of existing theoretical frameworks and competency models, often developed for more stable industrial contexts, which fail to fully capture the requisite fluidity, complexity, digital integration, and interconnectedness characteristic of contemporary knowledge work (Nonaka & Takeuchi, 1995; Reese, 2021; Sanchez & Levine, 2009; Westera, 2001). Consequently, fundamental questions arise regarding the continued relevance of traditional learning theories, the limitations and adaptability of universal competency frameworks (for example, SFIA, e-CF), and the potential necessity for new, dynamically aligned models (Bartodziej, 2017; McKinsey, 2020; OECD, 2018; Stuss, 2024).

The **main objective** of this dissertation is to develop a comprehensive competency framework for knowledge workers in the digital transformation landscape. This framework aims to equip knowledge workers with the skills needed to adapt and thrive in a dynamic workplace environment characterised by continuous digital advancements and technological integration.

Specifically, the dissertation intends to:

- Examine the impact of digital transformation on work structures and processes.
- Understand the distinct nature of knowledge work in the digital age.
- Evaluate and advance theoretical foundations for knowledge worker competencies.
- Analyse the evolution and future direction of competencies.
- Identify key emerging competencies and how organisations can prepare for future skill requirements.
- Develop a comprehensive competency framework tailored to the digital economy.

- Test and validate the hypotheses formulated.

Building on the aforementioned research problem and objectives, the following research questions are developed to guide this study and systematically address the identified **knowledge gaps**.

1. How does the phenomenon of digital transformation reshape the fundamental nature, structure, and operational context of knowledge work within contemporary organisations?
2. What are the defining characteristics of knowledge work in the digital age, and how do these characteristics require distinct competencies compared to traditional paradigms?
3. To what extent are established competency frameworks and theories adequate for addressing the evolving requirements of knowledge workers amidst advanced digital transformation?
4. What specific competencies - such as technical, cognitive, social, self-management, and learning-related - are essential for knowledge workers to navigate and thrive amid ongoing digital transformation, and how is their relative importance evolving?
5. What are the critical competencies for knowledge workers, how are they evolving, and which emerging competencies are expected to gain prominence in the near future?
6. What core competencies constitute a comprehensive and relevant framework to enable knowledge workers to effectively navigate and thrive within the digitally transformed workplace?

To empirically investigate these **research questions** and test the relationships derived from the literature and preliminary analyses, the following hypotheses are formulated:

- H1: The identified competency groups, including digital, cognitive, learning agility, social, self-management, social and emotional, and leadership, are crucial for effective knowledge work in the age of digital transformation.
- H2. Specific competencies within the cognitive skills group (such as critical thinking and creativity) and the social skills group (such as Communication Skills) have the greatest positive impact on effective knowledge work performance in the age of digital transformation.

- H3: The competency framework for knowledge workers shows a dynamic and structured relationship that can be effectively represented by a three-tiered framework: foundational competencies, enabling competencies, and strategic competencies, where each tier builds upon the preceding one.

To explain the key term used in this study, "effective knowledge work" (H1) is conceptualised as the successful application of cognitive skills, creativity, problem-solving, and collaboration to achieve intended purposes, add value, and drive innovation (Drucker, 1999c; Davenport, 2005). Distinct from simple output, "effective knowledge worker performance" (H2) similarly describes the attainment of desired outcomes, which encompass innovation, problem-solving efficacy, teamwork, adaptability, and positive contributions to organisational culture (Koopmans et al., 2011; Alzate et al., 2021). This performance is understood to be influenced by both individual attributes (for instance, critical thinking, domain expertise, and motivation) and enabling organisational factors (Alvesson, 2004; Schein, 2010). Given that competencies are considered valid predictors of superior job performance (Wong, 2020; Spencer & Spencer, 1993), a primary aim of this research is to understand which specific competencies drive these performance outcomes. The study substantially examines empirical evidence and analysis derived from literature review, expert opinions, and knowledge worker surveys that support the core assertions made in these hypotheses regarding the key competency groups (H1), the importance of specific cognitive and adaptive skills (H2), and the existence of a data-informed hierarchical structure within the competency framework (H3).

3. Research Design: Methodology, Tools and the Dissertation Structure

The study employs an exploratory research design that is particularly suitable for investigating emerging phenomena in rapidly evolving fields (Stebbins, 2011). This approach facilitates a comprehensive examination of knowledge worker competencies in digital transformation, as the work landscape is continually reshaped by technological advancements and organisational changes (Bertens et al., 2013; Williams, 2019). A mixed methods approach is utilised to provide a thorough understanding of the phenomenon under investigation. The quantitative survey data will identify trends and patterns in knowledge worker competencies, while qualitative data from expert panels will offer in-depth insights into the contextual factors driving those trends. The mixed-methods approach enables triangulation of findings, thereby enhancing the study's validity. The combination of qualitative and quantitative techniques ensures a robust and holistic understanding of the subject matter (Creswell & Clark, 2017). The study adopted a funnel strategy and developed the research design as follows:

- Systematic Literature Review,
- Expert Panels, and
- Surveys Implementation.

Below is an illustrative funnel strategy chart showing how the three methods, Systematic Literature Review (SLR), Expert Panel, and Knowledge Worker Survey, fit together within the research design. The widest part at the top represents the broad, foundational SLR, which narrows into the Expert Panel for validation and refinement and finally funnels down into the Survey stage for direct input from knowledge workers.

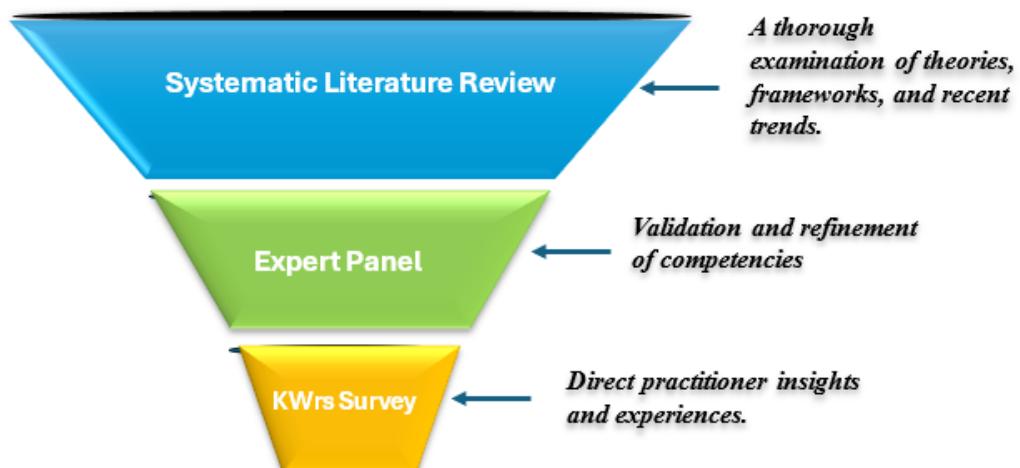


Figure 1: Research Design - Funnel Strategy

Source: Own work

This approach has been used to achieve the study's objectives by facilitating an extensive examination of the topic in a field where technological advancements and organisational changes continually reshape the work landscape (Bertens et al., 2013; Williams, 2019). The table and figure below explain the research method, design, and the study's outline.

Table 1: The Research Method Employed

Research Method	Main Goal / Justification	Questions this method was used to address
Systematic Literature Review (SLR) (Broad exploration of theory, frameworks, and recent trends)	<ul style="list-style-type: none"> - To map out existing research on knowledge worker competencies within the knowledge economy, focusing on publications from the last ten years (ensuring contemporary relevance). - To identify theoretical frameworks, current trends, and literature gaps in understanding the competencies needed in digital transformation contexts (Bertens et al., 2013; Williams, 2019). - To establish a grounded theoretical foundation that informs subsequent expert panel discussions and survey design. 	<ul style="list-style-type: none"> - <i>How do digital tools and platforms reshape organisational structures, workflows, and strategic decision-making processes? In what ways do these technological advancements foster new roles, collaborative behaviours, and cultural norms that influence required competencies?</i> - <i>Are the traditional learning theories compatible with the digital work environment?</i> - <i>What distinguishes knowledge work from traditional, routine-based labour; and how do these differences inform the competencies necessary for digital-era professionals?</i> - <i>Are universal competency frameworks adequate for knowledge workers in the digital age? What are the limitations of such approaches?</i>
Expert Panel Research (Validation and refinement of competencies)	<ul style="list-style-type: none"> - To validate and refine competency frameworks identified through the literature review by leveraging the insights of domain experts (Bertens et al., 2013; Keeney et al., 2011a). - To gather professional opinions on how competencies are evolving due to technological advancements and digital transformation (Brynjolfsson & McAfee, 2014). - To anticipate future trends and ensure the competency framework remains relevant and adaptable to emerging workplace demands despite the potential for expert bias (Rowe & Wright, 2001). 	<ul style="list-style-type: none"> - <i>Which group of competencies is the most important for effective Knowledge Work? Now and in the future.</i> - <i>Which competencies are currently most critical or useful for effective knowledge work, and which single competency stands out as paramount today?</i> - <i>How have the importance and nature of these competencies evolved over time, and how do they align with the requirements of today's digital landscape?</i> - <i>Which emerging competencies are expected to become central for effective knowledge work in the near future – next five years?</i>
Knowledge Workers Survey (Direct practitioner insights and experiences)	<ul style="list-style-type: none"> - To capture first-hand perspectives and experiences of individuals engaged in knowledge-intensive roles, ensuring the framework reflects real-world challenges and demands. - To collect quantitative and qualitative data on key competencies, skill acquisition, and workplace challenges (Creswell & Clark, 2017). - To triangulate with expert panel and literature review findings, enhancing overall reliability, validity, and contextual accuracy (Denzin, 2017; Williams, 2019). 	<ul style="list-style-type: none"> - <i>What competencies do knowledge workers need to navigate the complexities of digital transformation in the modern economy?</i> - <i>What individual competencies within these competencies are the most important for your daily knowledge work?</i> - <i>The interplay of competency: Describe how the different competencies you identified as crucial interact to empower you in effectively performing your job (Knowledge Work).</i> - <i>What are the core building blocks (individual, group, and network level) of a robust competency framework for knowledge workers?</i>

Source: Own work

A thoughtful combination of research methods and tools is employed to unravel the competencies essential for knowledge workers, and the methodological choices allow us to explore the multifaceted nature of competencies and provide a comprehensive understanding. The methods already explained above include a Systematic Literature Review (LR), Expert Panel (Quantitative), and Knowledge Worker Questionnaires. It employs a quantitative research design, using tables and descriptive statistics to analyse the collected data. The data was collected through a field survey in SW Cameroon. Specific data collection techniques were questionnaires and interviews. Also, Google Forms was used. The study employed several analytical techniques:

- Descriptive Statistics was used to analyse the dimensions of Knowledge Workers' Competencies.
- Reliability Analysis was performed to assess the internal consistency of the competency dimensions.
- Correlation Analysis to examine the relationships between variables related to knowledge workers' competencies.

The theoretical framework of this study is built upon a synthesis of several learning theories and competency perspectives, designed to offer a more holistic and integrated view applicable to the digital context. The central premise is that traditional theoretical frameworks, conceived largely before the advent of ubiquitous digital networks, are often inadequate and may require adaptation or augmentation to fully capture the complexity of learning and competence acquisition in the digital age. As the objective of the dissertation is to explicitly evaluate and advance theoretical foundations for knowledge worker competencies. This advancement is achieved by organising the theoretical foundations into three primary perspectives, reflecting the multi-dimensional nature of contemporary learning.

The key learning theories examined are organised by their primary focus of analysis, which reveals the foundational perspectives on competency frameworks:

- individual (constructivist) (Dennick, 2016). Brau (2020) and Whitman (1993), (Pande & Bharathi, 2020). experiential (Kolb, 2015; Kondratjew & Kahrens, 2018; Yeravdekar, 2022)., self-regulated (Morris, 2019; van der Walt, 2019). ,
- group (social, situated, collaborative), and
- network (connected, distributed) learning theories,

The table below shows the key theories from all three perspectives based on the learning theories discussed in this section.

Table 1. summarises the main theories across individual, group, and network perspectives, illustrating how they are translated from theoretical foundations to practical applications in modern learning environments.

Figure 3 below effectively maps the evolution of learning theories in the digital age according to all the perspectives discussed above, showing how traditional approaches have adapted to modern competency development needs across individual, group, and network perspectives.

Table 2: Theoretical Foundations for Competency Development in the Digital Age

Individual Perspective	Group Perspective	Network Perspective
Focus: How individuals construct knowledge & regulate learning	Focus: How knowledge is co-constructed & learned via social interaction & context	Focus: How learning occurs across & through distributed digital networks
Key Theories:	Key Theories:	Key Theories:
<ul style="list-style-type: none"> • <i>Constructivism</i> • <i>Experiential Learning</i> • <i>Self-Regulated Learning (SRL)</i> 	<ul style="list-style-type: none"> • <i>Social Constructivism</i> • <i>Situated Learning / Communities of Practice (CoP)</i> • <i>Collaborative Learning</i> 	<ul style="list-style-type: none"> • <i>Network Learning Theory</i> • <i>Connectivism</i>
Core Concepts:	Core Concepts:	Core Concepts:
Active knowledge construction	Knowledge co-construction via social interaction	Learning facilitated by digital network connections (nodes & links)
Learning through experience & reflection	Zone of Proximal Development (Vygotsky)	Knowledge co-constructed within networks
Personal meaning-making	Legitimate Peripheral Participation (LPP)	Technology enhances socially situated learning
Autonomy, Goal-Setting, Self-Evaluation	Authentic Context & Activities	Network Navigation & Digital Literacy
Digital Age Relevance/Implications:	Digital Age Relevance/Implications:	Digital Age Relevance/Implications:
<ul style="list-style-type: none"> • Digital tools (simulations, PLEs) enhance construction • VR/AR provide immersive experiential contexts • Learning analytics for self-monitoring 	<ul style="list-style-type: none"> • Online platforms (forums, wikis) mediate social interaction & collaboration • Virtual teams co-construct knowledge across distances • Fosters collective intelligence in digital spaces 	<ul style="list-style-type: none"> • Digital networks are the primary medium for learning & knowledge access • Learning systems leverage interconnectedness of people, resources, technology • Highlights relational aspects of learning across organisational boundaries

Source: Own work

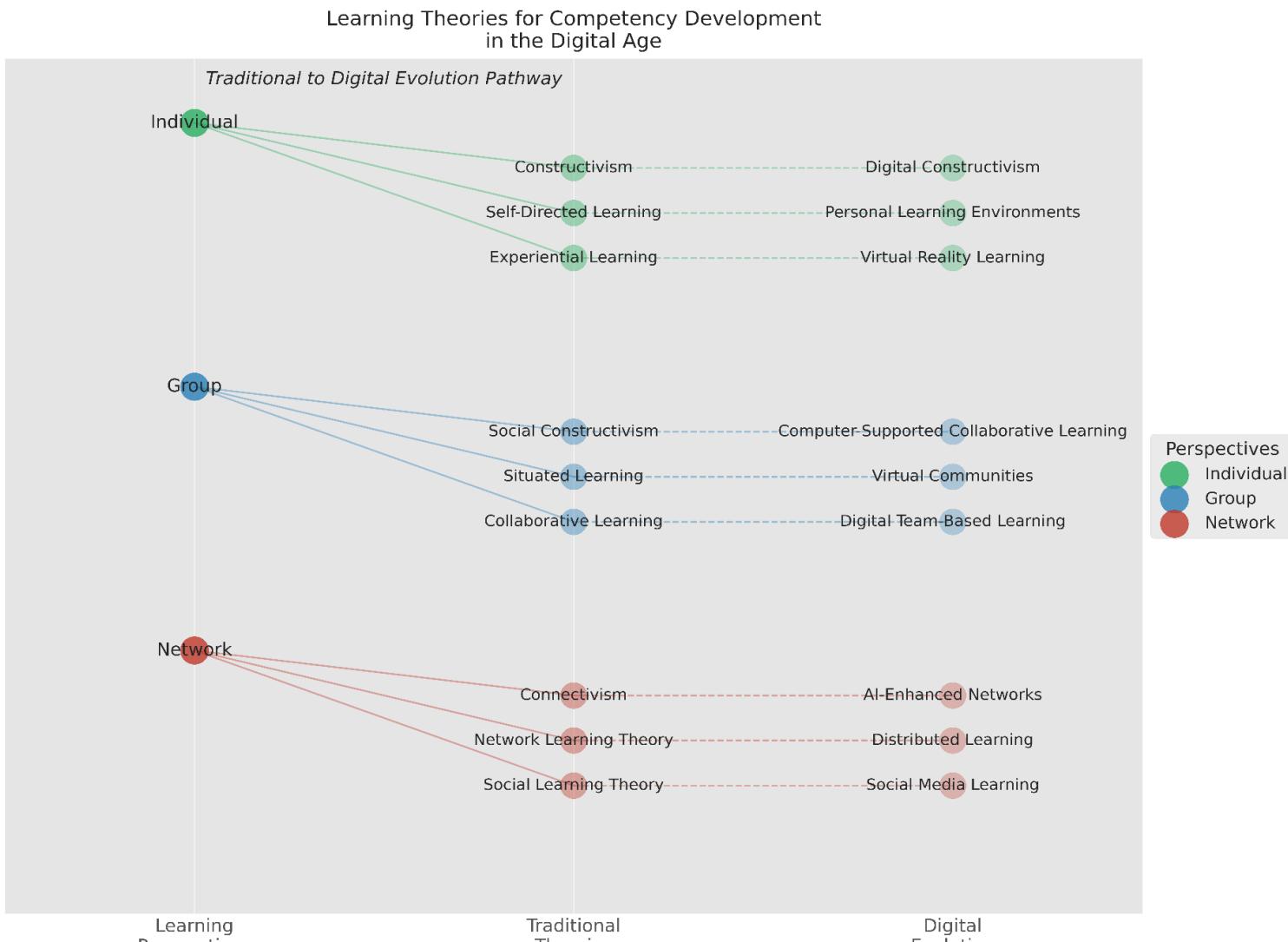


Figure 2: Learning Theories for Competency Development in the Digital Age Source: Own work

Figure 2 visually illustrates the traditional *digital evolution pathway*, showing how various traditional learning theories are adapted to digital transformations. It reveals the transition from traditional, often face-to-face or resource-limited contexts to more digitally empowered and distributed environments. The evolution of each theory is facilitated by digital technologies, providing new ways for individuals, groups, and networks to interact and learn effectively. This adaptation is crucial for competency development in the digital age, as learners need to acquire and refine skills in an environment that is becoming increasingly digitised and interconnected. The transformation across different perspectives emphasises personalised, collaborative, and networked ways of learning that align with the growing importance of digital literacy and technology-mediated competencies.

The critical examination of learning theories applicable to digital-age competency development reveals several key theoretical imperatives. Firstly, effective frameworks require synthesising insights from individual, group, and network learning perspectives (Dochy et al., 2021), moving beyond dependence on singular theoretical paradigms to capture the multidimensional nature of contemporary learning. Secondly, this integrated approach must acknowledge a significant theoretical shift that emphasises enhanced learner agency, manifested through active knowledge construction (Whitman, 1993; Pande & Bharathi, 2020), experiential reflection (Kolb, 2015), and metacognitive control (Milligan et al., 2015; Morris, 2019), while simultaneously recognising the profound influence of social interaction and authentic contexts (Palincsar, 1998; Lave & Wenger, 1991) on the learning process. Thirdly, the analysis highlights the centrality of networks, both human and technological, which serve as essential venues and conduits for learning (Siemens, 2009; Downes, 2009; Goodyear et al., 2004). Consequently, the ability to effectively navigate, contribute to, and synthesise knowledge within these distributed networks emerges as a fundamental competency in itself (Siemens, 2009; Chatti, 2012). The concept of knowledge in organisations is complex, as traditional approaches often offer compartmentalised and static views. A more dynamic perspective considers knowledge an active, mediated, and contested process, emphasising the importance of culturally located systems through which knowledge is achieved and generated (Dang et al., 2020). This evolving understanding of knowledge work highlights the need for organisations to adapt their competency framework to address the challenges of the modern economy. Davenport and Prusak underline the importance for organisations to recognise non-technical competencies, such as communication, collaboration, and creativity (T. Davenport & Prusak, 1998). Similarly, Leonard-Barton (1992) stresses the necessity for teams to devel-

op a wide range of competencies beyond technical skills. Organisations often focus on technical skills while neglecting individual-level competencies such as emotional intelligence, adaptability, and cultural awareness (Goleman, 2011; Valcour, 2021). Spender also emphasises the importance of recognising individual-level competencies in knowledge work (J. C. Spender, 2014).

The limited understanding of the interplay between competencies and knowledge work, as discussed by Hilsen and Olsen (2021) in their book "Collaboration: How Leaders Avoid the Traps, Create Unity, and Reap Big Results," highlights the significance of grasping this relationship, as emphasised by Hansen (2009). Understanding this is crucial in today's fast-paced and complex work environment. As knowledge work requires individuals to constantly learn and adapt, understanding the interplay between competencies and knowledge work is essential for individuals, organisations, and societies to thrive in the modern economy. By continuously developing and enhancing competencies, knowledge workers can keep up with the demands of their work and contribute to the advancement of their fields (Bontis, 1998). These gaps and limitations also highlight the need for a better understanding of the relationship between competencies and intellectual capital. Further research is needed to better understand the competencies and skills required for effective knowledge work in the knowledge economy, as well as how they can be developed and enhanced. Through the exploration of these inquiries, a deeper comprehension can be obtained regarding the competencies necessary for knowledge workers to thrive in the contemporary economic landscape.

Table 3: Research Gaps in Competency Development for Knowledge Workers

Gaps/ Limitations	Research Problems	References/Sources
The gap in understanding the specific competencies	What are the most important competencies for knowledge workers in the modern economy? What environment is required to develop them?	(Szydło et al., 2021) (EPRS, 2021; Hansen, 2009; Kochan et al., 2019; Oberländer et al., 2020a; O'Dell & Grayson, 1998)
Limited emphasis on non-technical competencies	What is the impact of non-technical skills, such as communication and collaboration, on the performance of knowledge workers in a specific field?	(Leonard-Barton, 1992) (T. Davenport & Prusak, 1998)(Oberländer et al., 2020)
Limited focus on individual-level competencies	What is the role of organisational-level competencies, such as a culture of innovation and collaboration, in enabling knowledge workers in the field of IT (or the Service industry) to perform their jobs effectively?	(J. C. Spender, 2014a) (Goleman, 2011a; Valcour, 2021)
Limited understanding of the interplay between competencies and knowledge work	How do different competencies interplay to enable knowledge workers in this field to perform their jobs effectively? How can these competencies be developed?	(Hilsen & Olsen, 2021b) (Hansen, 2009b)

Source: Own work

The analysis of competency frameworks reveals a critical need for models to evolve significantly in response to digital transformation. The key findings indicate that traditional competency models, characterised by static role definitions and a primary focus on task-specific skills, are inadequate for the dynamic requirements of modern knowledge work. Modern frameworks represent a necessary shift towards a holistic perspective, integrating technical, behavioural, and transversal skills while emphasising adaptability, continuous learning, digital proficiency, and collaborative development. The review of competency frameworks, including universal models such as SFIA and e-CF, uncovers persistent gaps and areas that require further research in the context of digital transformation and knowledge work. As highlighted in Table 14, key limitations include:

- A lack of adequate understanding of the key competencies essential for effective knowledge work across various industries and organisational contexts (Muzam, 2022; EPRS, 2021; Oberländer et al., 2020).
- Insufficient emphasis and empirical evidence on the impact and development of non-technical competencies (e.g., communication, collaboration, emotional intelligence, creativity) in relation to technical skills (Leonard-Barton, 1992; T. Davenport & Prusak, 1998; Goleman, 2011).
- Limited research exploring the interplay between individual-level competencies and enabling organisational-level competencies (e.g., innovative culture, collaborative infrastructure) (J. C. Spender, 2014; Valcour, 2021).
- A limited understanding of how different competencies (technical, cognitive, social, and personal) interact dynamically to produce effective performance in complex knowledge work (Hilsen & Olsen, 2021b; Hansen, 2009b), that is, the concept of competency Interplay.
- Persistent challenges remain in formulating frameworks that are both exhaustive and practical, even for SMEs (Doherty et al., 2013), as well as adequately adaptable to the rapid evolution of technological advancements (Harmse & Wadee, 2020).

Addressing these gaps is essential for developing a comprehensive competency framework. This dissertation aims to contribute by creating an enhanced competency framework that combines global perspectives with local contextual needs, emphasising both technical and non-technical skills (particularly soft skills), integrating competencies related to emerging digital technologies, and improving usability and adaptability.

3.2. The Structure of the Dissertation

The dissertation has been organised into six comprehensive chapters, each focusing on critical aspects of competencies among knowledge workers in the context of digital transformation.

Chapter 1, titled "*Digital Transformation and the World of Work*," offers a theoretical background on digital transformation. It defines key concepts such as digital transformation and explores their impact on modern organisations. The chapter examines the evolution of organisational structures and processes, highlighting the shift towards networked and learning organisations. It discusses the impact on skills and competencies, emphasising how digital transformation necessitates new skill sets among workers. The chapter also analyses the modern and knowledge economies, identifying knowledge as a key resource and discussing the role of knowledge workers in this new paradigm. Finally, it provides a detailed exploration of trends in workplace learning and development, shedding light on the changing nature of work, the skills required, and the evolution of human resource management, particularly focusing on talent management and competency-based approaches.

Chapter 2, entitled "*Knowledge Work and Knowledge Workers*," explores the concept of knowledge work and knowledge workers in modern organisations. It discusses the dimensions of knowledge, including its types, strategic importance, and management. The chapter defines knowledge work and knowledge workers, highlighting their unique characteristics compared to traditional work and workers. It examines the nature of knowledge work, emphasising aspects such as complexity, non-routine tasks, and reliance on cognitive abilities. Additionally, the chapter discusses the rise of new knowledge workers, setting the stage for understanding the foundation of competence development in the digital age.

Chapter 3, "*Competencies of Knowledge Workers*," focuses on identifying and conceptualising the competencies essential for knowledge workers. It reviews relevant theories for competency development, including Situated Learning Theory, Community of Practice, Social Learning Space, and Expansive Learning Theory. The chapter addresses the conceptualisation of competency frameworks in the digital age and identifies gaps in the existing literature. It presents the key competencies identified through the research and proposes a competency framework tailored for knowledge workers in the context of digital transformation. Furthermore, it explores strategies for improving knowledge work, discussing the determinants, enablers, and drivers of workplace learning. The chapter also examines various learning tools in the modern workplace, including both institutional and individual learning tools, and outlines a multi-level framework of social learning and knowledge sharing.

Chapter 4, "*Research Design and Methodology*," outlines the empirical approach of the study. It restates the research questions and details the methods and tools employed to address them. The methodologies include a systematic literature review (SLR) to synthesise existing knowledge, an expert panel (quantitative) to validate the competency framework, and a survey of knowledge workers conducted among 183 participants in Silicon Mountain, Cameroon. The chapter provides insights into

the survey design, data collection, and analysis procedures. It discusses the characteristics of the respondents, highlighting demographics such as age, gender, education, and industry experience. The chapter concludes with a presentation of the research model, illustrating how the different components of the study interconnect to address the research objectives.

Chapter 5, “*Findings and Discussion*,” presents and synthesises the empirical results from the expert panel and knowledge worker survey. This chapter provides a detailed analysis that addresses the research questions concerning the perceived importance, evolution, and interplay of various competencies. It discusses the key findings, highlighting significant patterns, correlations, and divergences between expert and practitioner perspectives. The theoretical and practical implications of these findings are explored in relation to existing literature, focusing on the impact of the identified competencies on enhancing knowledge work within the complexities of the digital era. The chapter examines how these findings inform a novel framework for knowledge workers.

Chapter 6, “*The Development of Competency Framework for Knowledge Workers in the Age of Digital Transformation*,” constitutes the core constructive contribution of this dissertation. Building directly upon the theoretical foundations established and the empirical findings analysed in the preceding chapters, this chapter proposes and details the developed competency framework. It outlines the framework's structure, likely incorporating the Tier-Based and Category-Based conceptualisations discussed earlier. It also elaborates on the specific competencies within each component, tailored to the needs of knowledge workers navigating digital transformation. This chapter answers the research question regarding the core components and structure of a robust framework.

Finally, the dissertation culminates in a General Conclusion that integrates the entire research journey. This section summarises the key findings in direct response to the overarching research questions, reiterates the study's main theoretical and practical contributions (including the proposed framework), and offers consolidated recommendations for practitioners, organisations, and policymakers. It also critically acknowledges the limitations inherent in the research design and geographical focus, proposing specific and actionable directions for future research to further advance the understanding of knowledge worker competencies in the dynamic global digital economy.

4. Research Findings and Development of a Competency Framework for Knowledge Workers

As previously explained, this study's primary objective is to develop a comprehensive competency framework for knowledge workers in the digital era. To clarify, the competencies are organised into seven competency groups, each containing detailed skill descriptions (see Appendix 2) from which the questions were derived. This chapter is dedicated to all results that address this goal.

4.1. Expert Panel Result

The expert panel was used to respond to the following questions:

1. Which group of competencies is the most important for effective Knowledge Work?
Now and in the future.
2. The most important skills: Which of these competencies in every group/category is the most important for effective knowledge? Work On the list of competencies provided.
3. List the top five skills and competencies you think are crucial for knowledge workers in today's digital era.
4. Which of these skills do you believe will become more prominent in the next five years?
5. How do you think these skills and competencies have evolved over the past decade?
(Trend)
6. Recommendations

The results are shown below:

Question 1:

1. Which group of competencies is the most important for effective Knowledge Work? Now and in the future.

An examination of the initial question reveals the key competencies identified by experts as critical for knowledge workers in the knowledge economy, both presently and in the foreseeable future. The following table illustrates the percentage of participants who regard each category of competencies as vital for effective knowledge work at present and in the upcoming times. The results are shown in the Table below:

Table 4: Which group of competencies is the most important for effective Knowledge Work? Now and in the future (Respondent Percentages by Competency Group for Effective Knowledge Work)

Competency	Responses	Percentage (%)
Digital Competencies	1	5.88
Self-management	2	11.76
Cognitive Skills	6	35.29
Social and Emotional Competencies	6	35.29
Learning Agility	2	11.76

Source: own work

An evaluation of the survey results presented above reveals multiple insights into the significance of various competency groups useful for practical knowledge work performances.

To identify the single most crucial competency within each group for effective knowledge work, experts were asked to respond to questions regarding the most essential skills. Which of these competencies in each group or category is the most significant for effective knowledge work? Excluding the single response that mentions "all of them," there is a total of 16 specific responses.

Question 2. Response to the question on the most important skills: Which of these competencies in every group/category is the most important for effective knowledge?

Table 5: Most Competencies Effective Knowledge Work

Skills	Responses	Percentage (%)
Cognitive Skills	2	12.5
Task and Time Management	1	6.25
Creativity	2	12.5
Critical Thinking	3	18.75
Resilience	3	18.75
Conversation	1	6.25
Self Motivation	1	6.25
Growth Mindset	2	12.5
Continuous Learning	1	6.25

Source: Own work

Question 3. The response to the question: List the top five skills and competencies you think are crucial for knowledge workers in today's digital era.

Table 6: Expert List of top five skills and competencies

Experts	List the top five skills and competencies you think are crucial for knowledge workers in today's digital era
1	Innovative, Critical Thinking, Communication Skills, Leadership Skills, Collaborative Skills,
2	Creativity, Emotional Intelligence, Learning from existing knowledge
3	Critical Thinking, Social Intelligence, Computational Intelligence, Emotional Intelligence, Resilience
4	Responsibility, Curiosity, Caring, Respect, Oracy
5	Understanding how and why people use knowledge and information; Also Requires Empathy, Curiosity, the Ability to relate, To Give/Inspire Trust
6	Critical Thinking, Creativity, Strategic Thinking, Socialisation and Networking, Continuous Improvement
7	Self-Motivation, Continuous Learning, Critical Thinking, Decision Making, Digital Literacy
8	Curiosity, Empathy, Creativity,
9	Inter-Personal Skills, Coordination, Change Management, Critical Thinking, Adaptability
10	Learning, Communication, Problem-Solving, Augmented Intelligence, Deep Work
11	Critical Thinking, Creativity, Learning, Collaboration, Digital Competencies
12	Critical Thinking, Self-Motivation, Adaptability to Change, Resilience, Change Management, Cross-Cultural Competence.
13	Effective Use of Digital Tech Systems, Critical Thinking, Continuous Learning, Emotional Intelligence, Self-Motivation
14	Social Skills, Emotional Intelligence, IT Skills, AI Skills, Leadership
15	Growth Mindset

Source: Own work

This table represents the percentage of respondents who selected each specific competency as the most important for effective knowledge work. Based on the above, the data is synthesised to deduce the key competencies mentioned:

Table 7: Synthesis of a list of the most prominent competencies identified

Rank	Skill	Percentage
1	critical thinking	46.67%
2	creativity	20.00%
3	emotional intelligence	13.33%
4	resilience	13.33%
5	curiosity	13.33%
6	self-motivation	13.33%
7	continuous learning	13.33%
8	change management	13.33%
9	innovative	6.67%
10	communication skills	6.67%

Source: Own work

"Learning agility" was combined with the mentioned skills, such as "continuous learning" and "learning from existing knowledge," as these represent closely related ideas. Similarly, the term "collaboration" was merged with both "collaborative skills" and "collaboration" for similar reasons. Individual respondents highlighted a wide array of additional skills, emphasising the varied skill sets necessary in the digital era. It is essential to note that the specific skills and competencies deemed most critical for knowledge workers may differ based on individual roles, industries, and organisational cultures. Nonetheless, the aforementioned top five skills consistently emerge as significant across diverse contexts.

Table 8: The top five skills consistently mentioned as important across various contexts

Rank	Skill	Number of Mentions
1	Critical Thinking	11
2	Learning Agility (Continuous Learning + Learning from Existing Knowledge)	6
4	Emotional Intelligence	4
4	Self-Motivation	4
4	Change Management	4
4	Resilience	4
3	Creativity	5
5	Collaboration (Collaborative Skills + Collaboration)	3
6	Empathy	3
7	Leadership Skills	2
7	Digital Literacy (Digital Competencies + Effective Use of Digital Tech Systems)	2
7	Communication Skills	2
7	Problem-Solving (Decision Making)	2
7	Adaptability	2

Source: Own work

The prevailing consensus among experts indicates the necessity of a multifaceted skill set that integrates traditional cognitive competencies with modern digital skills. Furthermore, it highlights the critical importance of social competencies and personal attributes in various fields of expertise. This analysis of expert responses reveals a clear set of crucial skills for knowledge workers in the age of digital transformation.

Question 4. Which of these skills do you believe will become more prominent in the next five years?

Table 26 shows the Expert Response on the Skills for the Future of Work. It provides a comprehensive overview of the anticipated shifts in skill requirements. *Which of these skills do you believe will become more prominent in the next five years?*

Below are their responses:

Table 9: Expert Response on the skills for the future of work

Skill	Number of Mentions
Critical Thinking	9
Adaptability to Change	3
Effective use of digital tech systems/Continuous learning	1
Oracy (Communication)	1
IT Skills	1
Time and task management	1
Creativity	1
Relational skills	1
Decision making	1
Empathy	1
Augmented intelligence	1
Critical thinking and adaptability to change	1
Emotional and time management	1
Strategic thinking	1
Resilience	1

Source: own work

Critical Thinking was cited seven times, underscoring its essential role in various facets of professional activities. It serves as the foundation for problem-solving, decision-making, analytical processes, and the navigation of complex information (Acton, 2023).

Adaptability to Change was mentioned three times, reflecting the fast-paced and evolving nature of modern work. The ability to adjust to new technologies, processes, and situations is crucial.

Question 5. How do you think these skills and competencies have evolved over the past decade? (Trend)

To understand how the importance and nature of these skills and competencies have changed over time. The Experts make the following remarks (See table 27 page 112):

Table 10: Respondents' response on the evolution of competencies: How do you think these skills and competencies have evolved over the past decade? (Trend)competencies

How do you think these skills and competencies have evolved over the past decade? (Trend)
From more human to AI-driven
People are worse at time and task management.
More emotional intelligence
Newer programs, such as the University of Waterloo's Bachelor of Knowledge Integration, offer exciting opportunities for aspiring "knowledge workers." However, it remains crucial to address contemporary societal trends that undermine critical thinking and the scientific method for their ultimate impact.
The growing importance of skills is inadequately addressed by tertiary education. Also, society is becoming more complex, and the rate of change is accelerating.
Oracy is becoming more and more important.
I think critical thinking skills have declined, and relational skills have improved, but they are now under threat because of the increasingly virtual working environment.
Organisations are realising the innovative capability of knowledge development capacity and are using it to leverage their competitive ability.
Not so much, the way you provide/deliver these skills has changed tremendously.
I am seeing fewer inside organisations and more outside organisations, such as freelancers.
Due to increasing stress levels, more and more brain workers have become shallow workers. Augmented intelligence increases a lot, e.g. Chatgpt. Communication got worse
Organisations are starting to understand the need. People are starting to get better on some, yet a long journey lies in front of us.
I still think that Brazilian K-workers have much to do to evolve in these competency gaps. We're crawling in these important aspects, especially in change management and cross-cultural competence.
They are becoming increasingly important.
Massively, and one needs to work hard constantly to catch up.

Source: Own work

Question 6. Experts' recommendations.

Table 28 below shows the Experts' recommendations for Enhancing Knowledge Worker Competency, synthesises the experts' insights and offers actionable suggestions for organisations aiming to build a future-ready workforce.

Table 11: Expert's Advice for Enhancing Knowledge Worker Competency Development

Advice	Number of Mentions
Embrace Flexibility and Adaptability:	2
Develop Critical Thinking Skills:	1
Combine Organisational and Specialist Talent:	1
Raise Awareness and Increase Change Speed:	1
Encourage Open Communication and Collaboration:	2
Invest in Young Talent and Empower Them:	1
Implement Regular Competency Assessments and Development Plans:	1
Set a Clear Vision and Empower Employee Choice in Learning:	1
Connect Learning Directly to Work:	1
Foster Peer-to-Peer Learning:	1
Invest in a Comprehensive Knowledge Management Strategy:	1
Demonstrate Top Management Commitment and Allocate Resources:	1
Define and Manage Competency Development as Part of Organisational Strategy:	1
Offer Personalised Learning Paths and Cater to Diverse Learning Styles:	2
Build Strong Partnerships with Academia:	1

Source: Own work

Organisations seeking to equip their knowledge workers for success in the digital era should adopt a multifaceted approach that fosters a culture of continuous learning, provides personalised development opportunities, and leverages strategic partnerships. By implementing these recommendations, organisations can create an adaptable, skilled, and prepared workforce to thrive in the ever-evolving digital landscape.

4.2. Knowledge Workers Survey Result

A total of 183 knowledge workers were surveyed, representing a diverse cross-section of demographics. The respondents responded to the first three main questions below:

- *What are the top three group competencies crucial for your daily knowledge work?*
- *The most important skills: What individual competencies within these competencies are the most important for your daily knowledge work?*
- *The interplay of competency: Describe how the different competencies you identified as crucial interact to empower you in effectively performing your job (Knowledge Work).*

The table below (Table 29) presents the results from this survey, mainly on the first and second questions. It reflects the perspectives of knowledge workers on the competencies they consider most critical in their roles. It summarises the responses, understanding how these dimensions are viewed and prioritised by those directly engaged in knowledge-intensive tasks.

Table 12: Characteristics of the Dimensions of Knowledge Workers' Competencies

	Description	Freq.	Percent	Cum.
	Description of respondents according to the Digital Competencies Group			
skill	Collaborative learning through ICT	21	11.48	11.48
skill	Effective use of digital tech systems	77	42.08	53.55
skill	Expertise in specific domains	31	16.94	70.49
skill	Knowledge management technology	24	13.11	83.61
skill	Utilising information	30	16.39	100
null	Total	183	100	-
	Description of respondents according to the Cognitive Skills Group			
skill	Creativity	29	15.85	15.85
skill	Critical Thinking	45	24.59	40.44
skill	Problem-solving	84	45.9	86.34
skill	Strategic thinking	25	13.66	100
	Total	183	100	-
	Description of respondents according to Learning Agility Group			
skill	Adaptability to change	79	43.17	43.17
skill	Continuous learning	67	36.61	79.78
skill	Growth mindset	18	9.84	89.62
skill	Self-motivation	19	10.38	100
	Total	183	100	-
	Description of respondents according to the Social Skills Group			
skill	Collaboration skills	51	27.87	27.87
skill	Communication skills	117	63.93	91.8
skill	Cross-cultural competence	15	8.2	100
	Total	183	100	-
	Description of respondents according to the Self-Management Group			
skill	Job Crafting	3	1.64	1.64
skill	Self-motivation	34	18.58	20.22
skill	Task and time management	123	67.21	87.43
skill	Time-spatial flexibility	23	12.57	100
	Total	183	100	-
	Description of respondents according to the Social and Emotional Competencies Group			
skill	Emotional intelligence	42	22.95	22.95
skill	Relational skills	99	54.1	77.05
skill	Resilience	42	22.95	100
	Total	183	100	-
	Description of respondents according to Leadership skills			
skill	Change management	4	2.19	2.19
skill	Decision-making	74	40.44	42.62
skill	Innovation	30	16.39	59.02
skill	Strategic thinking	75	40.98	100
	Total	183	100	-

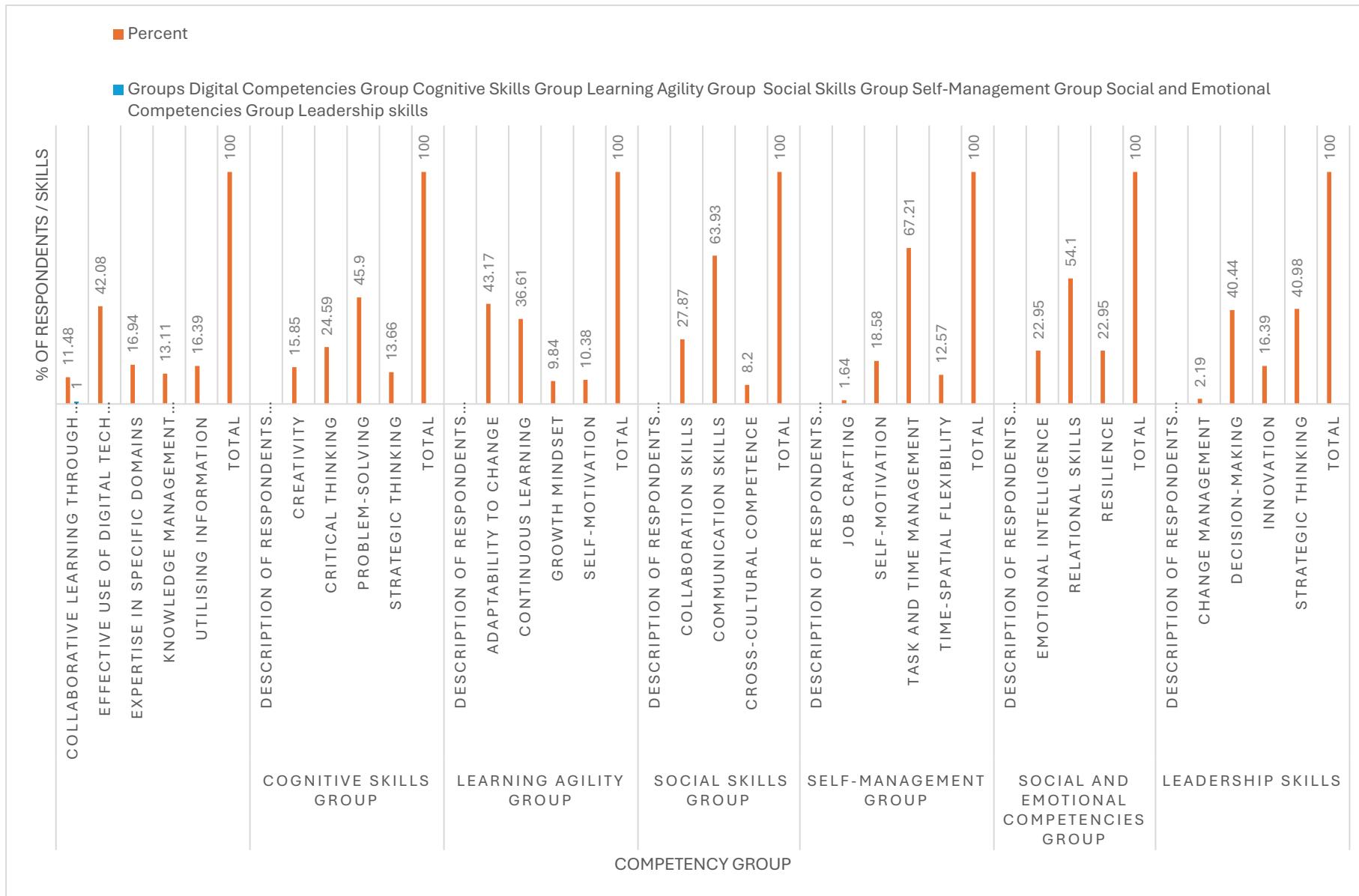


Figure 3: Characteristics of the Dimensions of Knowledge Workers' Competencies

Regarding the first (*what are the top three group competencies crucial for your daily knowledge work?*), probit regression analysis was used to analyse the data and respond to the questions. Probit regression is used for modelling binary outcome variables (Agresti, 2015; Sardana et al., 2023). In this context, it is used to determine the impact of various competencies on the likelihood of the usefulness of knowledge work. The interpretation of the result is presented below:

Table 13: Statistical Analysis of Competencies and Their Effect on Knowledge Work

Competency	Coefficient	p-value	Interpretation
<i>Digital Competencies</i>	0.40562892	0.081	Showed a positive coefficient, though the relationship was marginally significant ($p < 0.1$), suggesting a potential trend that warrants further investigation with a larger sample.
<i>Cognitive Skill</i>	0.6323841	0.007	Positive and statistically significant effect on effective knowledge work at 0.01 level.
<i>Learning Agility Skill</i>	0.0230582	0.922	No statistically significant effect on effective knowledge work.
<i>Social Skills</i>	0.6691741	0.002	Positive and statistically significant effect on effective knowledge work at 0.01 level.
<i>Self-management Skill</i>	-0.0234633	0.917	No statistically significant effect on effective knowledge work.
<i>Social and Emotional Competencies</i>	0.3562606	0.081	Positive effect on effective knowledge work; significant at the 0.1 level.
<i>Leadership Skill</i>	-0.2958531	0.194	No statistically significant effect on effective knowledge work.
<i>Constant (_cons)</i>	-0.6929445	0.042	Statistically significant baseline level of effective knowledge work when all competencies are zero.

Source: Own work

The table above presents the results of a Probit regression analysis, which estimates the most important competencies for practical knowledge work. The Pseudo R² value of 0.1264 shows that the model accounts for approximately 12.64% of the variance in effective knowledge work, suggesting a modest fit. The LR chi²(7) value of 31.49, along with a p-value of 0.0001, indicates that the model as a whole is statistically significant, meaning the predictors included in the model collectively have a significant effect on the outcome.

The survey question aimed to identify the *most important group competencies* considered useful for knowledge work, revealing a diverse set of skills prioritised by respondents (*Table 32 shows their ranking*). The coefficients from the Probit regression analysis are used to rank the groups of competencies based on their importance for practical knowledge work.

These coefficients indicate the strength and direction of the relationship between each competency and practical work knowledge. Here's the ranking based on the provided coefficients:

Table 14: Strength and Direction of Competency Relationships with Effective Knowledge Work

Competency	Coefficient	P-value	Significance
Social Skills	0.6692	0.002	***
Cognitive Skill	0.6324	0.007	***
Digital Competencies	0.4056	0.081	*
Social and Emotional Competencies	0.3563	0.081	*
Learning Agility Skill	0.0231	0.922	
Self-management Skill	-0.0235	0.917	
Leadership Skill	-0.2959	0.194	

Source: Own work

In relation to the most significant competency relevant to their knowledge work, *which individual competencies within these categories are the most vital for your daily tasks?* In response to this question, the study aimed to identify which specific skills are most essential for their daily knowledge activities. The charts below provide further details and the rankings for each category.

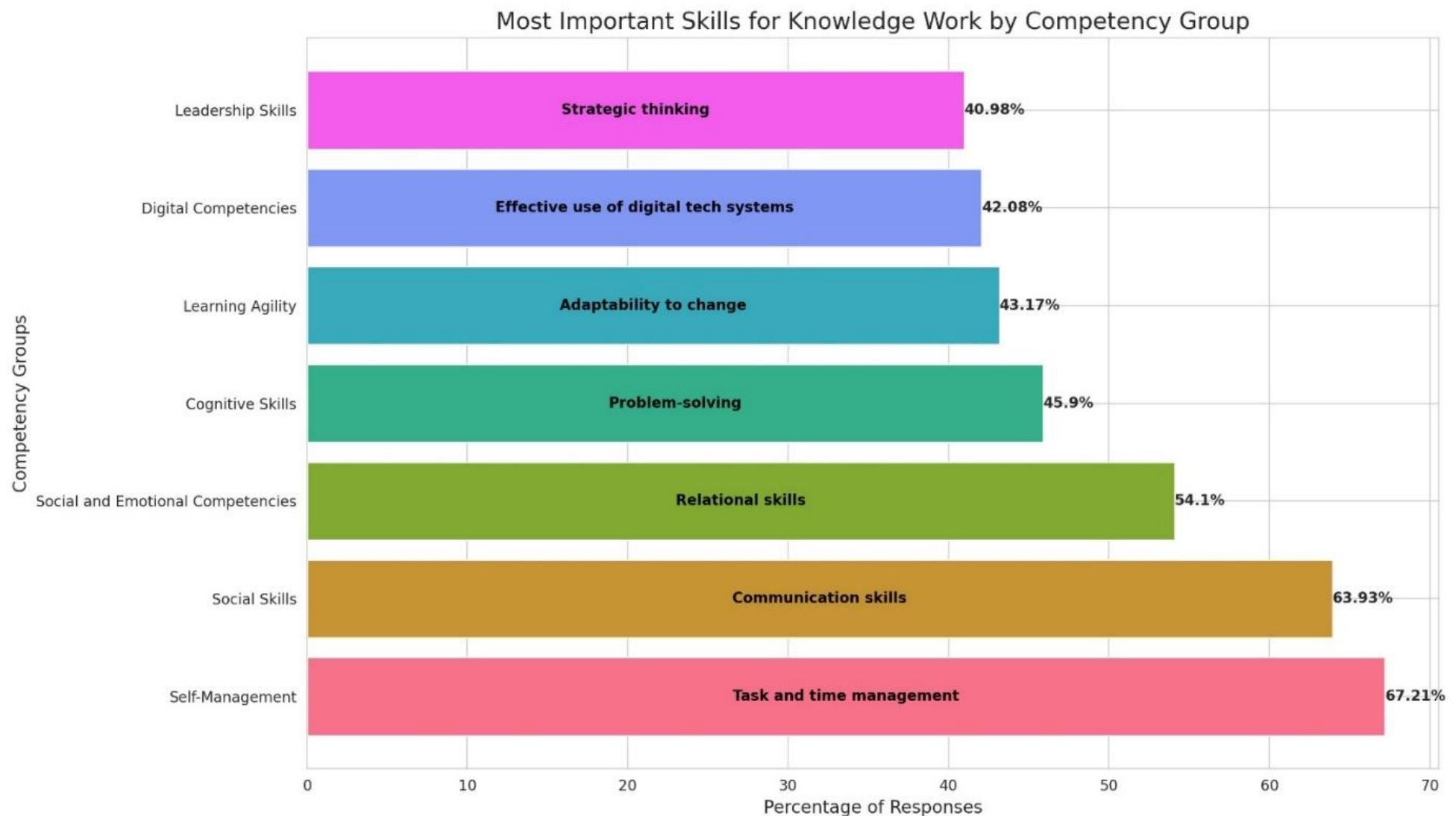


Figure 4: The most important skills crucial for Knowledge Work

For each competency group, the following were the skills/competencies ranked the highest: This horizontal bar chart above (Figure 11) provides a clear visual comparison of the most essential skills within each competency group for knowledge work. Below is the interpretation of the chart:

1. Self-Management: Task and time management are the most crucial skills overall, with 67.21% of responses.
2. Social Skills: Communication skills are a close second, with 63.93% of responses.
3. Social and Emotional Competencies: Relational skills are the third most important, with 54.1% of responses.
4. Cognitive Skills: Problem-solving is the fourth most important skill, with 45.90% of responses.
5. Learning Agility: Adaptability to change is fifth, with 43.17% of responses.
6. Digital Competencies: Effective use of digital tech systems is sixth, with 42.08% of responses.
7. Leadership Skills: Strategic thinking is the seventh most important skill, with 40.98% of responses.

Question: *Describe how the different competencies you identified as crucial interact to empower you in effectively performing your job (Knowledge Work).*

The respondents offered a range of responses and methods regarding how various competencies and skills interact with one another to develop their abilities. Their replies were highly varied, showcasing the diversity in how these competencies converge. Notably, this highlights some synergistic interactions among competencies, along with connections to empowerment, challenges, and growth. Given the extensive array of responses, they were synthesised and regrouped into distinct categories to facilitate a comprehensive understanding of the interplay of competencies. The table below reveals the details.

Table 15: The Interplay of Competencies: Correlation between variables

Competence	Digital skills	Cogni-tive skills	Learning Agility skills	Social skills	Self-Management skills	Social and Emotional Skills	Leader-ship Skills
Digital skills	1.0000						
Cogni-tive skills	0.1904 (0.0098)	1.0000					
Learn-ing Agility skills	-0.2761 (0.0002)	-0.2314 (0.0016)	1.0000				
Social skills	0.1486 (0.0447)	0.0923 (0.2142)	0.0034 (0.9641)	1.0000			
Self-Management skills	0.1089 (0.1424)	0.1929 (0.0089)	-0.1526 (0.0391)	0.1395 (0.0596)	1.0000		
Social and Emo-tional Skills	0.1612 (0.0293)	0.0166 (0.8237)	-0.1427 (0.0540)	0.0698 (0.3475)	0.2001 (0.0066)	1.0000	
Lead-ership Skills	-0.1788 (0.0155)	-0.2097 (0.0044)	-0.0131 (0.8608)	-0.1443 (0.0513)	0.0044 (0.9534)	-0.0304 (0.6832)	1.0000

Source: own work

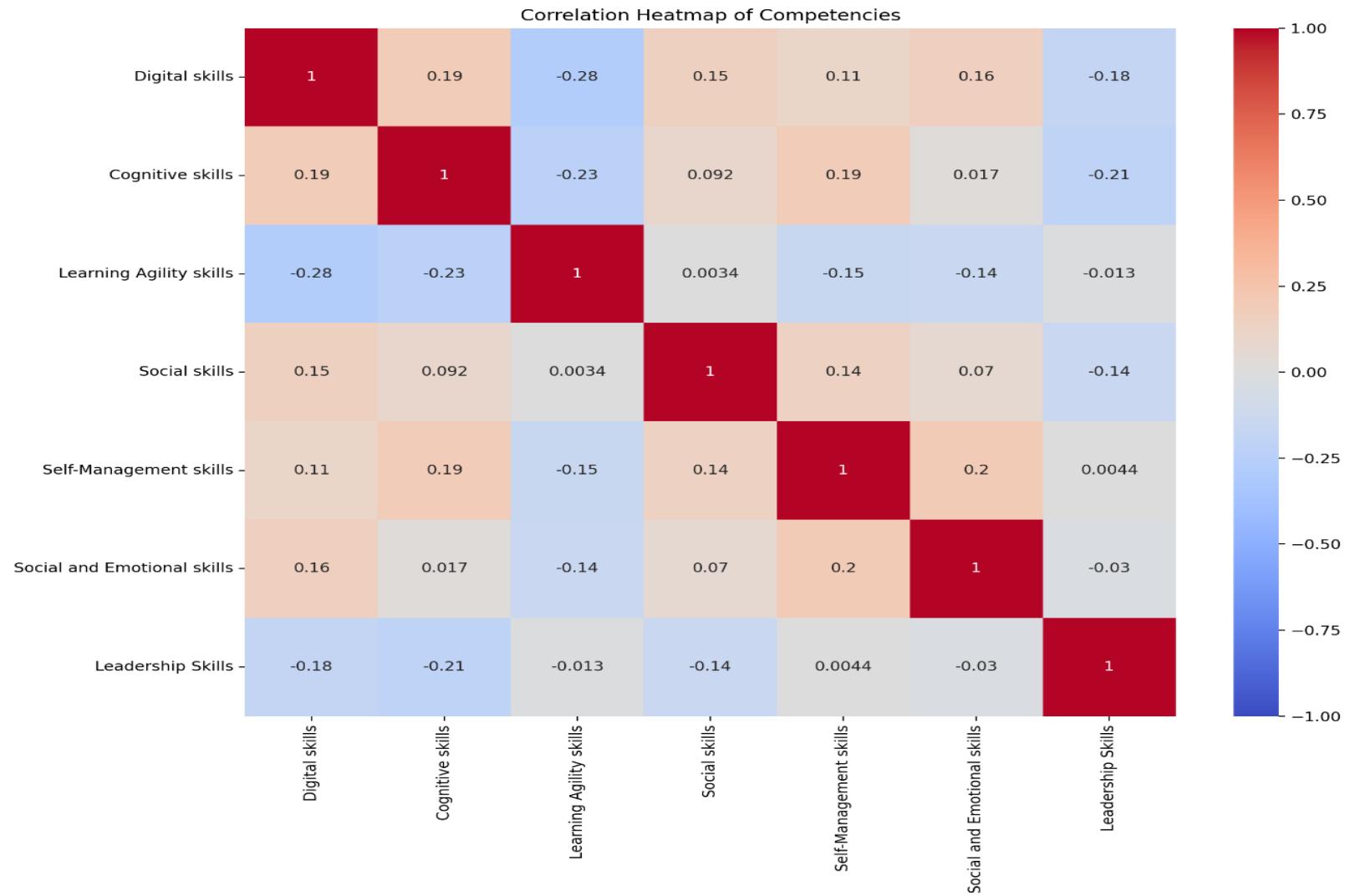


Figure 5: Correlation heatmap of competencies *Source: Own work*

4. Developing the Framework for knowledge Workers in the Age of digital transformation.

Based on the presented research results, this study proposes a more integrated competency framework that incorporates learning, technical, and transversal competencies, placing greater emphasis on skills such as cognitive flexibility, digital literacy, and adaptability as core competencies for knowledge workers in the digital age. This hierarchical design framework emphasises that mastering fundamental skills (cognitive and digital) is crucial for developing enabling competencies (social, emotional, self-management, and learning agility), which subsequently serve as a springboard for effective leadership at the strategic level. The progression reflects an increasing level of complexity and responsibility, illustrating how each tier supports and informs the next. This framework aligns with recent findings that stress the need for workers to develop “meta-competencies” that facilitate learning and adaptation across diverse contexts (Rialti et al., 2020). The findings of this research offer several key implications for developing and refining competency frameworks, particularly in the context of digital transformation and the evolving nature of knowledge work.

Each competency identified in this study (for example, digital literacy, communication, and collaboration) was mapped to corresponding skills or competency areas within a subcategory in which it can be further developed by defining similar levels for each competency, aligning them with the stages of professional growth observed within that specific context. This allows for benchmarking against international standards and facilitates the recognition of skills across different organisations and educational systems (Bach & Suliková, 2019; M. A. Campion et al., 2019; Sienkiewicz et al., 2014a). This process reveals some overlapping areas and highlights potential gaps where the study context might require unique competencies not fully addressed by the broader frameworks. The framework's key features are context-specific, diverse, and dynamic, requiring continual assessment and adaptation to maintain relevance.

The proposed competency framework is intentionally tailored to the unique context of Silicon Mountain, Cameroon. This deliberate focus enables the exploration of the specific cultural, economic, and infrastructural factors influencing knowledge work in this region, thereby offering a perspective that transcends the predominantly Western-centric viewpoints often found in existing literature (Asongu & Nwachukwu, 2018). While this framework is grounded in the specificities of Silicon Mountain, it is crucial to acknowledge that factors such as access to technology, educational infrastructure, and industry-specific demands or

even political influences will inevitably shape how these competencies are developed and valued within different contexts (Cappelli, 2009; Dauphinee, 2020; Nonaka & Takeuchi, 1995; Stuss, 2024). Therefore, the successful implementation of this framework necessitates ongoing evaluation and adaptation to ensure its continued relevance and efficacy in addressing the evolving realities of knowledge work within the region (Castells, 2010; Crossan et al., 1999; Harmse & Wadee, 2020). By establishing connections between this competency framework and established models like the Skills Framework for the Information Age (SFIA) and the European e-Competence Framework (e-CF), organisations and policymakers can forge a more robust system for developing, recognising, and leveraging the skills of knowledge workers in this emerging tech hub (J. Brown & Parr, 2018). This approach facilitates the bridging of local needs with global standards, promoting a workforce that is both contextually aware and globally competitive.

A. Tier-Based Framework Structure

In order to reflect the findings of the study, the framework is organised into three interconnected tiers, representing the foundational, enabling, and strategic competencies vital for knowledge workers in the digital era:

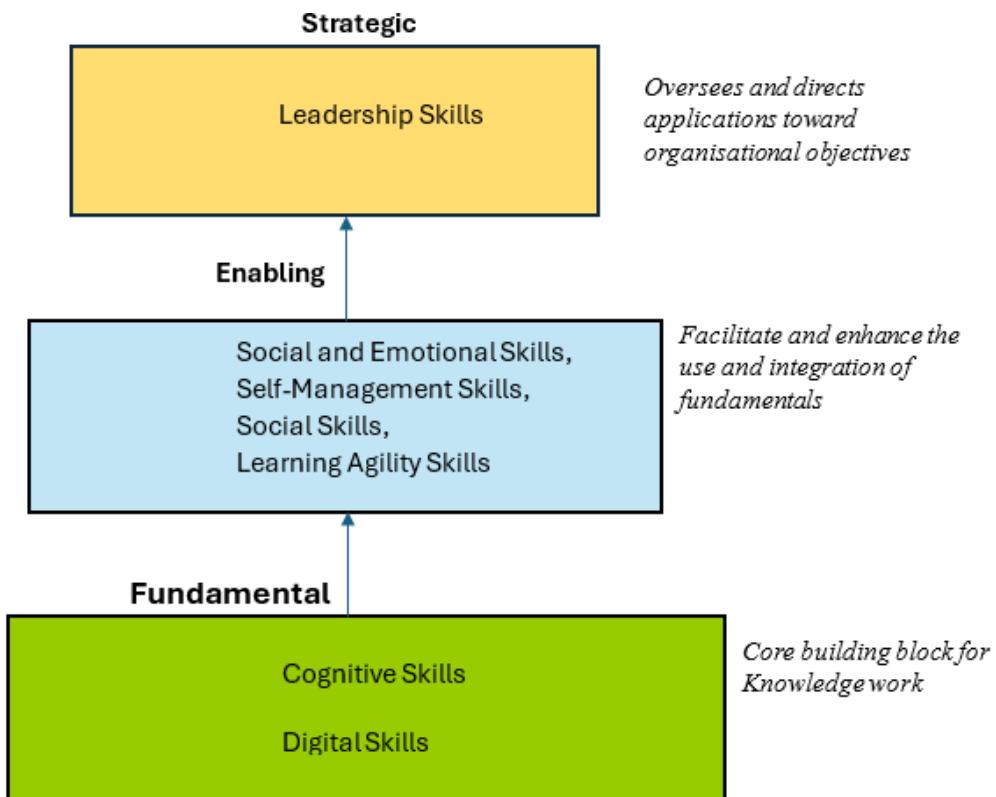


Figure 6: Competency Framework for Knowledge Workers (Tier-Based Framework Structure)

Source: Own work

Tier 1: Foundational Competencies

These are fundamental skills essential for all knowledge workers, forming the bedrock for more specialised abilities. This consists of Digital Literacy, Communication Skills, Problem-Solving, Critical Thinking, Collaboration, and Teamwork:

Digital literacy comprises basic computer skills, internet navigation, cybersecurity awareness, and proficiency in standard software applications such as word processing and spreadsheets. Both experts and knowledge found these skills important (42.08% of responses). The findings highlight the increasing importance of digital literacy as a core competency in the digital age. Expanding beyond basic IT skills, this includes proficiency in managing AI and data-driven platforms (Brynjolfsson & McAfee, 2014) and cybersecurity awareness to ensure knowledge workers are safe and efficient in a digitally interconnected environment. Communication skills were identified as essential by 63.93% of the knowledge workers surveyed. These skills include effective written and oral communication, active listening, clear articulation of ideas, and adapting communication styles to diverse audiences, all of which are vital for knowledge sharing, collaboration, and relationship-building within and beyond organisations. In today's digital landscape, effective communication also integrates digital tools for virtual teams and cross-functional collaboration, with emotional intelligence playing a key role in managing virtual interactions, aligning with Goleman's (1998) theory of emotional intelligence in digital contexts. Problem-solving and critical thinking are essential for handling the non-routine tasks typical of knowledge work. These skills involve analysing information, identifying problems, developing logical solutions, evaluating options, and making sound judgments (Bernik & Žnidaršič, 2012; de Laat et al., 2020; Weisberg, 2015). Knowledge workers need cognitive flexibility to solve complex problems using advanced digital tools (Cenamor et al., 2017; Gartner, 2020a; Mähler & Westergren, 2019; Ritter & Pedersen, 2020). Problem-solving ranks as the fourth most important skill, with 45.90% of responses highlighting its significance. Collaboration and teamwork are also critical, particularly in increasingly collaborative digital work environments (Bingham et al., 2024; Longmeier et al., 2021). These skills involve working effectively in teams, contributing to shared goals, resolving conflicts constructively, and valuing diverse perspectives. Digital collaboration is especially important, with an emphasis on managing virtual teams and utilising knowledge-sharing platforms such as cloud systems (A. C. Edmondson, 2002; Sánchez-Expósito & Naranjo-Gil, 2020).

Tier 2: Enabling Competencies

These competencies build upon the foundational layer, equipping knowledge workers to navigate digital environments and knowledge-intensive tasks effectively. They include data analysis and interpretation, digital collaboration tools, learning agility and adaptability, and innovation and creative problem-solving.

Data Analysis and Interpretation, which is the ability to collect, organise, and analyse data, identify patterns and trends, extract meaningful insights, and communicate data-driven findings, constitute a critical enabling competency for knowledge workers. These skills are paramount for leveraging data to inform decision-making and problem-solving in the digital age (McKinsey, 2020; van Laar et al., 2020). The study emphasises that 16.39% of respondents identified "Utilising information" as a crucial competency, underscoring the significance of data literacy in the modern workplace. Furthermore, the increasing prevalence of big data necessitates the ability to leverage AI tools for efficient and effective analysis, particularly in data-intensive fields such as fintech, as highlighted in the study's focus on Silicon Mountain. This aligns with the Knowledge-Based View (KBV), which posits that the strategic utilisation of knowledge, including data, is a key driver of competitive advantage (Grant, 1996).

Proficiency in utilising a diverse array of online platforms and software is indispensable for effective communication, project management, knowledge sharing, and virtual collaboration. Mastering digital project management tools (for example, tools like Jira and Trello) and collaboration platforms are essential for enhancing workplace efficiency, particularly in remote work environments (Adler et al., 2008b; Behrendt et al., 2021; Forman et al., 2023; Stokes et al., 2015; Teece et al., 2016). Moreover, the study reveals the importance of knowledge sharing and curation as crucial elements within networks and communities of practice (Horie, 2009). Promoting knowledge curation through enterprise systems and encouraging the use of social learning spaces can significantly enhance team innovation and facilitate the dissemination of knowledge throughout the organisation. Learning Agility and Adaptability is equally crucial in today's dynamic digital landscape. In the rapidly evolving digital landscape, the ability to embrace new technologies, acquire new skills expeditiously, demonstrate openness to change, and adapt seamlessly to evolving work environments constitutes a vital enabling competency. The study emphasises that 43.17% of respondents identified "Adaptability to change", and 36.61% recognised "Continuous learning" as a crucial skill, reflecting the imperative for continuous learning and adaptability to remain relevant in the face of rapid technological advancements (Bendkowski, 2018; Collin et al., 2012). This aligns with the dynamic capabilities theory, which posits that organisations must cultivate the capacity to sense, seize, and reconfigure their competencies to address the challenges and

opportunities presented by a changing environment (Teece et al., 1997). The concept of "dynamic learning," as highlighted in the study, further underscores the need for knowledge workers to engage in proactive upskilling, cultivating both technical and transversal skills that extend beyond the immediate requirements of their current roles. Lastly, Innovation & Creative Problem-Solving are fundamental for generating novel ideas, experimenting with new approaches, and challenging conventional assumptions. The generation of novel ideas, experimentation with new approaches, challenging assumptions, and contributing to innovative solutions within a digital context are pivotal competencies for knowledge workers. The study emphasises that 15.85% of respondents viewed "Creativity" and 45.90% highlighted "Problem-solving" as crucial skills, underscoring the importance of innovation as a key driver of success in the knowledge economy (Aparicio et al., 2021; H. W. Chesbrough, 2006). Knowledge workers must foster creativity and embrace experimentation, leveraging digital tools and cross-functional collaboration to develop and implement innovative solutions to complex problems.

Tier 3: Strategic Competencies

This tier represents the pinnacle of the framework, comprising advanced competencies that empower knowledge workers to operate strategically, contribute to innovation, and drive organisational success. These competencies include proficiency in artificial intelligence (AI) and machine learning, strategic decision-making and leadership, cybersecurity awareness and risk management, and mastery of industry-specific digital technologies.

As AI's ubiquity surges, knowledge workers must develop proficiency in understanding its foundational principles, adeptly applying AI tools and technologies within practical contexts, and critically evaluating the ethical ramifications inherent in AI utilisation (T. Davenport et al., 2020a; Harmse & Wadee, 2020; Tambiama, 2019). These skills are imperative for harnessing AI's transformative potential while navigating its inherent complexities and challenges. The study result shows the necessity for knowledge workers to cultivate expertise in AI integration and ethical decision-making, echoing a key point in Brynjolfsson and McAfee's (2014) seminal work on the profound impact of AI on organisations. Strategic decision-making and leadership are equally critical, requiring knowledge workers to leverage critical thinking and data analysis to inform strategic decisions, lead teams within complex digital ecosystems, and drive innovation within their organisations. These capabilities are indispensable for those in leadership roles or involved in strategic planning and implementation. Furthermore, the ability to adeptly manage digital teams dispersed across remote environments is paramount in today's increasingly virtualised workplace (Brettel et al., 2014;

Lynden, 2024; Venkatraman & Henderson, 1998). The study emphasises that 40.98% of respondents identified "Strategic thinking" and 40.44% recognised "Decision-making" as crucial skills, highlighting their significance in the digital age. In an increasingly interconnected digital landscape, cybersecurity awareness and risk management have emerged as strategic competencies. Knowledge workers must possess a deep understanding of cybersecurity threats, implement robust security measures, manage data privacy effectively, and proactively mitigate risks (Rainie & Wellman, 2018a; WEF, 2023a). The study highlights cybersecurity as a paramount concern in the digital age, particularly within technology-driven sectors. Knowledge workers must demonstrate proficiency in cybersecurity protocols and risk management to safeguard sensitive information and ensure organisational resilience against potential threats (Bendler & Felderer, 2023; U.Farooq et al., 2015). Finally, mastery of industry-specific digital technologies is a strategic competency that enables knowledge workers to excel within their specialised fields. While the Silicon Mountain research study primarily focused on Service & IT professionals, we acknowledge that the precise technical competencies required will inevitably vary across different sectors. The study indicates that 16.94% of respondents mentioned "Expertise in specific domains" as a crucial competency, highlighting the importance of domain-specific knowledge in conjunction with broader digital skills.

Table 16: Competency Framework for Knowledge Workers in the Digital Age

Tier	Competency Category	Specific Competencies	References
Tier 1: Foundational Competencies	Digital Literacy	- Basic computer skills, internet navigation - Cybersecurity awareness - Proficiency in standard software (word processing, spreadsheets, AI and data-driven platform management)	(Brynjolfsson & McAfee, 2014; Hernandez-de-Menendez et al., 2020)
	Communication Skills	- Effective written and oral communication - Active listening - Clear articulation of ideas - Adapting communication style - Emotional intelligence for virtual interactions	(Goleman, 1998; Hinds & Bailey, 2003)
	Problem-Solving & Critical Thinking	- Analysing information - Identifying and defining problems - Developing logical solutions - Evaluating options - Making sound judgments - Cognitive flexibility	(Acton, 2023)
	Collaboration & Teamwork	- Working effectively in teams - Contributing to shared goals - Resolving conflicts constructively - Valuing diverse perspectives - Digital collaboration skills	(Adler & Heckscher, 2008; Großer & Baumöl, 2022; Nonaka & Takeuchi, 1995)
Tier 2: Enabling Competencies	Data Analysis & Interpretation	- Collecting, organising, and analysing data - Identifying patterns and trends - Drawing meaningful insights - Communicating data-driven findings - Leveraging AI tools for big data analysis	Davenport, 2005; Grant, 1996 ;Benbya et al., 2020)
	Digital Collaboration Tools	- Proficiency in communication platforms (email, IM) - Project management software (Asana, Trello) - Knowledge sharing tools (cloud storage, wikis) - Virtual collaboration tools (video conferencing)	(Brynjolfsson & McAfee, 2014)
	Learning Agility & Adaptability	- Embracing new technologies - Acquiring new skills quickly - Openness to change - Adapting to evolving work environments - Proactive upskilling and reskilling	(Hecklau et al., 2016; Teece et al., 1997)
	Innovation & Creative Problem-Solving	- Generating novel ideas - Experimenting with new approaches - Challenging assumptions - Contributing to innovative solutions - Using digital tools for creative problem-solving	(Amabile et al., 2018b; Chesbrough, 2006)
Tier 3: Strategic Competencies	Artificial Intelligence (AI) & Machine Learning	- Understanding AI principles - Applying AI tools and technologies - Critically evaluating AI's ethical implications	(Brynjolfsson & McAfee, 2014)
	Strategic Decision-Making & Leadership	- Applying critical thinking and data analysis to strategic decisions - Leading teams in complex digital environments - Driving innovation - Managing digital teams across remote locations	(Ahern et al., 2015; J. C. Spender, 2014; Goleman, 2011b)
	Cybersecurity Awareness & Risk Management	- Understanding cybersecurity threats - Implementing security measures - Managing data privacy - Mitigating risks in digital environments	(Bendler & Felderer, 2023)
	Industry-Specific Digital Technologies	- Mastering advanced tools and technologies specific to the industry or domain (e.g., fintech, telehealth, digital marketing)	(Doherty et al., 2013)

Source: Own work

B. Category-Based Framework

The framework developed above is the main framework which outlines a progression of skills and competencies for knowledge workers, while the Category-Based Framework act

as a complementary framework, can also be used alongside this. It offers an alternative yet interconnected structure for conceptualising knowledge worker competencies. This framework classifies the identified competencies into three distinct domains based on their fundamental nature, providing a structured approach to understanding the diverse dimensions of skills essential in the digital age. The defined categories are Technical Competencies, Transversal Competencies, and Learning Competencies. The primary purpose of this categorisation is to ensure a *balanced perspective on competency development*. While the Tier-Based Framework maps the progression from foundational to strategic competencies, the Category-Based Framework ensures that the essential balance between technical expertise, transversal skills, and adaptive learning competencies is maintained within this progression. This reflects the reality that contemporary knowledge work demands a sophisticated synthesis of these different skill types (Persaud, 2021; Rialti et al., 2019).

By grouping competencies this way, the framework:

- Provides a structured understanding of the various dimensions of skills required.
- Emphasises the increasing significance of "meta-competencies" (such as learning agility and adaptability), which are crucial for effectively navigating the dynamic and rapidly evolving digital landscape (Bendkowski, 2018; Hernandez-de-Menendez et al., 2020; Kulkarni, 2021).
- Ensures that development initiatives consider all essential facets (technical, transversal, learning) within each stage of a knowledge worker's progression (as potentially outlined by the Tier-Based framework).
- Support in the design of targeted training and development programs by clarifying the type of skill being addressed.

The framework details are highlighted below:

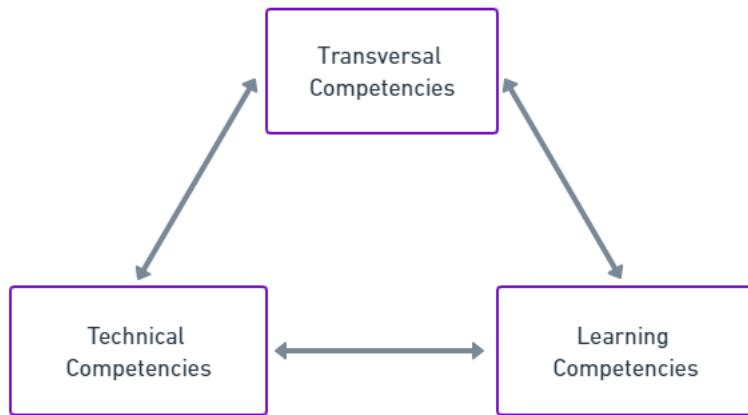


Figure 7: Competency Framework for Knowledge Workers (Category-Based Framework)

Source: own work

While the Tier-Based Framework (figure 6) focuses on the progression of skills across foundational, enabling, and strategic levels, mapping the developmental journey of individuals from basic competencies to advanced strategies, the Category-Based Framework (Figure 20) provides a clear structure for categorising competencies into three distinct domains: technical, transversal, and learning. This classification of skills enables a more refined understanding of the nature of each competency by ensuring that throughout the progression outlined in the Tier-Based Framework, there is a balance of technical, soft (transversal), and adaptive (learning) skills. This is attributable to the fact that knowledge work necessitates a synthesis of technical expertise and a broader skillset. This approach aligns with the increasing emphasis on "meta-competencies," which facilitate learning and adaptation across diverse contexts (Persaud, 2021; Rialti et al., 2019). A key feature of the framework is that it is dynamic and adaptive. It acknowledges the rapid pace of technological change and emphasises continuous learning and adaptability as core competencies (Bendkowski, 2018; Hernandez-de-Menendez et al., 2020; Kulkarni, 2021). This dynamic nature is essential for knowledge workers to remain relevant and competitive in the face of emerging technologies and shifting industry demands. In order to clarify the concepts, the key components and structures can be defined as follows: Technical competencies refer to the specific skills and knowledge required for working with digital technologies, such as AI, Big Data, and cybersecurity (Ismail & Hassan, 2019). Transversal Competencies involve broader competencies essential for navigating the complexities of knowledge work, including critical thinking, problem-solving, communication, collaboration (Craşovan, 2016; Devika et al., 2020), and learning agility

(Dixon, 2018; MacLean & Scott, 2011; Reeves, 2012). Learning competencies focus on an individual's capacity to acquire new knowledge and skills. Together, these components form a comprehensive framework for understanding and developing the necessary competencies and ensuring that all necessary competencies across types and developmental stages are addressed in alignment with both global standards and local needs.

In the effective implementation of the proposed frameworks, it is essential to clarify the specific roles that each framework serves and to examine their complementary relationship. The tier-based framework illustrates how competencies develop, while the category-based framework ensures a balance of technical, transversal, and learning competencies within each tier. As seen above, it is organised into three interconnected tiers: foundational, enabling, and strategic. Each tier builds upon the previous one, creating a cohesive and progressive learning pathway for individuals or organisations. These categories provide a structured overview of the skills and attributes required for knowledge workers. The category-based framework guarantees that within each tier, there is a balance of different types of skills, preventing an overemphasis on one skill type at the expense of others. The tiered framework can be employed to focus on the level of expertise and responsibility associated with each competency, showing how skills become more advanced and strategic as individuals progress in their careers. The focus of the category framework can be on the type of skill and its application, whether it is a core technical ability, a transversal (soft) skill applicable across various domains, or a learning skill essential for personal and professional growth. The category-based framework aids in understanding the different dimensions of competencies and guarantees that all relevant skills are considered within each tier of the tier-based framework. As a guide to the progression of learning and development, the tier-based framework reveals which skills to cultivate at each stage of a knowledge worker's career. This can aid organisations in effectively identifying and nurturing the required skills, as well as facilitating the design of targeted training programmes. Ultimately, it fosters a work environment that prioritises continuous learning and professional growth, empowering individuals and organisations to thrive in a dynamic and competitive landscape.

The study focuses on a specific context, that is, the knowledge workers in Silicon Mountain, Buea, Cameroon, and it is vital to acknowledge that the framework's applicability extends beyond Silicon Mountain and will require a careful adaptation when implemented in different geographical locations, industries, or organisational cultures. As previously mentioned, factors such as access to technology, the maturity of educational infrastructure, and

the specific needs of different industries will inevitably influence how these competencies are developed and valued (J. Baptista et al., 2020; Mittelmann, 2018; Polo & Kantola, 2020). For instance, in regions with limited technological infrastructure, the emphasis on digital literacy and AI-related competencies might need to be adjusted to reflect the local context (Asongu & Nwachukwu, 2018; Chua, 2013b; Großer & Baumöl, 2022a). Similarly, industries with distinct skill requirements may necessitate the incorporation of additional specialised competencies into the framework. The research reveals that developing these competencies requires a multifaceted approach that includes formal training programmes, on-the-job learning experiences, mentorship opportunities, and access to relevant resources (Candrell, 2024a; Jennings, 2013; Örtenblad, 2018; WEF, 2016). Furthermore, the study shows the importance of fostering self-directed learning environments that empower employees to take ownership of their learning trajectories and proactively seek opportunities for improving their skills (Reese, 2021). Therefore, this competency framework should be viewed as a dynamic and adaptable tool, subject to regular evaluation and refinement, to ensure its continued alignment with the ever-changing digital landscape and the evolving needs of organisations and industries. Integrating this framework with established models like SFIA and e-CF, organisations and policymakers can create a more robust and comprehensive system for developing, recognising, and leveraging the skills of knowledge workers. This approach facilitates the bridging of local needs with global standards, promoting a contextually aware and globally competitive workforce.

C. Validation Of the Hypotheses

One of the objectives of the study was to test and validate the formulated hypothesis. This section presents the empirical findings by assessing how these results support the stated hypotheses, which guide the dissertation's investigation into knowledge worker competencies in the age of digital transformation. The following hypotheses were formulated and tested:

H1: *The identified competency groups, including digital, cognitive, learning agility, social, self-management, social and emotional, and leadership, are crucial for effective knowledge work in the age of digital transformation.*

The systematic literature review established a theoretical foundation and identified key competencies relevant to knowledge workers in the digital age. Through this process, seven key competency groups essential for knowledge workers to thrive in the age of digital transformation were revealed: digital competencies, cognitive skills, learning agility, social skills, self-management, social and emotional competencies, and leadership skills. Each group contains critical competencies that knowledge workers require to excel in their roles and contribute effectively to organisational success. The expert panel results further reinforce the relevance of these groupings, showing crucial competencies they see as important across several of these groups for effective performance of knowledge work. Specifically, expert respondents highly valued both cognitive skills and social and emotional competencies. The findings from both the expert panel and the knowledge worker survey provide substantial support for **H1**. According to ***Expert Panel Findings*** (Table 23), Experts were asked to identify the most important group of competencies for effective knowledge work. While cognitive skills and social/emotional competencies received the highest responses (each 35.29%), learning agility and self-management were also identified as important (each 11.76%). Even digital competencies (5.88%), though ranked lower, were still considered. Experts' collective analysis of all these groups reveals the importance of their findings.

As for the Knowledge Worker Survey (Table 32 - Probit Regression), the Probit regression analysis examined the impact of these competency groups on the perceived effectiveness of knowledge work. Cognitive and social skills demonstrated a statistically significant positive impact at the $p<0.01$ level. Digital competencies and social and emotional competencies also showed a positive effect, significant at the $p<0.1$ level. Although learning agility, self-management, and leadership skills did not show statistically significant effects *in this specific model*, their inclusion in the overall assessment and their ranking in other parts of the survey (e.g., Table 29, Figure 12 showing individual skill preferences within groups) suggest they

are still considered relevant components of an effective knowledge worker's profile. The fact that most of the seven groups showed a statistically significant positive impact on effectiveness, and the others are widely discussed and valued in both expert and practitioner responses across different questions, lends broad support to the idea that these groups are collectively crucial. Therefore, based on the consistent identification and prioritisation across multiple data points and participant groups, H1 is considered to be supported.

***H2.** Specific competencies within the cognitive skills group (such as critical thinking and creativity) and the social skills group (such as Communication Skills) have the greatest positive impact on effective knowledge work performance in the age of digital transformation.*

Hypothesis H2 focuses on identifying which specific competencies within the broader groups, particularly cognitive and social skills, demonstrate the most significant positive impact on effective knowledge work performance. The study employed a quantitative approach, including a Probit regression analysis, to assess the impact of different competency groups on effective knowledge work. While the Probit analysis estimated the effects of the competency *groups*, the results indicated that the **cognitive skill** group (coefficient 0.6323841, p-value 0.007) and the **social skills** group (coefficient 0.6691741, p-value 0.002) had a positive and statistically significant effect on effective knowledge work at the 0.01 level. This empirical finding supports the premise that these broader groups have a strong positive influence. Complementing the statistical analysis, the expert panel and the knowledge worker survey provided vital perspectives on the importance and impact of *specific* skills for effective daily knowledge work. The expert panel was asked to list the top five crucial skills for knowledge workers in today's digital era. The synthesis of expert responses frequently highlighted skills such as **critical thinking, creativity, communication skills, and collaborative skills**. **critical thinking** stood out as the most emphasised specific skill. Critical thinking and creativity fall within the cognitive skills group, while communication skills and collaborative skills are key components of the social skills group. The Knowledge Workers Survey directly asked participants about the most important individual competencies for their daily tasks within specific groups. The results from this survey indicated that, among others, **problem-solving** (a cognitive skill), **communication skills** and **relational skills** (social skills) were perceived as highly critical. The synthesis of the knowledge worker findings further emphasised the strong importance placed on communication, problem-solving, and adaptability.

Taken together, the statistically significant positive effects of the Cognitive Skills and Social Skills *groups* identified by the Probit analysis, combined with the consistent emphasis from both the expert panel and the knowledge worker survey on specific skills like critical

thinking, creativity, problem-solving (from the cognitive group), and communication skills, collaborative skills, relational skills, and emotional intelligence (from the social/social and emotional groups) as most critical and impactful for daily knowledge work, strongly validate Hypothesis H2. The evidence suggests that specific competencies residing within these high-impact groups are indeed perceived and statistically indicated as having the greatest positive impact on effective knowledge work performance in the age of digital transformation. Collectively, the consistently high ranking of critical thinking, creativity/problem-solving (cognitive), and communication skills (social) by both experts and practitioners, coupled with the strong statistical impact of the cognitive skills and social skills dimensions in the regression model, **supports H2**.

H3: Hypothesis 3 stated: The competency framework for knowledge workers shows a dynamic and structured relationship that can be effectively represented by a three-tiered framework comprising foundational competencies, enabling competencies, and strategic competencies, where each tier builds upon the preceding one.

Hypothesis H3 connects the empirically identified high-impact competencies to the proposed structure of the competency framework. This hypothesis is directly and explicitly supported by the study's analysis and the resulting competency framework structure. It thus forms the basis for developing a comprehensive competency framework for knowledge workers in the digital era. This framework is organised into three interconnected tiers: Foundational, Enabling, and Strategic. The classification of competencies into these structures is based on their interaction patterns and position within the skill ecosystem. H3 is supported by mapping the empirically validated high-impact skills against the theoretical complexity of task execution, confirming that cognitive skills serve as the necessary bedrock (Foundation) for higher-order strategic behaviours.

As established in the validation of H2, the Probit regression analysis indicates that both the cognitive skills group and the social skills group have the strongest statistically significant positive impact on effective knowledge work. The knowledge worker survey also identifies specific skills within these groups (problem-solving from cognitive, communication skills, and relational skills from social), along with critical self-management skills (task and time management) as the most important for daily work. Cognitive skills are categorised in the fundamental layer, while social skills are placed in the enabling layer, accompanying other significant competencies identified by knowledge workers, such as self-management. The framework's design is hierarchical, emphasising that mastering fundamental skills (cognitive and digital) is essential for developing enabling competencies (social and self-management),

which then serve as a "springboard" for the strategic level such as effective leadership competencies. This structure confirms that the competencies with the strongest identified impact (cognitive and social skills groups) form the foundational and enabling layers of the framework, thereby building the necessary base for developing higher-level strategic competencies. Therefore, the alignment between the competencies identified as having the most substantial positive impact through empirical analysis (Probit) and those perceived as most critical by knowledge workers (survey), along with their placement within the Fundamental and Enabling layers of the proposed tiered competency framework, strongly validates Hypothesis H3. These validations reinforce the empirical grounding of the competency framework developed in this study. To ensure this empirical grounding is robust, the study next examines the validity and reliability of the research instrument.

According to Drost (2011), ensuring the validity and reliability of the research instrument is crucial for the integrity and applicability of a study's findings. The study uses both content and construct validity. The correlation matrix was analysed using Statistica and Excel through Cronbach's Alpha techniques. For instance, the correlation matrix showed significant correlations between digital skills and cognitive skills (0.1904) and between social and emotional skills and leadership skills (-0.1788), indicating that the items measured distinct but related constructs (Babin & Svensson, 2012; Drost, 2011).

Regarding reliability, a pilot study was previously conducted, and the results were published in the Springer Journal of Knowledge Economy on February 17, 2022 (Muzam, 2022). This study laid the foundation for the approach used in the current research. Additionally, a similar study was completed, and the survey was administered three times: during the pilot study, with the expert panel, and among knowledge workers. The tool Statistica was used to compute the correlation coefficient between the sets of responses for each participant. A strong positive correlation indicated good stability of the survey responses over time, thus supporting the test-retest reliability of our instrument (Drost, 2011). The reliability analysis showed Cronbach's alpha values for various competency dimensions, such as digital competence (0.4157), cognitive competence (0.4416), and social skills (0.4896), which, although slightly below the optimal threshold, indicate a reasonable level of internal consistency.

This study ensures high validity and reliability, providing a robust competency model that accurately reflects the competencies required for knowledge workers in the digital era. The rigorous validation process, including expert consultations and iterative refinement, enhances the credibility and applicability of the findings, ensuring they are both reliable and relevant for practical application in organisational settings.

Therefore, by synthesising the key findings from the analysis, it shows:

1. Strong Association Between Skills and Groups: The Cramer's V value of 0.9714 indicates a very strong association between skills and their respective groups. This suggests that the categorisation of competencies into groups is highly consistent and reliable.
2. Significant Chi-square Test: The chi-square test resulted in a p-value of 0.0, which indicates a statistically significant association between skills and groups. This further supports the reliability of the competency categorisation.
3. Variability Within Groups:

Group	Frequency
Cognitive Skills	0.5096635508970817
Digital Competencies	0.5611678654618685
Leadership skills	0.6598007095484082
Learning Agility	0.6028538537397893
Self-Management	1.0046771685894398
Social Skills	0.6924167895718976
Social and Emotional Competencies	0.4404927489358821

Figure 8: Variability Within Groups Source: Own work

This suggests that while the overall categorisation is strong, there is considerable variation in the frequency of different skills within each competency group. This variability could indicate that some skills are considered more critical or frequently required within their competency groups. It may also indicate potential differences in how respondents interpret or value specific skills within each competency.

4. Intraclass Correlation Coefficient (ICC):

Intraclass Correlation Coefficient (ICC): -0.041666666666666667

The negative ICC value (-0.04167) suggests that there is more variability within groups than between groups. This indicates low reliability in terms of consistency within each competency group. Consequently, it can be generally concluded that the study demonstrates strong reliability in terms of categorising skills into distinct competency groups for knowledge workers. The high Cramer's V value and significant chi-square test results support this conclusion. However, the negative ICC value and the moderate to high coefficients of variation suggest that there is considerable inconsistency in the frequency or importance of different skills within each group. This might also result in a more subtle conclusion:

1. The overall framework of competency groups appears to be reliable and well-defined.
2. The specific skills within each group show high variability, which may indicate:
 - a) A need for further refinement of the skills within each competency group.
 - b) The possibility that some skills are more central or important to their respective competencies than others.
 - c) Potential differences in how respondents interpret or value specific skills within each competency.

5. General Conclusion and Practical Recommendations

This dissertation addresses the critical research problem of identifying and conceptualising key competencies for knowledge workers operating in environments undergoing profound digital transformation. Recognising the limitations of traditional competency models and the dynamic nature of contemporary knowledge work, this study aims to develop a comprehensive, empirically grounded, and contextually relevant competency framework suited to the digital age. This concluding section synthesises the key findings related to the research questions, outlines the study's theoretical and practical contributions, discusses implications, acknowledges limitations, and suggests directions for future research. The research yielded several significant findings that directly address the guiding research questions and contribute to the understanding of knowledge worker competencies:

The research question concerning the redefined nature of knowledge work and competency requirements (addressing RQ1, RQ2), the analysis of the study confirmed that digital transformation fundamentally redefines knowledge work, shifting from routine tasks to complex, cognitively intensive, collaborative, and technology-mediated activities (Alvesson, 2004; Korczynski & Wittel, 2020; Baptista et al., 2020). This new context requires a unique and complex competency profile. The analysis systematically identified and empirically validated seven core competencies essential for navigating this environment: digital competencies, cognitive skills, learning agility, social skills, social and emotional competencies, self-management, and leadership skills. This complex requirement separates knowledge work in the digital age from traditional paradigms.

Regarding the question of the adequacy of existing frameworks and theories (addressing RQ3), the research concludes that established learning theories (constructivist, social, situated, etc.) provide foundational insights but are insufficient on their own to fully address the complexities of networked and digitally infused learning realities (Kolb, 2015; Lave & Wenger, 1991; Palincsar, 1998). Similarly, traditional competency models, which are often

static and task-oriented (Dubois et al., 2004; Sanchez & Levine, 2009), along with universal frameworks like SFIA and e-CF, demonstrate significant limitations in flexibility, holistic scope, contextual adaptability, and emphasis on essential non-technical skills (J. Brown, 2020; e-CF, 2024; Lehner, 2018). This highlights the need for synthesised approaches or new digitally aligned paradigms that integrate individual, group, and network learning perspectives, explicitly incorporating theories such as connectivism (Siemens, 2009; Bell, 2011) and adapting traditional ones. Therefore, this research contributes by synthesising disparate theoretical perspectives (constructivist, experiential, social, situated, network, and self-regulated learning) to create a more comprehensive theoretical foundation. It has developed a novel competency framework that has been empirically validated through an expert panel review and knowledge worker survey conducted within a specific emerging tech hub context (Silicon Mountain, Cameroon). Thus, it offers a practical and contextually relevant alternative or enhancement to potentially rigid or overly generic universal models.

On the analysis, the question of essential, evolving, and emerging competencies arises (addressing RQ4, RQ5). The empirical investigation (SLR, expert panel, KWrs survey) identified specific competencies deemed essential. Critical thinking has consistently emerged as paramount across multiple data sources. Resilience, learning agility (continuous learning), creativity, self-motivation, and emotional intelligence were also ranked highly by experts. Although baseline digital competencies are necessary, they seem less differentiating than advanced cognitive and socio-emotional skills (Muzam, 2022; van Laar et al., 2020). The study highlights a discernible shift where human-centric and adaptive skills are key differentiators in effectively leveraging technical proficiency within fluid, interconnected, and technologically mediated work structures. Furthermore, the study confirms the evolving nature of these requirements, with experts projecting the increasing prominence of critical thinking and adaptability to change in the near future, underscoring the lasting value of cognitive flexibility and adaptive competencies amidst technological advancements.

The empirical results gathered through the expert panel research and knowledge worker survey provided substantial validation for the study's primary hypotheses. Specifically, the findings confirmed the crucial collective importance of the identified competency groups (H1), highlighted the significant positive impact of specific Cognitive Skills (particularly critical thinking) and Social Skills (communication) on effective knowledge work performance (H2), and supported the assertion that these high-impact competencies form the foundational and enabling layers of the proposed tiered competency framework (H3). This valida-

tion strengthens the empirical grounding of the competency framework developed in this study.

In addressing the research question regarding the core components and structure of a robust framework (RQ6), the dissertation presents a novel, empirically derived competency framework as its primary output. It proposes a dual structure: a Tier-Based Framework that illustrates competency progression across Foundational, Enabling, and Strategic levels, reflecting increasing complexity and responsibility, and a Category-Based Framework that ensures a holistic balance among Technical, Transversal, and Learning competency types. This structured approach meets the need for core components and organising principles of a comprehensive model designed for digital-age knowledge workers.

Therefore, this study offers several significant contributions to competency development in the digital age. Firstly, it constructs a contextually grounded competency framework that moves beyond generic models by integrating both technical and soft skills deemed crucial for navigating the complexities of the digital landscape within this specific context. The empirical basis of this framework, derived from Knowledge workers' data collection and the expert panel, provides a useful and practical tool for organisations operating within similar environments seeking to optimise their human capital strategies. Secondly, this research advances theoretical understanding by synthesising disparate theoretical perspectives on competency development. This integrative approach facilitates a better exploration of the intricate relationships between individual competencies, organisational strategies, and dynamic capabilities. Thus, by connecting existing theoretical silos, the dissertation contributes to a more holistic and comprehensive understanding of competency development, offering novel insights that enrich the theoretical discourse within strategic management, Human resource and organisational behaviour. Furthermore, it offers practical implications for the development of more inclusive and effective strategies for competency development that address the needs of all segments of the workforce via the developed framework. This dissertation makes a substantial contribution to the scholarly understanding of knowledge worker competencies in the digital age. The findings challenge traditional static competency models, suggesting that more dynamic and adaptable frameworks are needed. The rapid pace of technological change means that static competency models, which focus on fixed or predefined skill sets, are inadequate for the evolving needs of knowledge workers. The study, therefore, enriches the existing literature on knowledge worker competencies and its comprehensive framework and can serve as a basis for future research.

From a practical standpoint, this research offers clear strategies for organisations aiming to foster the development of knowledge workers. Organisations should integrate personalised learning programs tailored to the individual needs of their employees, focusing not just on technical skills but also on transversal competencies such as leadership, teamwork, and creative problem-solving. Therefore, fostering a culture of continuous learning and adaptability is crucial. Organisations should prioritise environments that support experimentation, iterative learning, and mentorship, especially in tech-driven industries. For practitioners, the findings offer actionable guides that can be directly applied within organisations. As shown, learning agility is a key competency for KWrs; hence, investments in learning and development initiatives that promote continuous learning are crucial for building a workforce capable of adapting to new technologies and market demands. From a policy perspective, the study suggests that policymakers should consider initiatives that bridge the digital skills gap. This could include funding for lifelong learning programs and providing incentives for organisations and institutions that invest in employee development across all age groups. Such interventions can help ensure that the workforce remains skilled and competitive in the face of technological advancements.

1. Recommendations for Practice

This study enhances the theoretical discourse in strategic management, HRM, and organisational behaviour by offering a synthesised understanding of competency development that connects individual, group, and network learning perspectives within the context of digital transformation. It challenges static conceptualisations of competency and provides an empirically grounded framework as a foundation for future theoretical refinement. As a recommendation for practice, Organisations should consider implementing the following interconnected recommendations to effectively engage and empower knowledge workers. First, organisations should prioritise the development of robust competency assessments. Regularly evaluating the workforce allows for the identification of specific skill gaps and ensures that learning initiatives are strategically aligned with overarching organisational goals. For example, focus development on critical areas like critical thinking, learning agility, resilience, and collaboration. Furthermore, the creation of personalised learning plans tailored to individual needs enables targeted development of both technical expertise and essential transversal skills. Second, it is highly recommended that microlearning programs and mentorship initiatives be implemented. Microlearning provides easily digestible, just-in-time knowledge, enabling employees to navigate the ever-shifting digital landscape effectively. Complementing this, mentorship programs, pairing experienced knowledge workers with those facing chal-

lenges in adapting to new technologies, offer invaluable support. This approach not only helps bridge the digital skills gap but also fosters intergenerational knowledge transfer within the organisation, maximising the retention and dissemination of institutional wisdom.

Finally, cultivating a culture of continuous learning is paramount. Organisational leaders must actively promote and support ongoing professional development. This can be achieved by providing employees with access to a diverse range of learning opportunities, which include both formal training programs and informal learning channels. Embedding continuous learning into the organisational fabric, companies can empower their workforce to remain agile, adaptable, and equipped to thrive in the dynamic digital age. The role of competencies in driving innovation and organisational performance will continue to grow, making this research a valuable foundation for ongoing exploration into the future of work and the competencies required for success in the digital age.

2. Limitations and future research directions:

Despite its contributions, the study acknowledges limitations related to its methodological and geographical focus, as well as the inherent challenges in assessing competencies. It identifies gaps in the literature, particularly the need for more comprehensive and empirically validated frameworks. Future research is encouraged to explore the dynamic evolution of competencies across different geographical and methodological settings, the impact of organisational factors on competency development, and the framework's applicability in various industries and contexts. Additionally, further investigation is needed into social and emotional competencies, especially in industries that are increasingly reliant on interpersonal skills alongside technological expertise. Research should also focus on how emerging technologies, such as artificial intelligence (AI), the Internet of Things, and machine learning, influence the future competency needs of knowledge workers. As these technologies evolve, the demand for new competencies will shift, necessitating an ongoing reassessment of the knowledge worker competency framework.

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