Knowledge Creation for Digital Innovation in Malaysia: Practitioners’ Standpoint

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Abstract: Background: Malaysia established the National Industry 4.0 strategy (NI4.0) in 2018 to aid the country’s industries in adopting modern technologies to increase productivity and competitiveness. The purpose of NI4.0 is to increase enterprises’ intelligence capabilities as smart manufacturers in the Association of Southeast Asian Nations (ASEAN), who employ data and information across the whole enactment process. As a result, high-technology adoption in NI4.0 is expected to improve knowledge creation (KC) in the Information Technology (IT) business. Recent NI4.0 breakthroughs have permitted new types of borderless projects, thereby, increasing the complexity and unpredictability of IT projects while simultaneously providing a multitude of new knowledge. However, the understanding of contemporary practice difficulties in IT projects and the knowledge creation phenomena is limited. Method: This study is exploratory in nature with a generic qualitative research method. Ten selected key IT project managers were interviewed to understand the current challenges confronting IT projects in Malaysia to build practice-oriented problem statements and to provide relevance leading to a research framework for knowledge creation impacting digital innovation. Interview data were systematically analysed using the NVivo software tool. Results: Practitioners’ reflected that a transactive memory system, IT support and T-shaped skills are current challenges in Malaysian IT projects. This is consistent with the literature. Conclusions: This practice review benefits Malaysia’s public and commercial sectors by confirming that the literature is coherent with practice by providing insights that may warrant further research in this field.

Keywords: knowledge creation; preliminary interview; national industry 4.0; digital innovation

1. Introduction

In recent years, the remarkable development of Information and Communication Technology (ICT) systems has encouraged the movement of talent, resources and knowledge beyond the limits of ICT ventures. ICT industry has rendered important contributions to jobs and profits for Malaysia. Statistics indicate that the ICT industry contributes RM 267.7 billion to the national economy, which is equivalent to 18.5 per cent of the GDP in 2018 [1]. Under NI4.0, the Malaysian Government has defined the main digital areas for the ICT industry.

Admittedly, NI4.0 opens up the opportunity for a digital transition in the ongoing industrial revolution. Key digital fields include Artificial Intelligence (AI), Internet of Things (IoT), Cloud, Data Mining, Cyber Protection, Data Centers and e-commerce. New technology with broader scope and complexity increased in the ICT industry, a wealth of new knowledge has also appeared. While academics and practitioners are increasing worried regarding the usage of such emerging technology by organisations, little is known about the implications for the practice of KC and the potential to improve for enterprises [2].

KC has been a catalyst of global competitiveness for NI4.0 [3]. Competitive advantages are generated through KC and contribute to the firm’s potential progress [4]. Numerous pieces of evidence imply that Japanese firms, such as Honda, Canon, Matsushita, NEC,
Sharp and Kao, have benefited tremendously from KC’s contribution to their firm’s potential for advancement [5]. Through KC, firms have become well-known for their fast responses to clients, their capacity to establish new markets, their rapid development of new goods, their ability to take the lead in emerging technology and their potential progress [5].

The future of the business relies on how much they can create the knowledge in the shortest period to gain sustainable competitive advantages. KC fosters organisational human resources development [6], resulting organisation to become more innovation and achieve better competitive advantages. In addition, KC is a constant commitment to explore for more knowledge in Malaysian organisations and to create greater insights for the firms. The aim of this paper is to identify current challenges in IT projects in Malaysia to uncover new knowledge and make greater improvements for the organisation.

This paper proceeds as follows: Section 1 provides an introduction of the study. Section 2 provides a literature review on KC and the background of the studies. Section 3 describes the methodology of the research. Section 4 discusses the results. Section 5 provides discussion, Section 6 highlights limitation and future recommendation. Finally, Section 7 concludes the study. Hence, the research questions for this study are as follows:

1. What are the challenges faced by IT project managers?

2. Based on a practitioners’ viewpoint, what are the possible factors that require attention in order to ensure knowledge creation leading to digital innovation?

Our findings are derived from the analysis of the interview data. The paper provides important practitioner-oriented insights on how a transactive memory system, IT support, and T-shaped skills can impact KC and thus create digital innovation.

2. Literature Review

2.1. Knowledge in Organisations

In the modern world of digital age, it is challenging for an organisation to locate correct information in the right form to supporting its daily activities. Hence, the organisation might lose its competitive advantage. Ikujiro Nonaka and Hirotaka Takeuchi [7], pioneers in knowledge creation research, performed extensive studies on how the nation of rising sun developed and bring up the economies during 1995 by using this knowledge.

Knowledge is defined as “justified true belief” derived by Plato [8], a philosopher in ancient Greece, who stressed that belief in the truth of something does not constitute our true knowledge of it, so long as there is a chance or a possibility that we may have made mistakes in our belief. Nevertheless, knowledge needs to be nurtured, supported, enhanced and taken care of by humans [7]. According to the organisation’s learning process, the employee is the actor to develop knowledge and reduce uncertainty [9]. Employees use knowledge earned through experience rather than knowledge gained from rules or manuals.

The larger the amount of uncertainty that exists, the greater the potential for its reduction and the greater the possibility that organisations will be productive or effective as a result. Later, scholars clarified that knowledge is not utter reality and can be identified in fact according to perspectives through synthesized contradictions; thus, one may overcome the current state and build new truth [10]. Linking knowledge in organisation to the process of knowledge creation is essential for knowledge evolution.

2.2. Knowledge Creation

KC is an ongoing process that involves acquiring new context, perspective and knowledge [7]. Through the KC process, an individual may transcend the limitations of their previous selves and become a new version of themselves. The Theory of Organisational Knowledge Creation (TOKC) by Nonaka and Takeuchi [7] is the kernel theory. TOKC explained organisational knowledge creation process through four modes of conversion: through individual or group experiences sharing (Socialization), expressing awareness into concepts (Externalization), linking and systemizing the concepts (Combination) and embodying knowledge to create product value (Internalization) [7].
Past research has identified four aspects of knowledge creation including the knowledge creation process or SECI model [7], intellectual assets [11], “Ba” or a location as a dynamic setting in which knowledge creation happens [10] and practical wisdom that illuminates Aristotle’s notion of “phronesis,” which translates as “prudence” or “practical knowledge” [12].

KC has become increasingly necessary as business adapt to continuing rapid shifts in the market and advances in the emerging technology [13]. Currently, KC research is growing toward practical methodology for developing human-centered strategies for Industry 4.0 and beyond [14]. From the past research, TOKC indicated innovation through integrating both explicit and tacit knowledge amongst different sources in the value chain broaden the organisation’s knowledge [9]. In the new competitive market climate, KC is highly associated with the digital innovation to modernize goods and services [15]. Digital innovation is the consequence of the crystallisation of knowledge [3], as a result from the KC process [16]. Nevertheless, a stream of study on factors has been a significant contributor to KC studies.

Past studies have examined various factors in KC research, such as management influence [17], employee training, work scheduling autonomy, employee involvement, product design, benchmarking and vision statement [18], trust, collaboration, learning, incentive and IT support [19], decision making autonomy, work methods autonomy, task variety, task significance, task identity and feedback from job [20], collaboration, trust, learning, reward, decentralization, formalization, IT support and T-shaped skills [21], shared goals and hope [19], customer co-creation and partner sourcing [22], customer orientation [23], creativity [24], reward and collaboration [25], learning culture [26], ethical leadership and psychological capital [27]. These studies on KC factors are summarised in Table 1.

The summary of the past research on KC factors is shown in Table 2. There has been insufficient study on the influence of intellectual capital and KC initiatives on

| Author                  | Year | Country            | Key Factors to KC                                                                 | Context                      | Research Method                          |
|-------------------------|------|--------------------|-----------------------------------------------------------------------------------|------------------------------|------------------------------------------|
| Zelaya-Zamora and Senoo | 2013 | Japan              | Managerial influence, Employee Training, Employee Involvement, Product Design,     | Research and development firm | Quantitative, survey questionnaire       |
|                         |      |                    | Benchmarking and Vision                                                          |                              |                                          |
| Shan et al. [18]        | 2013 | China              | Trust, Collaboration, Learning, Incentive and IT support, Work Scheduling         | Aviation firms               | Quantitative, survey questionnaire       |
|                         |      |                    | Autonomy, Decision Making Autonomy, Work Methods Autonomy, Task Variety, Task     |                              |                                          |
|                         |      |                    | Significance, Task Identity and Feedback from Job                                 |                              |                                          |
| Berraies et al. [19]    | 2014 | Tunisia            | Government federal ministry                                                       | Quantitative, survey         |
|                         |      |                    | Small and medium enterprise                                                       | questionnaire                  |
| Yusof et al. [20]       | 2016 | Malaysia           | Reward, Decentralization, Formalization, IT support and T-shaped skills           | IT firms                     | Quantitative, survey questionnaire       |
| Pham and Le [21]        | 2018 | Vietnam            | Small and medium enterprise                                                       | Quantitative, survey         |
|                         |      |                    | Ethical leadership and Psychological capital                                      | questionnaire                  |
| Goswami and Agrawal [22]| 2018 | India              | Share goal and Hope                                                               | IT firms                     | Quantitative, survey questionnaire       |
| Goyal et al. [16]       | 2020 | United States and Singapore | Customer co-creation and Partner sourcing                                         | Financial and IT firms       | Quantitative, survey questionnaire       |
| Liow et al. [23]        | 2020 | Malaysia           | Customer orientation                                                              | Small Hotel                  | Quantitative, survey questionnaire       |
| Yoon et al. [24]        | 2020 | South Korea        | Creativity                                                                       | Service Industry             | Quantitative, survey questionnaire       |
| Yee et al. [25]         | 2020 | Malaysia           | Reward and Collaboration                                                           | Medical device firms         | Quantitative, survey questionnaire       |
| Rahbar et al. [26]      | 2021 | Iran               | Learning Culture                                                                  | Public Hospital              | Quantitative, survey questionnaire       |
| Goswami and Agrawal [27]| 2022 | India              | Ethical leadership and Psychological capital                                      | IT firms, public sector      |
|                         |      |                    | research organisations, university and colleges                                  | Quantitative, survey         |

The summary of the past research on KC research gap is shown in Table 2. There has been insufficient study on the influence of intellectual capital and KC initiatives on
corporate success in the knowledge economy [6]. From the innovation perspective, handful of studies are focus in the area of digital innovation [28,29] and related applications. Inadequate study on the implications of social media on KC and technological progress [29]. TMS’s effects on team KC skills are still scant [30]. At the moment, there is a scarcity of research on university-industry level KC [31].

Table 2. Summary of the past research on KC research gap.

| Author                     | Year | Country                 | KC Research Gap                                                                 | Context                        | Research Method               |
|----------------------------|------|-------------------------|---------------------------------------------------------------------------------|--------------------------------|-------------------------------|
| Mehralian et al. [6]       | 2018 | Iran                    | Lack of studies have looked into how the intellectual capital and KC initiatives affects the success of businesses in the knowledge economy. SECI model has not undergone thorough empirical validation with construct impacting transfer of learning. | Pharmaceutical companies      | Quantitative, survey questionnaire |
| Chatterjee [28]            | 2018 | India                   | Inadequate study of social media’s impact on KC and digital innovation.          | Organizations                  | Quantitative, survey questionnaire |
| Papa et al. [29]           | 2018 | Italy                   | Inadequate study of social media’s impact on KC and digital innovation.          | Small and medium-sized enterprises | Quantitative, survey questionnaire |
| Grimsdottir and Edvardsson [30] | 2018 | Iceland                 | Lack of studies on how KC may facilitate open-innovation ideas and practises.    | Small and medium-sized enterprises | Qualitative, case study         |
| Goyal et al. [16]          | 2020 | United States and Singapore | Lack of studies connecting external knowledge and inputs from customers to internal innovation and KC. | Financial and IT firms         | Quantitative, survey questionnaire |
| Tootell et al. [31]        | 2021 | Australia               | There is currently a dearth of studies on the factors that promote KC at university-industry level. There is a dearth of studies that examine how KC made possible by digital innovation to accelerate value creation. | University-industry collaborations | Qualitative, semi-structured interview |
| Di Vaio et al. [32]        | 2021 | Italy and France        | There is a dearth of studies that investigate the transfer of tacit knowledge into explicit knowledge across teams between different organisations. Transactive Memory System’s effects on teams’ abilities to KC are overlooked. | n.a.                          | Bibliometric analysis          |
| Li et al. [33]             | 2018 | China                   | There is a dearth of studies that investigate the transfer of tacit knowledge into explicit knowledge across teams between different organisations. Transactive Memory System’s effects on teams’ abilities to KC are overlooked. | State-owned research institutes | Quantitative, survey questionnaire |
| Cao et al. [34]            | 2020 | China                   | A handful of studies that focus on digital innovation, KC and its application.   | Information Technology industry | Quantitative, survey questionnaire |
| Hanelt et al. [35]         | 2021 | Germany                 | A handful of studies that focus on digital innovation, KC and its application.   | Automotive manufacturers       | Quantitative, Longitudinal study |
| Nisula et al. [36]         | 2022 | Finland                 | Lack of studies have focused on the KC process in leading innovative projects.    | Interorganizational innovation projects | Qualitative, semi-structured interview |

Few studies have examined how the introduction of digital innovation has aided KC’s capacity to accelerate value creation [32]. However, there has been little research into the KC process for guiding creative endeavours, such as connects KC to internal innovation or consumer feedback [16], including how KC can promote open innovation [29].

Industry 4.0 paradigm is distinguished by extensive digitization and integration of industrial manufacturing and logistics operations; as a result, digital knowledge is critical in producing digital breakthroughs [37]. Through KC, IT organisations acquired specialised knowledge and expertise from the market and industry, recombining a variety of proven digital and analogue knowledge to generate digital innovation [38].

2.3. Digital Innovation

Digital innovation refers to the use of emerging technology in a wide variety of innovative endeavours [39]. IT organisations used digital technology for example internet of things (IoT) with fifth generation (5G) telecommunication networks, big-data analytics,
artificial intelligence (AI), blockchain technology and others to help innovate in their respective fields. As digital technology progresses, DI is becoming increasingly important in the IT industry.

DI contains sociotechnical characteristics that are linked to the concept creation about how users interpret and use certain features in the digital technology [40]. DI are not only tied to visible IT functions but also consider what an application allows users to perform. For instance, mobile applications, such as ride-hailing and electronic wallets [41].

At present, IT employees work in dynamic environments that necessitate the acquisition of digital technology on a regular basis. Individuals are the foundation of digital innovation [42]. Space, time, sensory and social ties can be represented digitally. For instance, experience assessment from the mobile users increased granularity of digital representation and opportunities for products or services improvement. Collectively, they maximize data flows and connection, which multiply the potential value massively.

2.4. Knowledge Creation in IT Projects and Digital Innovation (KC-IT-DI)

Nambisan, Lyytinen, Majchrzak and Song [43] introduced KC-IT-DI into three concepts. First, KC-IT-DI creates problem–solution combinations that are both dynamic and diverse in nature. Furthermore, KC-IT-DI should be cognizant of the boundaries of the innovation area as well as the capacities of participants. Second, shared cognition and collaborative sense-making as a critical component of digital innovation, with digital technology serving as a vehicle for socio-cognitive sense-making and shared cognition in general. Third, technology affordances refer to the use of emerging technologies as a collection for produce various innovation results in different circumstances. Digital innovation stimulates the development of new business models, allow for more interconnected and networked environment, which necessitates the creation new knowledge and capture of value via a network of core and supplementary resources.

2.5. Current Challenges in IT Projects

Evidence from the literature revealed that transactive memory systems (TMS), IT support (ITS), team learning (TL), team collaboration (TC) and T-shaped skills (TSS) are critical factors in IT projects in creating new knowledge and producing larger benefits for the organisations [44–47]. When social interaction with a team is reduced, IT project managers face a “who knows what” conundrum due to a lack of TMS to recognise team knowledge when there is a need to react to crises, situations, continual change and problem solving [44,48]. The transactive memory systems, IT support, team learning, team collaboration and T-shaped skills are defined as follows:

a. Transactive memory systems (TMS) is a cognitive system whereby individually specific information is encoded, stored and retrieved using a common cognitive structure focused on mutual understanding of each other’s specialized knowledge domains [49]. Although they may have had interactions with other team members through online conferencing, a personal bond may not have grown as a result of IT support.

b. IT Support (ITS). ITS refers to the use of technology to aid in the maintenance of data storage, processing and transfer [50]. Lack of ITS, such as upfront analytics and data management, might put the project in jeopardy and create disasters in a variety of circumstances, such as offering misinformation in the meeting, opining or advising without solid supporting facts, or reacting emotionally to an occurrence [47,51].

c. Team Learning (TL). TL refers to groups of people that work together to make positive behavioural changes [52]. TL promotes KC through debating, brainstorming, workshops, online forums and communities of practise [53]. Team members learn from one another through imitation, which leads to increased sensemaking and more sound decisions.

d. Team Collaboration (TC). Remote project teams that lack team collaboration complicate matters for the project manager because team members are not based in an office
and operate in different time zones, making it difficult to assemble for impromptu conversations for decision making [44]. For effective remote project teams, IT project managers must broaden their knowledge in order to facilitate project implementation while making the best use of their strengths [54]. Evidence from the studies revealed that project managers lack team learning in order to obtain the information required to manage projects, deal with obstacles during a crisis and establish competitive advantages [42,44,48].

e. T-shaped skills (TSS). Project managers lack of TSS, which demonstrate the existence of in-depth knowledge and abilities in a certain area as well as an awareness of other fields required for the projects [46,55,56]. T-shaped skills refers individual who has in-depth knowledge and skills in a particular discipline and also has a background of other fields necessary to the projects [37]. It is vital to note that T-shaped skills allow for the expansion of team capabilities, allowing the team to be more agile, adaptive and robust throughout the project [57].

In a nutshell, the literature highlights the current challenges in IT projects required detail study in order to accelerate KC proliferation in Malaysia. To ascertain whether the challenges in IT projects are generalized within the context of Malaysia, practitioner-oriented interviews were performed to address the research objective.

3. Methodology

This study rests on an interpretive research paradigm. A qualitative method was used in conjunction with an inductive approach for this study. A Problem-Centred Interview (PCI) was used to acquire knowledge and to understand the current scenario of problems to support initial propositions generation. The PCI procedure was adopted from Witzel and Reiter [58]. Following the PCI procedure [58], the interviewer initiates the conversation with a specific question in order to prompt a narrative that is organised according to the interviewee’s concerns. By doing targeted investigations and referring directly to the accounts provided by the respondents, interviewer can gain more insights into the interviewees’ points of view.

These inquiries and assertions are founded on prior knowledge or information that becomes clear later on in the narrative portion of the discussion. The purpose of the PCI is to ensure that practical problems gathered through studies are consistent with what the practitioners are experiencing. The result is expected to strengthen the problem statement development of the doctoral research to develop a comprehensive KC model for digital innovation.

A total of 10 project managers from ICT organisations in Malaysia with at least 5 years of experience managing ICT projects, serving as subject matter expert inside the organisation and generating learning materials, were interviewed. The interviews were aimed to understand practitioner’s point of view about the current scenario as first-hand experience before embarking into the research based on published studies.

The findings of the interviews will be the basis of direction to offer theoretical framework for KC in IT project to support digital innovation. The questions posted are mainly on current challenges faced by project managers and on KC. Each face-to-face interview lasted approximately 30 min to 1 h conducted between 1–30 June 2021.

Figure 1 illustrates the mapping process of practice review to derive problem statements and the findings towards insights, challenges, conceptual model and research gap.

This study employs purposive sampling technique. Practitioners were selected based on their expertise, years of experience, position in organisation and involved in IT projects (refer to Table 3). The practitioners were reached through email and instant messaging for an invitation to attend face-to-face interviews. In order to keep the practitioners’ details anonymous, their names and details were kept confidential in this paper. The data collected were categorized into similar categories. NVivo qualitative analytical software tool were used to present word cloud visual representation along with tabulated findings.
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Table 3. List of practitioners.

| Expert     | Position          | Credibility                                      |
|------------|-------------------|--------------------------------------------------|
| Practitioner 1 | Project Manager   | Project Management Professional (PMP®)           |
| Practitioner 2 | Project Manager   | Project Management Professional (PMP®)           |
| Practitioner 3 | Project Manager   | Projects IN Controlled Environments (PRINCE2®)   |
| Practitioner 4 | Project Manager   | Project Management Professional (PMP®)           |
| Practitioner 5 | Project Manager   | None                                             |
| Practitioner 6 | Project Manager   | Projects IN Controlled Environments (PRINCE2®)   |
| Practitioner 7 | Project Manager   | Project Management Professional (PMP®)           |
| Practitioner 8 | Project Manager   | None                                             |
| Practitioner 9 | Project Manager   | Project Management Professional (PMP®)           |
| Practitioner 10 | Project Manager   | Project Management Professional (PMP®)           |

4. Result

4.1. Practitioners’ Demographic Profile

Half of the practitioners (50%) have approximately above 10 years of experience as ICT project manager (refer Table 4), another half with 5–9 years of experience. Overall, the practitioners have vast experience in ICT projects and were found suitable to be included for practice review.
Table 4. Practitioners’ working experience in IT project.

| Number of Working Experience in IT Project (Year) | Count (Percentage) |
|--------------------------------------------------|--------------------|
| 5–9                                              | 5 (50%)            |
| Above 10                                         | 5 (50%)            |

Participants were grouped into three categories including Project Management Professional (PMP®), Projects IN Controlled Environments (PRINCE2®) and None. A total of 60% of participants possess Project Management Professional (PMP®) certification, 20% have PRINCE2 certification, and 20% do not have any project management certification but have long years of experience working in this field (refer Table 5). This adds value to our interviews as participants can relate their ICT project experience and professional knowledge within the KC context.

Table 5. Practitioners’ credibility in project management.

| Project Management Certification                              | Count (Percentage) |
|---------------------------------------------------------------|--------------------|
| Project Management Professional (PMP®)                       | 6 (60%)            |
| Projects IN Controlled Environments (PRINCE2®)               | 2 (20%)            |
| None                                                          | 2 (20%)            |

For the PMP® category, 66.7% participants are male, and 33.3% are female (refer to Figure 2). On the other hand, 100% PRINCE2® holders are male. Lastly, the percentage of the male and female are equal in none category.

Figure 2. Project Management Qualification (by gender).

4.2. Challenges in IT Projects (Research Question 1)

Feedback from the respondents about the challenges in IT Projects were presented in Table 6.

a. Team related issues, particularly from remote team, knowledge gap and issues in communicating such knowledge between stakeholders. This refers to TMS, a method to leverage external memory to encode, store and retrieve knowledge.
Table 6. Team-related challenges.

| Challenges in IT Projects | Selected Excepts | Inference |
|---------------------------|------------------|-----------|
| Team related issues, particularly from remote team, knowledge gap and issues in communicating this knowledge between stakeholders. | Participant 1: “It is hard to identify the team knowledge.” Participant 4: “This may be a symptom of a lack of clear communication between the parties.” Participant 7: “The knowledge gap between technical or other teams with the project manager.” Participant 8: “One of the most frequent challenges connected with any project is the issue of communication and the inability to establish an efficient communication channel between parties.” | The inability to establish an efficient communication channel between parties. This may be a symptom of a lack of clear communication between the parties and a failure to identify the team’s knowledge gap. |

b. Lack of sophisticated IT tools for project analysis. Table 7 shows the statement related to the lack of IT tools for project analysis. Project managers do not have analytic tools for daily tasks. Inadequate team collaboration highlights the team having difficulties to know true project situations and the follow ups are inaccurate.

Table 7. IT tools challenges.

| Challenges in IT Projects | Selected Except | Inference |
|---------------------------|-----------------|-----------|
| Lack of sophisticated IT tools for project analysis. | Participant 2: “The project manager is only being provided some necessary software, such as Microsoft Word, Excel and Project.” | The project managers lack of IT support. |

c. Lack of in-depth knowledge and general skills in particular discipline involving estimating, risk and stakeholder management skills (Table 8).

Table 8. Skills challenges.

| Challenges in IT Projects | Selected Excepts | Inference |
|---------------------------|------------------|-----------|
| Lack of in-depth knowledge and general skills in particular discipline involving estimating, risk and stakeholder management skills. | Participant 3: “Things deteriorate further when the project experiences continual or uncontrolled scope development. This may be a symptom of a lack of stakeholder involvement.” Participant 4: “external factor, such as poor stakeholder management may result in the escalation of disputes.” Participant 6: A failure to manage stakeholders may result in a more serious issue.” Participant 8: “knowledge accumulation, experience review and organisational problems evaluation are all important.” Participant 10: “Project manager also lack of stakeholder management skills.” | Lack of stakeholder involvement in a project or scope development may be a cause for concern. Failure to manage stakeholders may result in a more serious issue. Knowledge accumulation, experience review and organisational problems evaluation are all important. |

Based on the above challenges, further thematic analysis on the interview excepts were analysed to produce axial themes and relevant factors as shown in Table 9.
Table 9. The challenges in IT projects.

| Selected Excerpts                                                                                                                                                                                                 | Axial Theme                                                                 | Relevant Factors |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------------|
| Participant 1: “It is hard to identify the team knowledge. Therefore, how much work the remote team accomplishes and at what rate remains unclear. Moreover, the project has an unreasonable timetable for completing the task. Junior team members lack the necessary skills to work on a project and thus need additional supervision and assistance from more experienced team members. It is possible that unnecessary management intervention will result in the project not being completed on schedule.” | Team knowledge, Remote team, unreasonable timetable, lack of necessary skills, management intervention, delay in project completion | TMS, TSS        |
| Participant 2: “The project manager is only being provided some necessary software, such as Microsoft Word, Excel and Project. IT support comes in as an essential tool for the PM to carry out project tasks. IT support helps in for PM to analyse data, understand requirements, compiling stats for business reporting, calculating efforts in anticipating project progress and financial, reviewing defects against business benefits for release considerations.” | Limited IT Support | ITS |
| Participant 3: “The remote team hard to know the true situation because it may not be told. The follow up will be not accurate. When several projects are operating in simultaneously, resource shortage is a constant problem. Furthermore, things deteriorate further when the project experiences continual or uncontrolled scope development. This may be a symptom of a lack of stakeholder involvement.” | Resource shortage, lack of stakeholder involvement, over-reaction to changes in funding | TMS, TC         |
| Participant 4: “The working environment differences, such as network, workspace, etc., may cause a different understanding or result. This may be a symptom of a lack of clear communication between the parties. Alternatively, external factor, such as poor stakeholder management may result in the escalation of disputes.” | Variations in network and workplace, affect comprehension or outcome, poor communication, Poor stakeholder management, disagreements. | TC              |
| Participant 5: “The customer gives unclear specifications. It is tough for the project team to meet their deadlines. Unrealistic timelines and resource limitations make it more difficult for the project team to fulfil the expectations of the clients. Other than scheduled meetings or discussions, sometimes, it’s challenging to connect with each other. The urgent issue will be complicated in this case as response time will be slower.” | Unpredictable deadlines, limited resources, inability to meet client expectations, slow response time | TC              |
| Participant 6: "When the scope of a project is not adequately specified, recorded, or managed, it may result in the customer’s business needs altering. As a general matter, it is seen as detrimental. A failure to manage stakeholders may result in a more serious issue. Furthermore, the escalation is not clear for most of the cases when something happens.” | Unclear escalation | TC              |
| Participant 7: “The knowledge gap between technical or other teams with the project manager. Therefore, the integration of communication and management skills into project management is critical to the success of the project. If the project’s objection is unclear and the team’s vision are not unified, it will be difficult to establish agreement on the project’s course of action.” | Poor communication and management skills | TSS, TC         |
| Participant 8: “One of the most frequent challenges connected with any project is the issue of communication and the inability to establish an efficient communication channel between parties. The communication issues as there is still some cultural, language and distance barrier. In terms of project management, knowledge accumulation, experience review and organisational problems evaluation are all important.” | Communication | TC              |
Table 9. Cont.

| Selected Excerpts                                                                 | Axial Theme               | Relevant Factors |
|---------------------------------------------------------------------------------|---------------------------|------------------|
| Participant 9: “Keep the team motivated, bring diverse teams together so that they may succeed as a single unit and demonstrate leadership are all tough tasks to do. Other impacts, such as time zone, for example, the United States vs. Malaysia time differences are 12 h, fastest it will be one day in response time.” | Team engagement, leadership | TL               |
| Participant 10: “Project managers lack knowledge in estimating the high-level effort and incoming risks that a PM needs to anticipate. This requires experience, time, as well as the right environment to acquire the skills. Project managers also lack stakeholder management skills. If a project manager knows how to manage people, projects can be well managed. People make or break a project, which is factual.” | knowledgeable project manager, TSS, TL |                  |

Figure 3 shown the word cloud was produced using the NVivo software to represent the most frequently occurring words from the group interview. The participants were posed with the question, “What are the challenges in IT projects?” in the interview session.

Figure 3 shows the word ‘team’, which contains the most often cited term in the respondent interviews, followed by ‘management’, ‘communication’ and ‘knowledge’. This indicates that project managers use the aforementioned term frequently in their everyday job and have it ingrained in their minds.

The word ‘team’ is the most often discussed topic since project managers work on a variety of projects on a daily basis with T-shaped skills. The project manager requires ‘management’ and ‘communication’ from the relevant stakeholders that require IT support to schedule the meetings and sending meeting invites, TMS to identify right meeting participants, T-shaped skills to apply right ‘knowledge’ to coordinate meeting, listening, asking questions and record actions and decisions made. “Team” and “Management”
indicate that project managers coordinate multiple teams that require TMS and T-shaped skills to drive the project and get aid or support from their management.

The study’s variables were organised into theme based on Lee and Choi [59]. People and technology are the subjects of two primary themes (refer to Table 10). T-shaped skills and the TMS are classified as theme of people [59]. IT Support is categorised in the theme of technology.

Table 10. Mapping word cloud to themes and key variables.

| Word Cloud | Themes                  | Mapping to Key Variables |
|------------|-------------------------|--------------------------|
| team       | people & technology     | x                        |
| communication | people & technology    | x                        |
| knowledge  | people & technology     | x                        |
| management | people                  | x                        |

The word ‘project’ is mapped to people and technology themes that incorporate Transactive Memory System, T-shaped skills and IT support. Project managers must equip themselves with these three variables to guide their daily activities.

The word ‘participation’ is linked to people theme including the variables of Transactive Memory System and T-shaped skills. Project managers should pick the appropriate participants based on their ability to determine who knows what and who can attend the meeting when required.

The word of “communication” has been mapped onto people and technology themes, which include the Transactive Memory System, T-shaped skills and IT Support. The managers of a project need to equip themselves with these three variables in order to carry out effective communication and ensuring that all parties involved are aware of their respective missions and responsibilities.

The words “team” and “management” have been mapped to corresponding people themes, which include the Transactive Memory System and T-shaped skills. These variables provide project managers the ability to effectively manage relevant parties, such as the project team and stakeholders, to ensure that they are working toward the project’s goals.

5. Discussion

5.1. Antecedents of Knowledge Creation

While all the above challenges exist in the professional field of IT Projects, several key challenges give light to identifying key antecedents to knowledge creation. The first challenge was related to knowledge gaps and communication issues, as depicted in the theme about project managers attempting to deal with the “who knows what” dilemma and is mapped to the Transactive Memory System. Second, the absence of an IT Support theme, revealed a lack of IT tools for project analysis as the second problem. Finally, the lack of T-shaped skills theme, which was associated with the T-shaped skills, revealed a lack of in-depth knowledge and broad abilities in a certain discipline involving estimating, risk management and stakeholder management skills.

TMS has a significant connection to the KC process [34]. In addition, TMS clarifies who knows what and encourages the appreciation of supplementary information. The literature demonstrated that TMS provided a knowledge network that facilitates the sharing of tacit information [60], which facilitated the transmission of tacit knowledge rapidly and readily [61]. According to Nonaka and Nishihara, the transmission of information was an integral aspect of the KC process [15].

IT support encourages project managers to become technologically savvy to meet corporate requirements and maintain workforce preparedness [53]. For instance, a social networking service (SNS) can serve as a collaborative platform emphasising collectivism.
and allowing teammates to develop new knowledge. Complementing SNS, instant messaging enhances team cooperation by making communication with peers easier and more comfortable [62].

Previous research has demonstrated that T-shaped skills have positive effects on KC [48,49]. T-shaped skills are extremely valuable for KC due to their capacity to mix multiple knowledge resources [63]. In accordance with Mamoun and colleagues, T-shaped skills are vital to organisations due to their capacity to generate and integrate diverse kinds of knowledge, which contribute to the formation of new knowledge and make it simpler to explore new domains of knowledge [64].

New knowledge in digital technologies is crucial for the creation of digital advancements [65]. Project managers must have a solid grasp of digital technologies and the ability to learn about technical breakthroughs on demand in order to be effective in digital innovation. Additionally, they should understand how to function more effectively with digital tools, such as SNS and instant messaging. Through KC, project managers acquired specialised market and industry expertise and recombined a variety of known digital and analogue knowledge to create digital innovation [66].

Transactive Memory System, IT Support and T-shaped skills were found to be important antecedents to KC in IT Projects. We propose that this research gap should be filled based on the research framework in Figure 4.

![Figure 4. Proposed research framework.](image)

The proposed framework suggests that Transactive Memory System, IT Support and T-shaped skills are important antecedents for reducing the problems in achieving KC. Solving KC issues will lead to improving digital innovation.

5.2. Increase 3Cs in IT Project (Collaboration, Communication and Coordination)

Further to the above findings, we suggest that increased communication, collaboration and the exchange of information in the IT project may further improve the current status of knowledge creation. First, team members need to be dependable, which means they should be able to rely on one another for more than simply fulfilling their daily responsibilities. When team members ask for feedback and receive none in response, it may be as frustrating as dealing with a co-worker who is easily offended by constructive criticism. Project team members are encouraged to continue to be engaged with the team, recognise their mistakes and to consistently seek opportunities for personal improvement [67].

Second, active listening requires members of the team to resist the impulse to answer before fully comprehending the other person’s views and to ask questions in order to elicit further information from the conversation. Active listening may be demonstrated through a variety of methods, including nonverbal clues, open-ended inquiries, paraphrase and verbal affirmations [68].

Even if members of a team should be able to understand how to take criticism in a constructive manner while the team is coping with disputes, disagreements can still cause unpleasant sentiments that interfere with teamwork. In the event that there is a problem, team members should instruct to look for ways to resolve the issue through facilitation, mediation, or creative problem solving [69].
Finally, team members will have access to a wide variety of alternatives for communication and collaboration in the workplace if a digital workspace is utilised. Some examples of such workspaces include Google workspace and Microsoft Teams. Any member of the team is capable of automating a repetitive activity, building a project board, or managing the workflow of a case using digital workspaces [70].

6. Limitations and Future Recommendations

This result and analysis of this study is based on interview results obtained from 10 IT managers. It will be more gainful to obtain views of more IT managers, particularly from varied segments of ICT sector. The results of this study are not meant for generalisation due to the nature of the study, which aims to understand the challenges from the practitioners’ point of view.

Future research may focus on KC in IT Projects to understand the significance of KC in IT Projects. Researchers may gain a better grasp of the issues afflicting the KC community, such as how to improve communication, collaboration and information sharing in IT Projects. Future study will focus on extrapolating new features to promote KC in IT Projects within the Volatility, Uncertainty, Complexity and Ambiguity (VUCA) landscape by investigating new variables or dimensions related to KC in IT Projects.

7. Conclusions

Moving ahead, KC will play a critical role in advancing the NI4.0 plan. The findings are likely to spark interest in KC research by addressing a gap in the literature and theory through partnership among the government, industry and universities. This study focused on the following three main points: First, the study focused on the difficulties inherent in IT initiatives that aim to generate knowledge for digital innovation within the context of Malaysia. Second, hypotheses relating KC to DI in the theoretical model were presented. This study contributes to a deeper comprehension of IT project management by providing an understanding of the role that KC plays in IT projects. The ramifications of this study provide scholars and the general public with useful references for further study and educational pursuits. This study will also be of assistance to scholars because it provides directions for KC research. In addition, this study sheds light on future research regarding knowledge communities in digital innovation in connection to IT projects. As a result, the community is being urged to conduct more research in order to fill this gap.

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