

Building Digital Competency for Digital Banking Innovation Through Knowledge Management 4.0 Strategy

Bambang A. Irawan*, Jann Hidajat Tjakraatmadja, Achmad Ghazali and Nur Budi Mulyono

School of Business and Management, Institut Teknologi Bandung, Indonesia

Email: bambang_irawan@sbm-itb.ac.id

Abstract—Banking sector in Indonesia has enormous potential to grow. The large unbanked population, quick mobile & internet penetration, and advancement of digital technologies have propelled the fast-moving trend toward digital banking services. Being a data-driven decision-making organization is essential to win the competition in the digital era. However, there are several flaws in managing knowledge and learning in Indonesian banking organizations which may become impediments to achieve that goal. This research focuses on investigation through multiple case studies involving several banks in Indonesia that have already started their digital transformation to better understand the following: (1) how does KM 4.0 strategy help the Digital Banking Innovation, (2) what are the required Digital Competency Level 4.0 for banking organization and how it aligns with KM 4.0 strategy, (3) how does Learning Interaction Model between knowledge actors in 4.0 era i.e. humans and machines effect relationship between Digital Competency Level and KM 4.0 strategy. This is ongoing research, nevertheless, some early findings and observations will be presented. The results are expected to become a useful reference to banking partitioners as well as for future research.

Keywords - digital banking innovation, digital competency level, KM 4.0 strategy, learning interaction model, knowledge actors.

I. INTRODUCTION

With an aggregate asset of more than IDR 8,725 trillion from a total of 110 commercial banks in Indonesia [1] and a large number bankable unbanked population of 113 million, the banking industry is deemed as one of the most prospective business sectors in Indonesia [2]. However, banks are facing increasingly complex regulations, growing risk and operation challenges, disruptive technologies, shrinking margins, and more intense market competition. More than ever, banks are under huge pressure to maintain and grow their market share.

Banking services were traditionally delivered through physical facilities such as branches, booths, and kiosks, so banking was location-and time-bound. Today, customers want to access bank services anytime, anywhere, without the need to visit a branch for every single transaction that they wanted to do. This is the main reason for digital banking to emerge. Digital banking is about automating and digitalizing banking processes and services to offer a much better customer experience and maximizing growth

potential. A survey on digital banking in Indonesia by PwC [3] reported that digital banking has turned mainstream with around 66% of survey respondents indicating that they have developed a digital banking strategy as part of corporate strategy.

According to Brynjolfsson & McAfee [4], organizational innovation is crucial to winning the ever-challenging competition in the ‘machine’ era. Innovation is a complex concept that encompasses human, organizational, and process aspects of an organization to improve performance through production efficiency and reducing costs [5]. Willingness to innovate is the main proxy to the company’s propensity for a change, driven by the exploitation of new ideas and new technology to create a competitive advantage [6]. The advancement and use of technological solutions for product and service innovation are inevitable to meet customer needs in the digital era. Digital innovation is defined as the creation of market offerings, business processes, or models that result from the use of technology [7].

With these in mind, for banks to survive and advance with the market competition it is imperative that they need to be innovative to expedite the new product/service delivery, enhance customer experience, while on the other side, continuously drive efficiency, improve productivity, and overcome the increased overhead costs to comply with regulations, whether they are from the local regulators or to respond to global industry requirements. Overlying with the context of digital banking trends, digital innovation has become essential for banks to survive and grow. As suggested by Nylén & Holmström [8], the following areas to be considered in building a managerial framework for digital innovation strategy: user experience, value proposition, digital evolution scanning, skills, and improvisation.

Despite “digitalization” and “innovation” have become commoditized keywords that are often regarded as the main characters of the new and modern banking model, there is a major issue that needs to be addressed to support the digital innovation for competitiveness, namely management of knowledge within the banks’ organization since knowledge is a fundamental basis of competition [9][10]. Furthermore, Mardani et al. [11] argue that knowledge management (KM) strategies, i.e. knowledge acquisition and utilization, have direct and significant effects on the speed, quality, and quantity of innovation. This is also implied by Gloet & Terziowski [12], stating that organizations should look to integrate the approach of

KM to foster innovation culture and sustain performance. Therefore, it is imperative that companies must have consistent and common KM strategies and share them within the whole organization as KM is central to their ability to grow and compete.

KM is a general term that refers to a process of capturing, distributing, and effectively using knowledge [13]. Combined with the use of technology, KM has become a crucial asset that makes organizations work [14]. Technology has no doubt become part of our daily life, not only has it made it simpler and better, but technology has also made possible things that were never there before. KM is not an exception in that it is also a great beneficiary of technology development [14]. Filippov and Iastrebova [15] state that information and digital technology have increased access to information and improved the ability to produce and share it. While KM in the analog era is called KM 3.0, in the digital era, North & Maier [16] introduce the concept of Knowledge 4.0 as a “digitize knowledge society”, that is a societal stage where the application of digital technologies is extensively used in everyday life, leading to the “digital ubiquity” and also contribute a significant share of value creation. From this concept, Ansari [17] defines KM 4.0 as a strategic and operational function of exploration and exploitation processes from both human and technology-oriented perspectives.

Digital technology has provided wide opportunities for KM 4.0 to grow even faster in the sense that it provides more extensive capabilities to acquire, store, distribute, and even apply knowledge. New technologies such as the Internet of Things (IoT), Big Data Analytics, and Artificial Intelligent (AI) have tremendously improved the interaction between humans and machines. These activities are fundamental because they can help to increase organizational responsiveness and adaptability which are essential elements for an organization to deal with continuous change and competitive environments. The use of mobile technology has significantly promoted the learning process to become more efficient, faster, and easily accessible. In a constant rapid change environment with the increase of uncertainty, adaptability has started to emerge as a unique essential capability any organization has to own.

Companies, irrespective of their business focus, whether they are big or small, are forced to be adaptive to stay in the business or simply die. Instead of being really good at doing some particular things, the requirement has shifted to how good companies are at learning how to do new things. For companies to successfully evolve and grow, it is determined by the ability of the staff. Company transformation is very much linked to its individual staffs' transformation, at the heart of it, individual learnings. Senge [18] defines the concept of a learning organization (LO) as a company that continuously transforms itself through the learning and development of its members. To adapt to the digital transformation era and to provide more prescriptive actions to Senge's original idea, Daly & Overton [19] introduce a new learning organization as a

living and learning organization that intelligently facilitates the performance and learning its entire members, continuously transforming itself. It emphasizes the mutual responsibilities of business leaders and people professionals to deliver the company's goals. In much recent literature, the latter concept is known as LO 4.0, while the earlier is usually called LO 3.0.

When introducing knowledge management, it must not be introduced as stand-alone, but rather in the context of optimizing a business process [20]. In other words, it is not about introducing knowledge management, but about implementing concrete knowledge management instruments and measures that support and optimize a specific business process. This ensures that innovation is relevant to the workplace and is more easily understood by employees. In this context, it becomes clear that a comprehensive procedure for a purposeful and acceptance-oriented implementation must precede the introduction of knowledge management instruments and measures. This procedure should be largely center on the needs of the end-user to contribute to the optimization of a process.

A. Knowledge Management 4.0 (KM 4.0) & Learning Organization 4.0 (LO 4.0)

Knowledge Management (KM) emerged as a scientific discipline in the early 1990s. One of the most popular and widely read works to date is Ikujiro Nonaka's and Hirotaka Takeuchi's *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation* [21]. Before that, some management theorists had contributed to the evolution of knowledge management with various angles to see KM in the analog era namely KM 3.0, such as Drucker [22] who's arguing that information and knowledge as organizational resources, Leonard-Barton [23] with a well-known case study of "Chaparral Steel" highlighting KM strategy implementation, and Davenport [13] concerning the process of capturing, distributing, and effectively using knowledge.

Polanyi [24] introduced a fundamental concept of explicit knowledge and tacit knowledge. Explicit knowledge is the collection of tangible information which are written and normally accessible through the company's documents, whereas tacit knowledge is kept unwritten and used only by verbalizing the knowledge. However, Dalkir [25] made a note that tacit knowledge is a quite relative concept, what is easy to articulate by someone may be extremely difficult for another, therefore the same context may be both explicit and tacit depending on the perspective of the examiners. In a later study, Nonaka and Takeuchi [21] presenting a knowledge creation model from viewed tacit knowledge and explicit knowledge as separate but mutually complementary entities. They view that organizational knowledge is produced by interaction and conversion between the two types of knowledge (explicit and tacit) in a spiral manner. The knowledge creation process takes place through the

four modes of knowledge conversion, known as the SECI model for knowledge creation.

Thornley et al. [26] highlighted that the new evolution of KM is highly influenced by digital-age technologies such as Big Data and the Internet of Things (IoT). The Authority and trustworthiness of data become a key competency for modern KM. North & Maier [16] introduce the concept of Knowledge 4.0 as a “digitize knowledge society”, which is a societal stage where the application of digital technologies is extensively used in everyday life, leading to the “digital ubiquity” and also contribute a significant share of value creation.

From there, Ansari [17] defines KM 4.0 as a strategic and operational function of exploration and exploitation processes from both human and technology-oriented perspectives in Knowledge 4.0. Although KM 4.0 has not been widely discussed, the generally considered properties of the new discipline are: highly dependent on digital technology, the emergence of the machine as a knowledge actor, and the complementarity of human-and technology-oriented perspectives. Ansari argues that there are two tasks expected to be accomplished by KM 4.0, first is value generation through enhancing and balancing knowledge acquisition (exploration) and knowledge utilization (exploitation) capacities. Second, KM 4.0 is expected to facilitate the development of the human-machine cognitive learning process. Both human alone and human-machine team-up learning may become organizational knowledge when an organization is capable of providing a home for knowledge creation, storing, sharing, and implementing, i.e. knowledge management.

Another emerging organizational competency in the digital era is to provide, tailor, and equip its members with their learning needs. It was Peter Senge who first coined the terminology learning organization (LO) through his inspirational writing, fifth discipline: *The Art and Practice of the Learning Organization* [18], in which he defines a LO as a company that continuously transforms itself through learning and development of its members. Now, 31 years later from Senge’s writing, the concept is still relevant. Moreover, as we are now living in an era that the learning approach has evolved where learning has been made easy by various digital technologies such as AI, Big Data, and mobile apps, capabilities, and skills are developed through virtual and agile processes. Online communities share practices and solutions just like human gurus, membered by participants from around the world. The characteristics of LO have shifted from Senge’s originals (LO 3.0): *System Thinking, Personal Mastery, Mental Model, Shared Vision, Team Learning* into a new LO in the digital era (LO 4.0) introduced by Daly & Overton [19] that is defined as living and learning organizational that intelligently facilitates the performance and learning its entire members, continuously transforming itself. The characteristics of the new LO 4.0 are:

1. *Clarity of purpose* is a shared vision and dialogue on how people are valued and need to adapt to support the organization’s objectives.
2. *Holistic people experience* is a trusted brand that develops innovative, commercial, and continuous learning opportunities.
3. *Thriving ecosystem* is a people-led system that enables its people, teams, and enterprise to thrive the learning, linked to common goals.
4. *Agile, digital infrastructure* is a virtual environment that enables the exchange of knowledge, ideas, and adaptation of competence.
5. *Continual engagement* is a dynamic community that continually builds on the business relationship, resulting in energy, resilience, and growth.
6. *Intelligent decision-making* is a robust platform using insight and performance analytics to drive organizational performance and customized experience.

Harvard behavioral scientists [27] made some comments on why Senge’s LO 3.0 vision is difficult to be realized; first, the ideas were less concrete to be implemented. Second, the concept was aimed at the senior management level while managers have no views on how learning would contribute to organizational objectives. Third, lack of standard tools for assessment. LO 4.0 tried to overcome these impedances by providing empowerment to the staff and learning ecosystem, stronger partnerships between business leaders and people leaders (L&D managers) and take advantage of digital infrastructure to optimize the learning process.

In the later development, Antonacopoulou et al. [28], introduced the term Sensuous Organizational Learning, which aligns cognitions, emotions, and intuitive insights by fostering critique. It demonstrates the value of “sensuousness” as a way of understanding volatility, uncertainty, complexity, and ambiguity. This concept was an attempt at completing the LO 4.0 that was previously introduced by Daly and Overton to go beyond the focus on the clarity of purpose to the common goals. LO 4.0 provides more holistic disciplines of internal and external collaboration with digital infrastructure as bridges the digital era characteristics (rise of IoT, AI, and VR) and business model in the digital era (sharing economy, collaborative consumption) through focused on collaboration and agile organization.

LO and KM are two inseparable and interdependent concepts. To be a learning organization (LO) requires knowledge management (KM) which in turn is dependent on LO because knowledge can only be created from a learning process in a learn-fostering environment [29]. Since both OL and KM in the digital era are highly dependent and widely leverage technologies, this suggests that LO 4.0 and KM 4.0 are interdependent on one another.

B. Digital Competency Level 4.0

To support their digital innovation agenda, banking leaders have to understand the required digital competency level across human, process, and technology aspects, particularly ones that are relevant to the digital environment that the business lives in.

European Union has included digital competency to be part of the eight key competencies for lifelong learning. Digital competence comprises confidence, critical, and responsible use of digital technology to achieve various goals related to study, work, and participation in society [30]. According to Ferrari [31], there are five areas of human digital competence:

1. *Information*: identify, store, organize, and analyze digital information, including interpretation of its relevance and purpose.
2. *Communication*: any means of digital communication, including sharing resources through online media, collaboration through digital devices, cross-cultural awareness.
3. *Content creation*: digital content creation, editing, and integration with previous knowledge and content. Including applying intellectual property and licenses for the produced media outputs and contents.
4. *Safety*: any means of digital protection; data, personal identities, security measures, safe, and sustainable use.
5. *Problem Solving*: solving conceptual and technical problems through digital means, utilize technology creatively, provide appropriate digital tools for decision making.

From the process competency perspective, aside from LO that has been discussed earlier, some literature has named agile process to leverage rapid technological development as one of the key process competencies toward the digital maturity era (4.0). The agile implementation not only provides flexibility and autonomy in a digital transformation process, but it also provides flexibility to redirect actions when new technologies and new opportunities come [32]. Agile is an iterative process comprised of continual planning, learning, development, and early delivery of software or project. It is widely used in typical software and digital development. Camarinha-Matos et al. [33] performed a competency analysis for Industry 4.0, in which they argue that agile is a required component of the ongoing “industrial revolution” that digitalization and interconnection of systems, products, processes, and value-chains trigger the value creations and business models.

The following emerging digital technologies to support transformation in the financial industry are repeatedly reported by some scholarly papers as well as top consultant firms’ journals: Artificial Intelligence (AI), Mobility/Mobile Technology, Cloud Computing, and Big Data Analytics [34], [35], [36]. Therefore, the stage of adoption of those emerging technologies will be used to measure the digital competency level at a financial organization.

Two research questions emerge from the literature review, namely:

RQ1: *What are the key elements of Digital Competency Level in Banking? Across People, Process, and Technology perspective.*

RQ2: *How Digital Competency Level constitutes KM 4.0 Strategies?*

C. KM 4.0 Strategy and Digital Banking Innovation

Innovation is a specific tool of entrepreneurs, the mean by which they exploit change as an opportunity for a different business or service [37]. Looking at this definition, the concept of “innovation” is not new at all. In fact, it has been started from the pre-historic age until this recent day that mankind was able to turn ideas into realization through various innovations [38]. We can see countless evidence of past innovations, from the pyramid of Giza, Hindunese and Buddhist temples in Indonesia, the invention of the light bulb, the steam machine, railways, computers, electric vehicles, etc. Today, as digital technologies have played a significant role and influenced almost all aspects of our life, innovation development towards the digital world, in other words, digital innovation, has been pervasive. Digital innovation is a means for companies, especially new entrants, to leverage digital technologies for the creation of various breakthrough products and services [39].

As previously discussed, many past literature suggested that KM strategies, i.e. exploitation and exploitation are essential to support and sustain the innovation process. Therefore, another research question can be formulated in the context of digital banking innovation in Indonesia:

RQ3: *How Knowledge Management (KM) 4.0 Strategies are essential to support Digital Banking Innovation in Indonesia?*

D. Learning Interaction Model

Organizational competency level is influenced by the intensity of the learning process in the organization. The higher the organizational competency level the bigger opportunity it can identify and create the required additional skills and knowledge the organization needs to grow and sustain in the fierce market competition, for which individual and organizational learning play their important roles. This observation draws a hypothesis that the learning process and its actors’ interaction (human and machine, in the digital era) would moderate the relationship between organizational competency and knowledge management. Align with this thinking, Yu et al. [40] suggest that explorative and exploitative learnings have positive moderating effects on the relationship between technological competencies and knowledge management. This moderating effect will be further investigated in this research, including human-to-human (H2H), human-to-machine (H2M), and machine-to-machine (M2M) learning interaction. A research question out of this will be:

RQ4: Since 4.0 era is characterized by a closed learning interaction model between humans and machines; how would Learning Interaction Model i.e.: H2H, H2M, and M2M moderate the impact of Digital Competency Level on KM 4.0 Strategy?

Many literatures have discussed the importance and insights of the following topics: digital competency level, knowledge management, learning interaction, and digital innovation” as an individual or as coupled-construct studies. However, lack of studies that have comprehensively linked all the above constructs, especially those that focus on digital banking innovation, in particular discussing knowledge management and learning organization in the digital era i.e. KM 4.0 and LO 4.0.

This research aims to prescribe how to build digital competency level particularly for banking industry and to develop a model that connects digital competency level to knowledge management 4.0 strategy through moderation of the learning interaction model which will eventually have positive effects on digital banking innovation. The outcomes of this research are expected to provide useful references for banking practitioners during their digital transformation planning as well as for academia.

II. METHODOLOGY

This research is based on multiple case studies participated by several banks in Indonesia that have already started their digital innovation/transformation program. Case study object selection criteria were based on (a) the level of digitalization being implemented by the bank, and (b) from the view of the department appointed to be responsible for digitalization across functions or as a dedicated business unit as suggested by KPMG [41]. KPMG categorizes it from the perspective of digital roles in an organization, from a merely fragmented function scattered in multiple departments to digitalization as an integral part of doing business as shown in Fig 1. Four case study participant banks have been identified to represent the four categories, respectively.

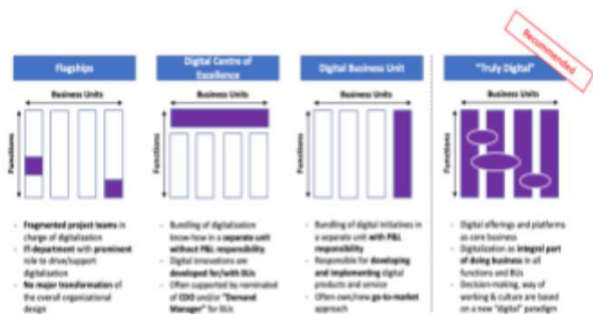


Fig 1. Digital transformation categories adapted from KPMG [41]

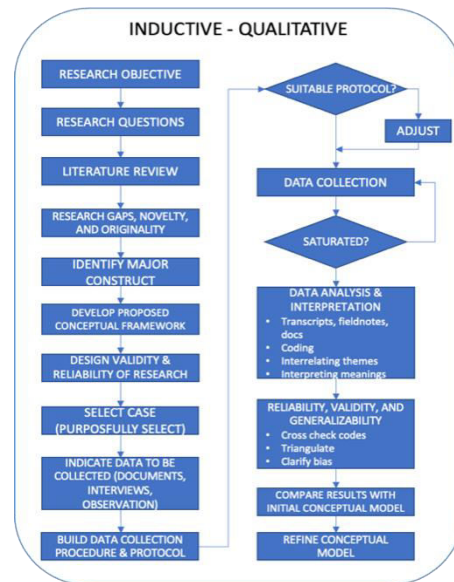


Fig 2. The research flow

Research questions and literature review, identification of possibly prior constructs have been initially conducted to help shaping the initial design of the model-building [42]. Based on the literature review, a proposed conceptual framework with the tentative constructs has been formulated as outlined in. From here, an exploratory study applying a qualitative approach are being conducted to better understand the concepts of KM 4.0 strategies, digital competency level, learning interaction particularly involving machine/technology as another learning actor to human, digital innovation, and their interrelations in the 'real-life' within the four case study participant banks.

A research flow is illustrated in Fig 2, following guidelines for qualitative study prescribed by Creswell [43].

In-depth semi-structured interviews with some digital banking executives who drive the digital transformation agenda in their respective banks as subject matter experts are being conducted to get insights regarding what makes each major construct and the nature of the relationship between constructs. The interview questions may change and become more specific in the subsequent interviews as the authors reach a better understanding of the substantial issues related to the topic. Document reviews, records analysis, and focus group discussion may be conducted as well to enrich the qualitative data or for triangulation purposes. The nature of the exploratory study is unstructured, relies on the quality of informants, and requires the interviewer to understand the context.

Upon the completion of the data analysis and interpretation step, this phase will result in a model that will be compared and refined to the proposed conceptual framework into the final model as the main outcome of this research. To overcome bias risks, two tests namely reliability and validity will be performed through peer-

checking and triangulation with a different data source, respectively.

III. RESULTS

Since this research is ongoing, then no final result shall be concluded in this paper. Nevertheless, some early and insightful findings and observations regarding digital competency level in the banking sector and its interaction with the implementation of KM 4.0 for digital banking innovation will be shared in this section.

Two expert informants have been interviewed representing two case study banks that have been running their digital transformation for a few years. Due to the Covid 19 pandemic limitation, interviews were conducted virtually through Zoom video conferencing. Voice-recorded interviews along with field notes taken during the interview sessions were collated for further processes, namely transcribing, coding, and interpreting. NVivo software was employed to assist throughout data sorting, coding, and preparing diagram processes. This software has improved the flexibility, accuracy, and comprehensiveness of the overall process. The most frequently appeared words from the interviews are outlined in the word-cloud Fig 3.

The qualitative data analysis was conducted in the following two stages: the first stage was individual-case analysis trying to explain and address research questions concerning digital competency level, KM 4.0 strategy, learning interaction model, and digital banking innovation, following the “replication” principle [44]. Subsequently, in the second stage, a cross-case analysis was conducted to identify common patterns, observations, as well as to analyze the extent of the replication logic between individual cases.

A. Individual-case analysis (Bank A & Bank B)

Bank A as a major state-owned bank is currently at a nearly mature state in terms of digital competency level. It can be observed through the level of process and technology implementation. Gold standard knowledge management tools have already been rolled out and implemented consistently.



Fig 3. Most frequent words mentioned during interviews

The focus of the Bank is to enhance the social and learning interactions among its employees to facilitate transforming tacit to explicit knowledge, assisted by several collaboration tools. With the readiness of the organization to tackle the challenges and disruption in the 4.0 business market, through the implementation of agile methodology, creating a fast-paced and iterative environment. Bank A aims to create an effortless and seamless experience complemented with a unique value proposition for its customers. They are always thriving for innovation, to create more traction while maintaining “design for no operation”. All being said, the level of digital competency in Bank A is categorized as closed to advanced, while transforming the knowledge management process to not only be able to capture explicit knowledge but continue the legacy of tacit knowledge. Moreover, it aims to innovate to create a seamless and frictionless experience for its customer and internal employees, while maturing as a learning organization to help to foster the learning interactions.

Although Bank B is a major regional subsidiary bank, it is still in the early stage of the development and implementation of digital transformation. They aim to improve the usage of data to create a data-driven company during tight competition in the financial market. In terms of knowledge management practices, they are also still in the early stage, in which much of the knowledge is still cluttered. The bank is trying to improve the knowledge management (KM 4.0) processes to be able to capture, store, and distribute more knowledge, be it tacit or explicit. Currently, the digital banking innovation focuses on the internal part of the bank, in which they are trying to create better data storage, utilizing big data analytics to constitutes every decision that the bank will make. Through this analysis, Bank B would create a unique value proposition and experience for their customers to improve customers' stickiness.

B. Cross-case analysis

From the analysis of both banks represented by the expert informants (informant will be added as research progresses), the authors find that both informants from Bank A and Bank B consciously emphasized that the current financial market is under heavy disruption, creating a more dynamic competition while gradually gaining speed in terms of changes and innovation. Banking products and services are undergoing massive digitalization due to the disruption of industry 4.0 that had influence bank customers' expectations and the effect of the emerging financial technology companies that offer new propositions while promoting easiness and accessibility.

Bank A and Bank B rely heavily on adaptability to persevere through the market shift. The ability to adapt and perseverance depends on the ability of the bank to improve their organization competency level, particularly digital competency level. They believed that digital competency level comprises of the following elements:

human, process, and technology. Both banks are in the stage of the ongoing development of their digital competency level through the over-arching efforts across people, process, and technology aspects.

To address the people competency issue, learnings and training have been programmed and executed on an ongoing basis. This is to equip the staff with new digital skills such as mobile application engineering, cybersecurity, and other digital-savvy skills. They believed that through the implementation of those skills, an organization would be capable to deliver intuitive applications and propositions that would meet customers' needs and elevate their experience. For the process competencies, both interviewees believed in shifting silos or traditional organization process with a new and faster model, that is agile methodology. They also confirmed that the organization needs to be able to facilitate and foster a learning process. Through the implementation of these processes, banks are expected to deliver more projects seamlessly, creating a faster gap on each product to be delivered in the everchanging market. The last is concerning the technology competencies, both strongly believed that in the future, the advancement of technology would bring a breath of fresh air on the development of the financial industry, especially banks. For now, the most anticipated emerging technologies would be cloud computing, IA, Data Analytics, Customers' Touchpoint apps, and Micro-services.

IV. DISCUSSION

The above early findings suggest the following insights to the previously formulated research questions:

A. RQ1: *What are the key elements of Digital Competency Level in Banking? Across People, Process, and Technology perspective.*

From the above two interviews, the authors consistently observed informants mentioning the need for comprehensive focus across the people, process, and technology aspects. Communication, learning capability, and security are among the people-required competencies mentioned by the expert informants. On process competency, both informants confirmed the need for a learning organization and agile practices. While on the technological aspect, some emerging technologies were mentioned such as IA, data analytics, cloud computing, and microservices.

B. RQ2: *How Digital Competency Level constitutes KM 4.0 Strategies?*

While there has been a very clear suggestion on this matter, there are close alignments between the required digital competency level at people, process, and technology aspects with the characteristics for KM 4.0 strategy that emphasized the extensive use of technology

during overall KM processes and the active two actors in KM i.e.: human and machine/technology. Further qualitative study is required to understand it better.

C. RQ3: *How Knowledge Management (KM) 4.0 Strategies are essential to support Digital Banking Innovation in Indonesia?*

Both informants highlighted the need for being a data-driven organization that is backed by proper management of implicit and tacit knowledge to innovate and advance in the digital competition. They are also in the same opinion that technology has been greatly facilitating the whole KM 4.0 strategies (exploration and exploitation).

D. RQ4: *Since 4.0 era is characterized by a closed learning interaction model between humans and machines; how would Learning Interaction Model i.e.: H2H, H2M, and M2M moderate the impact of Digital Competency Level on KM 4.0 Strategy?*

Similar to the previous subject, although there has not been a prescribed moderating role of learning interaction involving humans and machines to the effect of digital competency level 4.0 on KM 4.0 strategy, some insights come out from the interviews such as proper learning agenda and implementation of the right technologies would amplify and improve the soundness of KM 4.0 resulted from the organizational digital competency level.

V. CONCLUSION

The initial qualitative study involving expert informants from two different major banks in Indonesia has suggested the following insights that will be useful to guide the direction of the rest of this research:

1. There is a common awareness that banks need to transform their products and services into holistic digital propositions to adapt to the market competition, exceeded customers' needs, and the technology advancement.
2. Building a sound digital competency level is essential. The management focus should be balanced across people, process, and technological aspects. Several core competencies of each category are also explicitly mentioned during the interviews. It will be investigated further to address research question 1.
3. The development of digital competency level aligns with the need of having a robust KM 4.0 strategy as the foundation to a data-driven organization. This gives insights regarding research question 2 and 3.
4. Learning becomes a prominent skill that must be acquired by any organization. The need has been shifted from great at doing particular things to become good at learning new things. Era 4.0 has promoted dual learning

actors i.e.: human and technology that work hand in hand during acquisitions and utilization of knowledge in the banking organizations. This analysis will be continued to address research question 4.

The model that connects digital competency level to KM 4.0 strategy influenced by learning interaction model between humans and machines that will eventually have positive effect on digital banking innovation is expected to contribute to the existing literature.

ACKNOWLEDGMENT

The authors wish to extend our special appreciation to the expert informants, lecturers, and staff of the School of Business Management Department of Institut Teknologi Bandung (ITB) who have greatly facilitated and assisted this ongoing research. We would also like to thank the ICMEM for the opportunity to present and share the ideas and early findings for this research.

REFERENCES

- [1] OJK. "Digital Finance Innovation," *Indonesia Financial Service Authority (OJK)*, <http://www.digifin.org/digital-finance-innovation/>, July 2020.
- [2] Mehrotra, M., Tan, A., Hutasuht, M., Poon, H. E., Demirova, A., & Hyunbin, L. B., "The Future Is Now: Digital Financial Services in Indonesia," *Deloitte*, 1–15, 2015.
- [3] PWC, "Digital Banking in Indonesia 2018," *PwC Survey*, July, pp 1–48, <https://www.pwc.com/id/en/publications/assets/financialservices/digital-banking-survey-2018-pwcid.pdf>, 2018.
- [4] Brynjolfsson, E., & McAfee, A., "The Race Against the Machine," In *Digital Frontier Press, Digital Frontier Press*, <http://www.ncbi.nlm.nih.gov/pubmed/24768042>, 2012b.
- [5] Schumpeter, J. A., "Entrepreneurship as Innovation," <https://papers.ssrn.com/abstract=1512266>, 2000.
- [6] Harryson, S. J., "Entrepreneurship through relationships – navigating from creativity to commercialization," *R&D Management*, 38(3), 290–310, <https://doi.org/10.1111/j.1467-9310.2008.00516.x>, 2008.
- [7] Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M., "Digital innovation management: Reinventing innovation management research in a digital world," *MIS Quarterly: Management Information Systems*, 41(1), 223–238, <https://doi.org/10.25300/MISQ/2017/411.03>, 2017.
- [8] Nylén, D., & Holmström, J., "Digital innovation strategy: A framework for diagnosing and improving digital product and service innovation," *Business Horizons*, 58(1), 57–67, <https://doi.org/10.1016/j.bushor.2014.09.001>, 2015.
- [9] Zack, M. H., "Developing a knowledge strategy," *California Management Review*, 41(3), 125–145, 1999.
- [10] Grant, R. M., "Towards a knowledge-based theory of the firm," *Strategic Management Journal*, 17(10), 109–122, 1996.
- [11] Mardani, A., Nikoosokhan, S., Moradi, M., & Doustar, M., "The Relationship Between Knowledge Management and Innovation Performance," *Journal of High Technology Management Research*, 29(1), 12–26, <https://doi.org/10.1016/j.hitech.2018.04.002>, 2018.
- [12] Gloet, M., & Terziowski, M., "Exploring the relationship between knowledge management practices and innovation performance," *Journal of Manufacturing Technology Management*, 15(5), 402–409, 2004.
- [13] Davenport, T., "Working Knowledge: How Organizations Manage What They Know," 1994.
- [14] Vahedi, M. & Ali Irani, F., "Information Technology (IT) for Knowledge Management," *Procedia Computer Science* 3, 444–448, 2010.
- [15] Filippov, S. and Iastrebova, K., "Managing Information Overload: Organizational Perspective," *Journal on Innovation and Sustainability*, Vol. 1, No. 1, 2010.
- [16] North, K., & Maier, R., "Knowledge Management in Digital Change," (O. Haas (ed.); 1st ed.), *Springer International Publishing*, <https://doi.org/10.1007/978-3-319-73546-7>, 2018.
- [17] Ansari, F., "Knowledge Management 4.0: Theoretical and practical considerations in cyber physical production systems," *IFAC-PapersOnLine*, 52(13), 1597–1602, <https://doi.org/10.1016/j.ifacol.2019.11.428>, 2019.
- [18] Senge, P. M., "The Fifth Discipline: The art and practice of learning organization," 1990.
- [19] Daly, J., & Overton, L., "The new learning organisation: How to unlock the potential of L&D," *Towards Maturity & CIPD*, May, 2015.
- [20] Winkler, K., & Mandl, H., "Implementation of knowledge management in organizations," *Learning Inquiry*, 1(1), 71–8, <https://doi.org/10.1007/s11519-007-0006-0>, 2017.
- [21] Nonaka Ikujiro & Takeuchi Hirotaka, "The Knowledge-Creating Company," *Oxford University Press*, New York, 1995.
- [22] Drucker, P. F., "The Coming of the New Organization," *Harvard Business Review*, 66, 45–53, 1988.
- [23] Leonard-Barton, D., "Chapparral Steel: Rapid Product and Process Development," 1988.
- [24] Polanyi, M., "The Tacit Dimension Magnolia," MA: Peter Smith, 1966.
- [25] Dalkir, K., "Knowledge Management in Theory and Practice: 3rd Edition," 10, 2005.
- [26] Thornley, C., Carcary, M., Connolly, N., O'Duffy, M., & Pierce, J., "Developing a maturity model for knowledge management (KM) in the digital age," *Proceedings of the European Conference on Knowledge Management, ECKM, 2016* (October), 874–880, 2016.
- [27] Garvin, D., Edmondson, A., & Francesca, G., "Is Yours a Learning Organization?," *Harvard Business Review*, <https://hbr.org/2008/03/is-yours-a-learning-organization?registration=success>, 2008.
- [28] Antonacopoulou, E. P., Moldjord, C., Steiro, T. J., & Stokkeland, C., "The New Learning Organisation: PART I – Institutional Reflexivity, High Agility Organising and Learning Leadership," *Learning Organization*, 26(3), 304–318, <https://doi.org/10.1108/TLO-10-2018-0159>, 2019.
- [29] Aggestam, L., "Learning Organization or Knowledge Management – Which Came First, the Chicken or the Egg?," *Information Technology and Control*, 35(3), 295–302, <http://www.mechanika.ktu.lt/index.php/ITC/article/viewFile/11760/6424>, 2006.
- [30] The Council of the European Union, "Council recommendation of 22 May 2018 on key competences for lifelong learning (text with EEA relevance)," *Official Journal of the European Union* (2018/C 189/01), 2, 1–13, [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604\(01\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604(01)&from=EN), 2018.
- [31] Ferrari, A., "DIGCOMP: A Framework for Developing and Understanding Digital Competence in Europe," <https://doi.org/10.2788/52966>, 2013.
- [32] Sjödin, R. R., & Parida, V., "Smart Factory Implementation and Process Innovation A Preliminary Maturity Model for Leveraging Digitalization in Manufacturing Moving to smart factories presents specific challenges that can be addressed through a structured approach focused on people," pr. *Markus Leksell & Aleksandar Petrovic*, 61(5), 22–31, <https://doi.org/10.1080/08956308.2018.1471277>, 2018.
- [33] Camarinha-Matos, L. M., Fornasiero, R., Ramezani, J., & Ferrada, F., "Collaborative networks: A pillar of digital transformation," *Applied Sciences (Switzerland)*, 9(24), 5431, <https://doi.org/10.3390/app9245431>, 2019.
- [34] Henke, N., Palmer, J., Smaje, K., & Van Kuiken, S., "Reflections on Technology from Davos 2020," *McKinsey Digital*, <https://www.mckinsey.com/business-functions/digital-our-insights/digital-blog/satellite-internets-new-era-making-the-price-right>, 2020.
- [35] Marr, B., "The 7 Biggest Technology Trends To Disrupt Banking & Financial Services In 2020," *Forbes*.

- <https://www.forbes.com/sites/bernardmarr/2019/11/08/the-7-biggest-technology-trends-to-disrupt-banking-financial-services-in-2020/?sh=1a3ce3072c42>, 2019
- [36] Vives, X., "Digital Disruption in Banking and its Impact on Competition," *Oecd*, 1–50. <http://www.oecd.org/daf/competition/digital-disruption-in-financial-markets.htm>, 2020.
- [37] Drucker, P. F., "Entrepreneurial strategies" *California Management Review*, 27, 9–25, 1985
- [38] Eveleens, C., "Innovation management; a literature review of innovation process models and their implications." *Science*, 800(2010), 900, 2010.
- [39] Nylén, D., & Holmström, J., "Digital innovation strategy: A framework for diagnosing and improving digital product and service innovation," *Business Horizons*, 58(1), 57–67. <https://doi.org/10.1016/j.bushor.2014.09.001>, 2015
- [40] Yu, C. P., Zhang, Z. G., & Shen, H., "The effect of organizational learning and knowledge management innovation on SMEs' technological capability," *Eurasia Journal of Mathematics, Science and Technology Education*, 13(8), 5475–5487. <https://doi.org/10.12973/eurasia.2017.00842a>, 2017.
- [41] KPMG, "KPMG Digital Transformation Playbook: Digital Transformation in the Saudi Levant Cluster," 18, 2020
- [42] Eisenhardt, K. M., "Eisenhardt, 1989 - Building theories from case study.pdf. 4(4)," 532–550, 1989
- [43] Creswell, J. W., & Poth, C. N., "Qualitative Inquiry & Research Design: Choosing Among Five Approaches," In *Sage Publication* (Vol. 3, Issue 1). SAGE Publications Ltd. <https://doi.org/10.13187/rjs.2017.1.30>, 2018.
- [44] Yin, R. K., "Case Study Research: Design & Methods," *Cosmos Corporation*, 2014.