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RESEARCH ARTICLE

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A multi-stakeholder engagement framework for knowledge management in ICT4D

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Abstract

Knowledge management (KM) is increasingly important to the field of information and communication technologies for development (ICT4D). Yet, scant literature has addressed KM in the ICT4D context. This study takes an important step toward addressing this gap by conceptualizing KM in the context of ICT4D based on the people-process-technology perspective. To elicit KM factors most relevant to ICT4D, a Delphi study is conducted with a panel of experts representing three key stakeholder groups (beneficiaries, partners, and designers) with cumulative experience of leading ICT4D projects in 25 countries. Based on the Delphi study findings, 16 factors relevant to KM in ICT4D are synthesized. A multi-stakeholder engagement framework for KM in ICT4D and an activity checklist are proposed. The study contributes to the body of knowledge by providing insights into the differing views of stakeholders related to KM practices in ICT4D projects. Practitioners may find the framework and checklist useful in coordinating and managing KM in ICT4D projects. As development initiatives become increasingly knowledge focused, the study calls upon researchers for more enquiry in this progressive area of study.

1 | INTRODUCTION

Information and communication technologies (ICT) for development (ICT4D) is a multidisciplinary area of study concerning the provision and use of ICT to foster the progress of developing communities (Donner & Toyama, 2009; Walsham, 2017; Zhao et al., 2021). Generally speaking, ICT4D projects are contextualized to low- and middle-income countries that, although represent a heterogeneous group, share many common challenges in human development (Karanasios, 2014). The contextualization of ICT4D remains incomplete without consideration of the human foundation (Heeks, 2017), and one core component of the human foundation in ICT4D is the knowledge of the beneficiaries[1] (Venkatesh et al., 2019).

Knowledge is an essential ingredient in the economic growth of a country, as the diffusion of knowledge fosters sustainable economic development (Tang & Hu, 2013). In recent years, ICT4D projects have increasingly focused on enhancing the knowledge of the beneficiaries (Venkatesh

et al., 2019). Knowledge management (KM) thus becomes integral to ICT4D projects that seeks to bridge the gaps between the knowledge needs of the beneficiaries and actionable strategies that can be taken to fulfill those needs (Vong et al., 2017). However, KM has received very little attention in the ICT4D context (Conger, 2015).

As a mature area of inquiry in organizational sciences and information systems, KM research investigates methods and processes to improve the knowledge of individuals and the collective (Cummings et al., 2013; Shin et al., 2001). Yet, KM research in ICT4D is sparse (Conger, 2015), with the scant literature focusing on specific KM activities (Jain et al., 2015; Krone & Dannenberg, 2018; Muriithi et al., 2016; Van Biljon et al., 2017) and knowledge outcomes of the beneficiaries. The theoretical foundations from seminal KM literature have not been transferred to the ICT4D context especially as it pertains to unique challenges in ICT4D projects, such as power dynamics (Kelly, 2018), impact evaluation (Stern et al., 2012), localization of knowledge (Li & Thomas, 2019), and stakeholder engagement (Renken & Heeks, 2013). A closer look at these challenges underscores three fundamental issues related to KM in ICT4D.

First, in seminal literature, the goal of KM is defined as "to support and improve the performance of the organization" (Kinney, 1998) and KM practices are often constrained to the realms of formal organization (Meyer et al., 2019). By contrast, KM in an ICT4D are activities undertaken by different stakeholders to enhance the knowledge of beneficiaries. A rich understanding of what constitutes the management of knowledge in ICT4D projects is therefore required before existing KM theories and practices can be transferred to development settings. For example, the ubiquitous availability of technology infrastructure is taken for granted in organizational KM practices. On the contrary, a vast number of development settings continue to manage knowledge in an old-fashioned manner or with make-do technologies such as using blackboards for knowledge sharing and filing cabinets for knowledge storage. Thus, the first research question that this study aims to address is: what are the key factors that influence KM in ICT4D? Answering this question would not only help with the design of more effective means to support KM in ICT4D, but also the development of KM practices that are appropriate to development contexts (Conger, 2015; van Biljon, 2020).

Second, although numerous KM frameworks have identified the factors for successful KM implementation (Anantatmula & Kanungo, 2010; Kamhawi, 2012; Ragab & Arisha, 2013; Sanghani, 2009), none depict the role of key stakeholders in ICT4D projects. Stakeholders play a critical role in development initiatives and make vital contributions to ICT4D project success. Stakeholders are agencies, individuals, or groups who have direct or indirect interests in the ICT4D intervention or its evaluation (OECD, 2009; Renken & Heeks, 2013). Although a series of stakeholder groups are associated with development initiatives (Heeks, 2017), three groups are directly related to KM in ICT4D projects—beneficiaries, partners, and designers. Beneficiaries are the target group of ICT4D initiatives. They are specific individuals or organizations for whose benefit the development initiative is undertaken (ICAI, 2014). We adopt the definition of partner from the Organization for Economic Co-operation and Development (OECD) as "individuals and/or organizations that collaborate to achieve mutually agreed upon objectives" (OECD, 2009, p.25). Partners are organizations or groups who are centrally responsible for the ICT4D projects, and involved in funding, implementing, and/or overseeing interventions (OECD, 2009). They may include governments, nonprofit organizations, universities, professional associations, multilateral organizations, and private companies (OECD, 2009). Our definition of designer follows that of Heeks (2017, p.72) as "those who design the ICT4D systems." This leads to our second research question: what KM factors are most relevant to each of the three key stakeholder groups? Answering this question would serve in providing practical and purposeful guidance in KM activities undertaken by stakeholder groups in ICT4D projects.

Third, there are many documented instances where unequal power parities between key stakeholders compromise outcomes of ICT4D projects (Lin & Myers, 2015). On one hand, there are designers and partners, usually from the developed countries, who provide expensive resources. On the other hand, there are beneficiaries who are, in many cases, passive recipients of the resources. There is also the recurring concern of the *designer-reality gap* (i.e., gap between the designer's conception of how to create technology for development, and the realities that operators and users experience in its use; Stratton et al., 2016). This suggests that successful KM in ICT4D would require the stakeholders to establish common understanding of how the associated factors are coordinated and managed. This leads to our third research question: how can stakeholders better coordinate the management of knowledge in ICT4D projects? Answering this question would enable stakeholder groups to focus on coordinating initiatives and combining efforts in value-adding areas of the KM initiative, thereby increasing the likelihood of successful KM outcomes.

To answer the first research question, we used the conceptualization of KM by Alavi and Leidner (2001) as a broad framework to analyze key elements of KM in ICT4D projects. To answer the second research question, we conducted a Delphi study to elicit inputs from an expert panel representing three key stakeholder groups (beneficiaries, partners, and designers) with cumulative

experience of leading ICT4D projects in 25 countries. Through an iterative process, we synthesized the factors that the panelists determined as most important to KM in ICT4D. Based on the Delphi study findings, we answer the third research question by proposing a multi-stakeholder engagement framework for KM in ICT4D.

2 | BACKGROUND

The field of KM spans multiple disciplines and is vastly scattered with differing concepts, perspectives, and approaches (Alavi & Leidner, 2001; Scholl et al., 2004). In this section, we review KM studies in ICT4D based on the widely accepted view of KM as a process comprising of three fundamental perspectives. We then highlight the need for a shared understanding of KM among key stakeholders involved in ICT4D projects.

2.1 | KM in ICT4D

This study adopts the viewpoint of Alavi and Leidner (2001) that knowledge is a process. Within this viewpoint, KM is conceptualized based on three underlying perspectives namely, people, process, and technology (PPT; see Figure 1). This conceptualization has received wide support in research (Cummings et al., 2013; Edwards, 2019; Girard & Girard, 2015) and practice (APQC, 2018). For example, Massey et al. (2002) argued that successful KM involves a tripartite focus on PPT. More recently, Edwards (2019) conducted a review of KM theories and practices, and concluded that KM initiatives are compounded by the PPT perspectives.

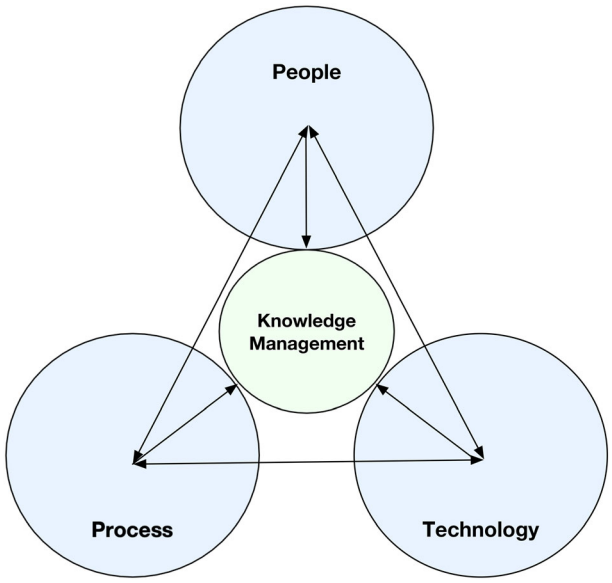

FIGURE 1 People, process, and technology perspectives of knowledge management (adapted from Alavi and Leidner [2001])

The viewpoint of knowledge-as-a-process (Alavi & Leidner, 2001) focuses on knowledge flows through different KM activities. Based on this viewpoint, we conceptualize that KM in ICT4D involves the creation, storage, distribution, and application of knowledge, the four generally agreed types of KM activities (Alavi & Leidner, 2001). We further conceptualize that the goals and objectives of KM in ICT4D target the enhancement of beneficiaries' knowledge outcomes. It is worth noting that most published ICT4D literature on KM focuses on any one specific KM activity (Jain et al., 2015; Krone & Dannenberg, 2018; Muriithi et al., 2016; Van Biljon et al., 2017). Among the few studies that have investigated the overall KM lifecycle in the context of ICT4D, Kelly (2018) took the perspective of knowledge, vis-à-vis data and information, for the impact evaluation of international development projects. Conger (2015) investigated the need for KM in a specific ICT4D project and summarized a set of best KM practices for ICT4D projects. These best practices aim to guide KM activities within ICT4D projects to improve the probability of project success. Andoh-Baidoo et al. (2014) designed an architecture for managing knowledge on cybersecurity in Sub-Saharan Africa and highlighted relevant contextual factors (i.e., economic, cultural, technical, social, governmental, and legal) related to ICT4D projects. Suorsa and Huotari (2014) proposed framework for understanding knowledge creation based on hermeneutic phenomenology. Vong et al. (2017) found that KM activities can promote ICT adoption and facilitate the socio-economic growth of rural communities in developing countries. However, prior studies adopt the seminal view of KM without consideration of improving knowledge outcomes of the ICT4D beneficiaries, the true measure of a successful KM in ICT4D. Additionally, no studies have examined KM in the ICT4D context from the viewpoint of key stakeholders. In the following section, we discuss why such a viewpoint is important.

2.2 | KM frameworks

Research in the field of KM has aimed to achieve a common understanding of what constitutes its central concepts and themes (Edwards, 2019). Many frameworks have been proposed to prescribe the essential elements of KM, to communicate KM coherently, and to guide the design and evaluation of KM processes (Heisig, 2009). Fteimi (2015) performed a structured literature review of KM frameworks and grouped them into two categories: holistic KM frameworks that focus on the KM discipline

in general, and specific KM frameworks that focus on few concrete KM elements such as knowledge definition, KM models, KM theories, and influencing factors of KM.

Among the myriad frameworks, many have explained factors associated with KM implementation. For example, Kamhawi (2012) created a KM framework of critical factors that managers may apply to maximize the organization's performance. Similarly, Sanghani (2009) proposed a framework to help organizations implement KM systems. Anantatmula and Kanungo (2010) created a framework to model the relationships between influencing factors of KM and its successful implementation in the organization. Heisig (2009) identified 170 different factors based on a review of 119 frameworks. Ironically, few of those factors can be directly translated to the ICT4D setting because of differences in the purpose, goals, and practices of KM in ICT4D and those in traditional organizational settings, as previously discussed. As KM studies in ICT4D are sparse, our understanding of influencing KM factors in ICT4D is inadequate. Furthermore, no studies have investigated the factors associated with KM through the lens of key stakeholder groups involved in ICT4D projects. A shared understanding of what the stakeholders consider to be influencing factors of KM would enhance knowledge outcomes of the beneficiaries, improve the development and implementation of the ICT4D project, and increase the likelihood of the project success (Heeks, 2017).

3 | RESEARCH METHODOLOGY

We chose the qualitative Delphi study method over other methods for several reasons. First, one objective of our study was to understand the influencing factors of KM in ICT4D projects through the lens of three key stakeholder roles (i.e., beneficiaries, partners, and designers). An obvious source of such information are stakeholders themselves who are engaged in ICT4D and have expertise in KM. However, individuals with this specific expertise are often geographically separated, making qualitative techniques such as case studies and focus group interviews impractical and expensive. The Delphi approach allows greater inclusion and participation of experts who are globally distributed and actively involved in ICT4D projects. Second, anonymity promotes participation in scientific studies (Fletcher & Marchildon, 2014) and helps avoid common issues in group interviews such as polarization effect, group thinking (Isenberg, 1986), and power dynamics (Fletcher & Marchildon, 2014). The Delphi study approach ensures quasi-anonymity of the respondents, that is, the respondents are known to the researcher and possibly to one another, but their judgments and opinions remain strictly anonymous (Hasson et al., 2000). Thus, it enables the respondents to contribute realistic opinions without knowledge of other participants (Okoli & Pawlowski, 2004). Third, in other qualitative methods, sampling is conducted by the researcher for maximum variation as opposed to obtaining consensus. In contrast, our study aimed to elicit KM factors most relevant to key stakeholder groups through agreement and consensus building by experts. The consensus building focus is one of the key strong points of Delphi studies (Henderson et al., 2016). Similarly, traditional quantitative surveys are limited in gathering iterative feedback and seeking consensus, and therefore not suited for our study. In short, the Delphi approach offers the iterative approach with controlled feedback, which is ideal to converge the most relevant factors (Okoli & Pawlowski, 2004) of KM in ICT4D.

The Delphi study approach has been used in many comparable study settings (Bagheri et al., 2017; Fletcher & Marchildon, 2014; Henderson et al., 2016). Compared to other approaches such as grounded theory, phenomenology, constructivist inquiry, narrative inquiry, and surveys, the Delphi method is low cost, easy to use, enables access to a sample of geographically dispersed experts, emphasizes consensus building, and provide a pragmatic way to develop theories and models that are testable in subsequent studies (Brady, 2015).

4 | DELPHI STUDY DESIGN

To conduct the Delphi study, we followed guidelines by Okoli and Pawlowski (2004) and Schmidt (1997). The steps undertaken are shown in Figure 2. The study started with selecting expert, followed by three phases: Brainstorming, Narrowing down, and Ranking. Below we summarize the key steps in each phase of the study. We direct interested readers to Appendix S1 for a detailed description of the participant selection criteria, factor coding, data analysis, and validity assessment in each phase of the study.

The study was initiated in July 2020 by contacting 20 experts with vast experience in ICT4D projects and established expertise in KM. The selection criteria required the participants to have actively engaged in ICT4D research or practice, contributed to the design of KM solutions in an ICT4D context, participated in related discussions (e.g., through publications or conference presentations), or held senior positions or key role as beneficiaries in an ICT4D project. A total of 16 participant agreed to participate in the study, and 13 participants completed all phases of the study (see Table 1 for the profile of the participants). The overall response rate was

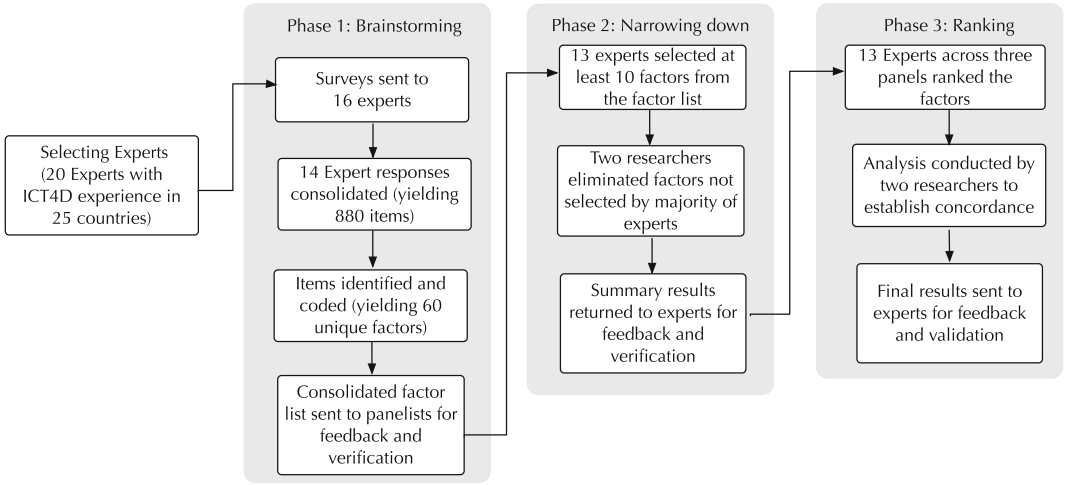

FIGURE 2 Delphi study design

TABLE 1 Expert profile of the Delphi study participants

Expert ID	Role	Organization represented	Gender	Years of experience	Countries where participants have ICT4D experience
Expert 1	Beneficiary	Hospital, NGO	Female	26	Botswana, Chad, Democratic Republic of Congo (DRC), India, Mongolia, Nepal, South Africa, St. Lucia, Zambia
Expert 2	Beneficiary	Local Government	Female	25	
Expert 3	Beneficiary	Hospital, NGO	Male	15	
Expert 4	Beneficiary	Hospital, NGO	Male	13	
Expert 5	Partner	World Vision (NGO)	Female	26	Costa Rica, Dominica Republic, DRC, El Salvador, Guatemala, Haiti, Honduras, India, Kenya, Malawi, Nepal, Peru, Tanzania, Uganda, Yemen, Zambia
Expert 6	Partner	PATH (NGO)	Female	26	
Expert 7	Partner	Catholic Relief Services (NGO)	Male	19	
Expert 8	Partner	White Cross International Ministries (NGO)	Female	25	
Expert 9	Designer	University	Female	12	DRC, Ghana, Jamaica, India, Nepal, Senegal, Uganda, Zimbabwe
Expert 10	Designer	University	Male	13	
Expert 11	Designer	University	Male	11	
Expert 12	Designer	University	Male	16	
Expert 13	Designer	NGO, University	Female	26	

Abbreviation: ICT4D, information and communication technologies for development.

81.2%, which is more than the recommended 70% response rate required to ensure rigor in the Delphi study method (Sumsion, 1998).

During the first phase (Brainstorming) of the Delphi study, a questionnaire was sent to all participants (see Figure D1 in Appendix S1). They were asked to think freely and provide an exhaustive list of factors associated with the PPT perspectives that impact KM with respect to improving knowledge outcomes of the ICT4D beneficiaries. The respondents were also asked to provide an explanation of why each factor was considered important or relevant. This was to ensure that similar factors can be identified even if they were described in different terms by the participants (Okoli & Pawlowski, 2004; Schmidt, 1997). A total of 14 participants completed Phase One of the study. Two researchers then reconciled the responses, labeled factors, and removed duplicates. The output of this phase resulted in 60 factors (23 factors for people perspective, 21 factors for process perspective, and 16 factors for the technology perspective).

In Phase Two (Narrowing down) of the study, a questionnaire was created with the list of 60 factors in random

order. The participants were asked to select (not rank) at least 10 factors for each of the PPT perspectives along with comments explaining the selection. They were also asked to include any other items that might not have been considered initially, as well as validate the coded factors. A total of 13 participants completed this phase of the study. To consolidate the results, researchers retained factors that were selected by more than 50% of the respondents (Schmidt, 1997). This process reduced the factor list to a manageable size of 24 factors (10 for people perspective, 8 for process perspective, and 6 for technology perspective).

In Phase Three (Ranking) of the study, a questionnaire with the list of factors retained from Phase Two was sent to the panelists. They were asked to rank the factor for each of the PPT perspectives in ascending order from most important to least important. The questionnaire also asked the participants to submit comments explaining or justifying their rankings. Using a stopping criteria similar to Okoli and Pawlowski (2004), the ranking iteration was stopped after the third round when Kendall's *W* reached a value greater than 0.7. Table 2 shows ranking results, including the final mean rank for each factor, Kendall's *W* for each PPT perspective, and the top-half rank (percentage of experts who ranked respective items in their top half). To construct the multi-stakeholder engagement framework (discussed in Section 6), we retained factors with the top-half rank more than 50% (bolded in Table 2) within each stakeholder group.

5 | FACTORS INFLUENCING KM IN ICT4D

In the following sections, we discuss the factors identified by each stakeholder group. The relevance of each factor is exemplified based on narratives gathered through the Delphi study.

5.1 | Factors identified by partners

The main factors that the partner panel considered relevant to KM in ICT4D (more than 50% top-half rank) along with sample quotes explaining their interpretation of the factors are summarized in Table 3. With regards to the people perspective, partners generally agreed that intrinsic and extrinsic motivation played an important role in how stakeholders perceive knowledge outcomes from ICT4D projects. Examples of intrinsic motivation included the perceived need for new knowledge, interest in organizing, storing, and retrieving knowledge, and personal motivation toward the outcomes of applying knowledge. Examples of extrinsic motivation mentioned included financial gains, acquisition of status, and future advancement of educational opportunities. Perceived benefits of KM mentioned by the partner panelists included the value of knowledge application in personal and professional life, and value given by senior leadership to create and disseminate knowledge. While benefits of having new knowledge were well recognized, risks associated with unfamiliar information decreased the willingness to apply new knowledge. Current knowledge and skills included digital literacy (Heeks, 2017) as well as prior experience and knowledge of the learner. The partner panelists generally agreed that beneficiaries with limited time availability (bandwidth) would deprioritize KM activities. In the words of a provider,

> Heavy workload leaves the employees with little time to invest in learning new things or acquiring new information that can be used to augment existing knowledge.

Within the process perspective, the partner panel highlighted the significant role of leadership, a factor that is also regarded highly in KM literature (Donate & de Pablo, 2015; Lakshman, 2007; Srivastava et al., 2006). Examples of leadership mentioned included senior leadership support and appointment of KM lead to support KM activities. The partners also felt that organizational culture, strategies, goals, and policies were crucial to KM, such as the institutional culture of preserving and utilizing knowledge, policies to promote engagement in KM processes, and organizational strategies to prioritize and institutionalize KM (e.g., integration of KM tasks within job descriptions and performance reviews; Forsgren et al., 2018). The partner panel expressed that establishing organizational goals and policies associated with the KM strategies would drive demand and utilization of knowledge and ensure compliance. Resource allocation was another important factor identified by the panelists. The importance of mirroring resources between the partner and beneficiary capacities was emphasized. The panelists narrowed down human capital (e.g., availability of dedicated KM staff), as well as monetary funds and material (e.g., KM tools, training material) as primary resources needed for KM. As indicated by one panelist,

> KM positions and activities are difficult to prioritize. When they are prioritized, the quality of programs, approaches, and outcomes typically is higher.

From a technology perspective, the partners ranked ease of use, quality of technology, and availability and access to hardware as the three most influencing factors. Ease of use alluded to why unfriendly technologies and antiquated information systems made KM difficult to

TABLE 2 Phase Three ranking results

Factors	Designer ($n = 5$)		Partner ($n = 4$)		Beneficiary ($n = 4$)	
People	**Mean rank ($W = 0.738$)**	**Top-half rank**	**Mean rank ($W = 0.774$)**	**Top-half rank**	**Mean rank ($W = 0.738$)**	**Top-half rank**
Attitude	**3**	**80%**	7.5	0%	6.75	0%
Individual's time availability	6.4	20%	**4**	**100%**	5.25	25%
Perceived benefit of KM	**2.4**	**100%**	**1.5**	**100%**	**2.5**	**100%**
Contextual factors	**3.6**	**100%**	7	0%	8	0%
Extrinsic motivation	7.8	0%	**2.25**	**100%**	9.25	0%
Intrinsic motivation	**3.8**	**80%**	**3.5**	**75%**	**3.5**	**75%**
Current knowledge and skills	**5**	**80%**	**4.5**	**75%**	**1.5**	**100%**
Professional identity	8	20%	7.5	25%	**5**	**50%**
Self-efficacy	6.6	20%	8.25	0%	**4.5**	**75%**
Cultural norms	10	0%	9	0%	8.75	0%
Process	**Mean rank ($W = 0.760$)**	**Top-half rank**	**Mean rank ($W = 0.797$)**	**Top-half rank**	**Mean rank ($W = 0.723$)**	**Top-half rank**
Bureaucracy	6.2	0%	6.75	0%	6	25%
Access to existing knowledge	**3.2**	**100%**	6.75	0%	**4**	**75%**
Leadership	**2.4**	**80%**	**1.75**	**100%**	**2.25**	**100%**
Org culture	5.8	20%	**3.5**	**100%**	**1.5**	**100%**
Org procedures	7	0%	6	0%	6.25	0%
Org strategies, goals, and policies	**2.4**	**100%**	**1.5**	**100%**	**3**	**75%**
Resource allocation	**2.2**	**100%**	**3.25**	**100%**	6	25%
Time allocation by organization	6.8	0%	6.5	0%	7	0%
Technology	**Mean rank ($W = 0.751$)**	**Top-half rank**	**Mean rank ($W = 0.741$)**	**Top-half rank**	**Mean rank ($W = 0.737$)**	**Top-half rank**
Availability & access to hardware	**2**	**100%**	**2.75**	**75%**	5.25	0%
Availability & access to infrastructure	**2**	**80%**	4	0%	5	25%
Availability & access to software	**2.2**	**100%**	4.75	25%	6	0%
Cost	5.2	0%	6.25	0%	**2**	**100%**
Ease of use	4.8	20%	**1.5**	**100%**	**1.5**	**100%**
Quality of technology	5.4	0%	**2.5**	**100%**	**2.75**	**75%**
Tech support	6.4	0%	6.25	0%	5.5	0%

Abbreviation: KM, knowledge management.

TABLE 3 Key factors identified by partners related to PPT perspectives of KM

Perspective	Key factors	Partners' interpretation of the factors—Sample quotes
People	Extrinsic motivation	"Motivation—financial gain, acquisition of status, advancing educational opportunities, attaining power."
	Perceived benefits of KM	"Perceived consequences of applying knowledge, either substantively (in helping a population) or winning favors or increasing political power."
	Intrinsic motivation	"Stemming from the overall humanitarian actor's KM strategy should be a set of goals for knowledge creation, dissemination, sharing, and amplification both internally and externally."
	Current knowledge and skills	"Knowledge management related to an ICT4D project can be impacted by the level of individual subject matter understanding."
	Individual's time availability (bandwidth)	"Finding time to focus on knowledge management is difficult to prioritize. It is sometimes an afterthought."
Process	Leadership	"If global leadership of an NGO makes it clear that KM is important and should be prioritized, then it is much more likely that it will be budgeted for, staffed properly and supported by all senior leadership and management."
	Organizational culture	"Institutional value placed on having new knowledge favors creation and transmission of knowledge."
	Organizational strategies, goals, and policies	"Promotion of KM processes and resulting impact in organizational communications as reinforcement. Institutionalization of processes to support and encourage internal and external knowledge distribution."
	Resource allocation (human, monetary, material)	"Mirroring resources between partner organization and beneficiary capacities."
Technology	Ease of use	"With staff who are juggling multiple duties, ease of use is frequently a determinant of actual use of a knowledge management system."
	Quality of technology	"System Performance Issues—invariably, there will be latency issues or internet service outages, with either ISPs or MNOs that will affect ability to access the information needed."
	Availability and access to hardware	"Access and ability to use appropriate tools and systems required for KM."

Abbreviations: ICT4D, information and communication technologies for development; KM, knowledge management; PPT, people-process-technology.

accomplish. They felt that quality of technology is a determination of whether the technology fits the ICT4D context (e.g., the choice of security options and cloud-based storage options), as it can make or break the overall demand and use of KM resources. The panel raised concerns about unsupported hardware (limiting the ability of beneficiaries to use knowledge) and inventory shortage (availability of specific hardware to effectively search and find knowledge). As mentioned by one provider,

> Sometimes programs are not using supported hardware or software, so the knowledge they [beneficiaries] get from HQ might not even be applicable to the tools they are using.

5.2 | Factors identified by beneficiaries

Important factors ranked by the beneficiary panel and sample quotes explaining their interpretation of the factors are summarized in Table 4.

The five most relevant factors related to the people perspective included current knowledge and skills, perceived benefits of KM, self-efficacy, intrinsic motivation, and professional identity. Examples of current knowledge and skills included prior familiarity with knowledge systems, professional and educational background, and skill-sets required to put new knowledge to practice. Perceived benefits of KM were a recurring theme among beneficiaries in all three phases of the Delphi study. The eudemonic value from future use of stored knowledge (e.g., substantively helping a population) and perceived gains of applying knowledge (e.g., increasing political standing or winning favors) were particularly noted by the beneficiary panel.

Self-efficacy in the context of our study is defined as the belief in one's ability to organize and execute courses of action required for KM (Hsu et al., 2007). Examples of self-efficacy included self-confidence in the practical use of acquired knowledge and aptitude to use technology. Unfamiliarity with knowledge content and fear of appearing wrong impeded engagement in KM activities

TABLE 4 Key factors identified by beneficiaries related to KM activities

Perspective	Key factors	Beneficiaries' interpretation of the factors—Sample quotes
People	Current knowledge and skills	"The educational background and skillset of the population has definitely more to say when it comes to the role of people in KM. Education is supposed to refine the way of systematic and scientific thinking which will naturally facilitate KM activities. My experience with flood management in a small community of 85 families."
	Perceived benefit of KM	"There is anticipated gain or benefit in future use of the knowledge."
	Self-efficacy	"Aptitude of usage of technology of the individual and collective."
	Intrinsic motivation	"Desire to advance career (e.g., by demonstrating knowledge, leadership/mentor skills, etc.)."
	Professional identity	"Field of expertise (some fields more secretive of knowledge sharing than others)."
Process	Leadership	"Lack of institutional leadership or mentors to oversee process and usage can be an obstacle."
	Organizational culture	"Women not viewed as role models or allowed leadership roles within learning institutions."
	Organizational strategies, goals, and policies	"Presence/existence of established purpose or usage of KM systems."
	Existing knowledge base	"Ubiquity of access to the knowledge store."
Technology	Ease of use	"Simplicity or difficulty of the learning methodology and the system."
	Cost	"Cost of technologies, data storage devices, and access to the Internet can be a problem."
	Quality of technology	"Quality of available technology. Age/how up to date the technology is."

Abbreviation: KM, knowledge management.

(e.g., a doctor forgetting a procedure or medication dose might not want to look it up if it made them appear incompetent).

Examples of intrinsic motivation identified by beneficiaries included recognition of the value of creating and disseminating knowledge (e.g., lifesaving treatment), motivation to be meticulous and logical, and personal motivation toward the outcomes of knowledge applications. Other examples included the desire to solve problems creatively, anticipated social impact and community change, and aspirations to advance one's career. As suggested by one beneficiary,

> There is the desire to solve problems creatively and improve outcomes as a measure of one's own ability and successes.

The beneficiaries felt that access to specialized knowledge enhanced professional identity and expertise, especially in technical disciplines such as medicine and healthcare. The knowledge reflected an individual's professional standing in the community and among peers, particularly in fields that tend to be more secretive of knowledge sharing than others.

From the process perspective of KM, leadership was ranked the highest by the beneficiaries. Concerns regarding leadership included lack of mandates from supervisors, insufficient institutional support or interest (e.g., no admin time set aside for managing knowledge), lack of forward-thinking administrators who do not associate knowledge application with innovation, and inadequate institutional leadership or mentors to oversee knowledge processes and usage.

The beneficiary panel suggested that organizational culture determined the existence of systems that promote creativity and nimbleness of KM activities. Problems related to organizational culture included not rewarding work beyond what was expected, limiting the support for knowledge implementation when seen as a threat to those in power, and discouraging new ideas from junior workers. The beneficiaries emphasized the need for more inclusive organizational strategies and policies to motivate the adoption of knowledge practices. They also noted the need for regulations and guidelines related to storing, sharing, retrieving, and applying knowledge. One beneficiary mentioned,

> The strategy used in delivering knowledge applications should be one that motivates the stakeholder to adopt them.

Access to existing knowledge was included in the top four rankings by the beneficiaries. Related examples included ease of retrieval of stored knowledge and

functionalities that allow information access on mobile devices. Safety and security in accessing stored information from public systems were mentioned as process related concerns.

With regards to the technology perspective, the beneficiaries specified ease of use, cost, and quality of technology as most relevant. In the ICT4D context, ease of use implied low barriers to the use of technology. Difficulties to set up, use, and navigate software were deterrents they felt would impact meaningful use of KM. Outdated technologies, unfamiliarity with systems, lack of experienced IT support staff to configure and manage ICT, as well as poor quality and durability of technology frustrated users. In the words of a beneficiary,

> Systems that outdated, easily corrupted, or hacked can frustrate users. For example, in Nepal, older laptops are used and the old operating systems can't support newer [knowledge] delivery or retrieval systems.

Cost of equipment and compatibility of technology with KM activities were other technology-related concerns asserted by the beneficiaries.

5.3 | Factors identified by designers

Factors identified by the designer panelists along with sample quotes summarizing their interpretation of the factors are shown in Table 5.

From the people perspective, the designer panelists recognized the perceived benefits of KM as an important factor for attaining knowledge outcomes in ICT4D projects. Examples included awareness of the value of generating and storing knowledge and rewards associated with knowledge application. The designers believed that the current knowledge and skillsets of the beneficiaries were important for their engagement in KM practices. ICT skills required to create, use, store, curate, organize, retrieve, and extend knowledge, analytical skills to transform data and information to knowledge (knowledge efficacy), and domain specific skills to translate knowledge into action were listed by the designers. In the words of a designer,

> Without skills it is difficult to create knowledge or to learn, use or extend knowledge.

Examples of attitude toward KM included willingness of employees to learn, habits of seeking new knowledge,

TABLE 5 Key factors identified by designers related to KM activities

Perspective	Key factors identified by designers	Designers' interpretation of the factors—Sample quotes
People	Perceived benefits of KM	"Workshops, seminars, etc. that explain and highlight the importance and/or benefits of knowledge activities."
	Current knowledge and skills	"Experiences and skills of employees may hinder/improve knowledge application."
	Attitude	"Attitude or unwillingness of employees to extend what they have learnt."
	Intrinsic motivation	"Enjoyment in helping others and learning from others."
	Contextual factors	"Poverty (subsistence existence significantly limits creativity, hope, human initiative, health and human energy, vision)." "Gender (in the developing world, men are too often given priority over women)"
Process	Resource allocation (human, monetary, material)	"Dedicated knowledge management staff and expertise—KM positions and activities are difficult to prioritize. When they are prioritized, the quality of programs, approaches and outcomes typically is higher."
	Organizational strategies, goals, and policies	"Established procedures, laws, and goals for knowledge preservation are vital."
	Access to existing knowledge	"Access to knowledge contributed by others."
	Leadership	"Senior Leadership support and prioritization of KM is crucial."
Technology	Availability and access to infrastructure	"Availability of infrastructure to the individual and the collective."
	Availability and access to software	"Software—as knowledge is shared, the receiver will need to be able to access, open, and interact with the actual knowledge products."
	Availability and access to hardware	"Are there enough of a certain hardware to integrate the knowledge effectively into a project?"

Abbreviation: KM, knowledge management.

and the sense of obligation and commitment. Examples of intrinsic motivation included enjoyment in helping others and learning from others, the need to grow a personal knowledge base, and the desire to apply knowledge for practical purposes.

Unlike partners and beneficiaries, the designer panelists highlighted the importance of contextual factors. They felt that context factors or situational factors played a role in knowledge outcomes since using knowledge requires familiarity with the concepts themselves and the context where it may be put to use (Stenmark, 2002). Gender (e.g., women being at a disadvantage in some cultures), age of employees (e.g., younger employees being more open to integrating new knowledge), literacy levels shaped by cultural background, and poverty limiting hope, creativity, and human energy were examples of contextual factors that impacted KM.

Similar to the partner panelists, the designer panel ranked resource allocation high within the process perspective. They argued that the allocation of material and monetary resources would enable beneficiaries to attend seminars, workshops, and conferences, as well as access to vendor knowledge bases that are subscription-based or expensive. Like partners and beneficiaries, the designer panelists also found organizational strategies, goals, and policies relevant to the process perspective. Establishing goals for knowledge preservation, defining areas to which to contribute knowledge, mandating and creating workflows for storage of knowledge, ensuring secure procedures for knowledge access, and training policies were recommended by the panelists to improve organizational KM practices.

The designer panel underlined access to existing knowledge as an important factor. They felt that technologies can be utilized for easy and secure access to knowledge. For example, in settings where infrastructure limitations restrict access to Internet-based knowledge sources, designers foresee the use of newer technologies to enable the download and storage of content on personal devices. Effective search tools were indicated as a crucial requirement to allow quick access to existing knowledge. The designer panel felt that leadership, as well as clearly defined organizational strategies, goals, and policies related to KM were vital to successful KM in ICT4D. One designer indicated,

> Is there agreement among staff and leadership that the knowledge should be applied? ... a lack of consensus could prevent the application of knowledge.

Finally, from a technology perspective, the designer panelists largely agreed that availability and access to infrastructure, software, and hardware influenced KM in ICT4D. They felt that the use of mobile phone-based technologies for the delivery of training assets where Internet access is limited needed further development.

6 | A MULTI-STAKEHOLDER ENGAGEMENT FRAMEWORK FOR KM IN ICT4D

The final ranked list of factors (Table 2) enabled us to determine how different stakeholder groups view the influencing factors of KM in ICT4D. The ranked list indicates that not all factors are equally ranked by the stakeholder groups. It also shows that, not all KM factors are relevant to all stakeholder group, and conversely, not all stakeholder groups can manage every factor. To answer the third question, how can stakeholders better coordinate the management of knowledge in ICT4D projects, we constructed a multi-stakeholder engagement framework for KM (see Figure 3). To construct the framework, we grouped ranked factors that specific stakeholder group are best positioned[2] to address (shown in the solid-lined boxes). Factors that two or more stakeholder groups must coordinate and manage are grouped separately (shown in the dotted-lined boxes). The arrows to boxes indicate the assignment of stakeholders to respective factor groups. The framework is intended to serve as a guide for partners, designers, and beneficiaries to coordinate initiatives and combine efforts in ICT4D projects, and thereby increasing the likelihood of successful KM outcomes.

A triad of factors—current knowledge and skills, perceived benefits of KM, and organizational strategy, goals, and policies were recognized by all three panels. For partners, the triad signifies narratives embodying the benefits of KM and skill improvements, and for beneficiaries, it is the willingness to use skills and knowledge to undertake KM activities. For designers, they represent skills favorable for activities such as knowledge storage and retrieval. All three stakeholder groups also recognized the importance of explicitly endorsed strategies, goals, and policies around KM. Hence, these three factors are included in the central box of Figure 3.

Two factors were ranked high by beneficiaries: self-efficacy and intrinsic motivation. Self-efficacy is the individual's perception of competence (Ryan & Deci, 2000). In the context of our study, self-efficacy is the beneficiaries' perception of designated levels of performance required to carry out KM activities. The efficaciousness to take actions for managing knowledge has to manifest from within the beneficiaries. Intrinsic motivation is the behavior motivated by an internal desire such as the need to grow personal knowledge base or joy in helping others. Although intrinsic motivation was also ranked high by

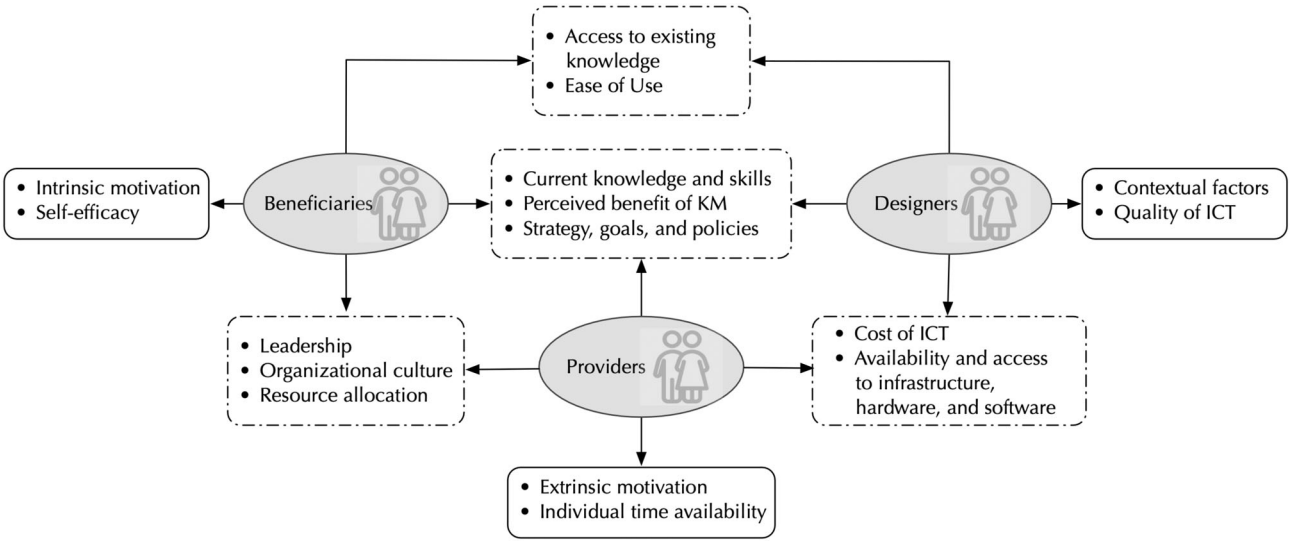

FIGURE 3 A multi-stakeholder engagement framework for knowledge management in information and communication technologies for development

partners and designers, it is unlikely that they can directly influence this factor. Therefore, self-efficacy and intrinsic motivation are grouped in the beneficiaries' box.

In ICT4D, extrinsic motivation corresponds to factors that motivate beneficiaries to undertake KM activities, such as compensation, rewards, financial gains, acquisition of status, or attain power. Individuals are more likely to undertake action when they have extrinsic goals that are efficacious (Ryan & Deci, 2000). Partners are better positioned to manage extrinsic factors by promoting the value of knowledge to the beneficiaries. Similarly, the time availability (bandwidth) of the beneficiaries impacts the ability to undertake KM activities. The data from the Delphi study suggested that the beneficiaries are willing to find time to undertake KM activities and utilize knowledge if appropriate technologies and supporting processes are in place. If the targeted knowledge outcomes from the ICT4D project require beneficiaries to learn new skills and undertake new roles, then partners have to be cognizant of time commitment and other priorities, without which KM is likely to be relegated as a burdensome task. Thus, extrinsic motivation and availability of time (bandwidth) are grouped in the partners' box.

Partners and beneficiaries emphasized the importance of leadership in KM. In the words of a partner,

> If mandated alignment to strategy, policy, and goals are not put into place by senior leadership, KM processes are likely to not be implemented as rigorously as desired.

And, in discussing leadership challenges, a beneficiary added,

> Lack of forward-thinking administrators and directors who don't associate knowledge-application with innovation impact KM.

Published literature has documented leadership as a complex problem in the ICT4D context (Conger, 2015). Partners can also assist beneficiaries' institutions by providing expertise in change management. This includes raising awareness and instilling change management strategies at target institutions. Beneficiaries and partners recognize the impact of organizational culture on KM practices, especially with regards to the beneficiaries' perception of the importance of KM. Since leadership, organizational culture, and allocation of resources are essential strategies that are to be dealt with collectively by partners and beneficiaries, they are grouped with arrows leading to both stakeholder groups.

From the process perspective of KM, both designers and beneficiaries ranked access to existing knowledge as an influencing factor. Since designers of ICT4D projects often collaborate with beneficiaries to ensure ease of use of technology (Limayem et al., 2007) and ubiquitous access to knowledge, these factors are grouped and linked to the two stakeholder groups. As designers have to take the lead in ensuring that ICT is contextually relevant (Mengesha & Garfield, 2019; Thomas & Li, 2015) to the beneficiaries, quality of ICT and contextual factors are assigned as designer priorities. In the words of a beneficiary,

> Storing of knowledge becomes relevant when it comes to the need for recalling and retrieving it, is called for.

The beneficiary panelists were mindful of the costs associated with KM. However, our analysis of data from the Delphi study did not provide a complete picture. For instance, it was not clear why they felt that costs were specifically relevant to knowledge storage and distribution in contrast to knowledge creation and application. A likely explanation is that the beneficiaries are more impacted by the hardware and infrastructure costs required for storage and distribution of knowledge, whereas the creation and application of knowledge are a human function. Since partners and designers account for availability and access to technologies along with associated costs, these factors are organized together in the framework for both stakeholder groups to jointly address.

The factors synthesized in the framework are not the only factors relevant to stakeholder engaging in ICT4D. For example, during the Delphi study, partners referred to the importance of educating women and the limitations of prevalent educational systems that emphasize rote learning over problem-solving type approaches. Designers included prevailing customs, traditions, and norms regarding acceptable practices for KM. Beneficiaries felt that gender bias and political views impact the creating and flourishing of knowledge. These factors are certainly crucial to ICT4D projects and were coded as cultural norms in the Delphi study. While it is likely that cultural norms may play a prominent role in the extent to which knowledge outcomes are attained through ICT4D, they represent areas of necessary change that are unlikely to be realized through stakeholder engagement or ICT4D intervention. Hence, they are not included in the proposed multi-stakeholder engagement framework.

7 | IMPLICATIONS FOR RESEARCH AND PRACTICE

The study has many implications for practice and research. Selected aspects are summarized below.

7.1 | Implications to research

Scholarship has not sufficiently conceptualized the knowledge needs of key stakeholders involved in ICT4D projects (Zhao et al., 2021). To the best of our knowledge, no prior studies have investigated the differing stakeholder views of KM practices in ICT4D projects. Our study addresses this literature gap by first conceptualizing KM in the context of ICT4D based on the PPT perspective. Our conceptualization draws parallel to the broader perspective of the information field that includes people, information, technology, and management (Zhang et al., 2013), and compatible with the conceptual framework and mission of ICT4D (Zhao et al., 2021). We then conducted a Delphi study of KM as it applies to key stakeholders in ICT4D projects. The Delphi study systematically elicited the most relevant factors of KM in ICT4D from 13 experts with vast experience in leading ICT4D projects in 25 countries. Carefully designed sequential questionnaires interspersed with feedbacks gathered from earlier responses and iterative refinement ensured validity and reliability of the findings.

Although many influencing factors of KM have been identified in prior literature, we elicited 16 factors that key stakeholder groups (beneficiaries, providers, and designers) must manage in KM focused ICT4D projects. ICT4D is firmly grounded on human-centered imperatives and much needs to be done to ensure that ICT4D research initiatives are translational (Heeks, 2017; Zhao et al., 2021). Our study shows that, although organizational KM concepts may not be directly transferable to the development context, they serve as a meaningful basis for stakeholders to manage knowledge initiatives in ICT4D projects. In this regard, our study is backed by substantive and methodological rigor.

Based on a rigorous inductive analysis, we developed the multi-stakeholder engagement framework for KM in ICT4D. Compared to the existing KM frameworks developed for the "westernized" organizational perspective (Fteimi, 2015; Heisig, 2009; Holsapple & Joshi, 1999; Lai & Chu, 2000; Rubenstein-Montano et al., 2001; Shongwe, 2016), our framework makes ICT4D-related theoretical contributions in two distinctive ways. First, it classifies the manageable set of 16 KM factors identified through our study, which are then mapped across specific stakeholder groups in the multi-stakeholder engagement framework. Second, to the best of our knowledge, the proposed framework is the first to depict the specific nature and scope of how stakeholders may engage and coordinate to increase the likelihood of successful KM outcomes. The outcomes of our study are thus pragmatic and significant to the ICT4D context.

As development initiatives become increasingly knowledge focused (Heeks, 2017; Kelly, 2018; van Biljon, 2020), we call upon contemporary ICT4D research to go beyond the conventional notion of socio-technical examinations and include knowledge outcomes of the individual and the collective. In this regard, progressive research opportunities are abundant. For example, techno-centric research is well suited to investigate topics related to the delivery of contextually relevant knowledge in a sustainable and timely manner, and socio-technical research is ideal to assess the impact of knowledge assets (Li &

Thomas, 2019). Similarly, socio-centric research is appropriate to explore the dimensions of knowledge focused ICT4D and to theorize knowledge relationships in ICT4D.

7.2 | Implication to practice

The Delphi study showed that each stakeholder group has distinct views of the influencing KM factors in ICT4D. The multi-stakeholder engagement framework that is grounded on the study findings depicts stakeholder roles and collaboration on a select set of factors that influence KM in ICT4D. The framework categorizes areas that one or more stakeholder groups may target in KM focused ICT4D projects. While some aspects of KM are best addressed by specific stakeholders, other areas benefit from multiple stakeholder collaboration as shown in Figure 3. For instance, designers are best prepared to ensure the quality of technology, whereas partners and designer roles are more adept to jointly communicate the value of KM and its benefits. Although beneficiaries may deprioritize KM due to limited time availability, partners can assist in supportive functions such as change management, leadership, and resource allocation. Similarly, some aspects of the ICT4D project such as the availability and access to hardware, software, and technology infrastructure are best addressed as collaborative initiatives between partners and designers. Where beneficiaries fall short in knowledge and skills (e.g., gaining quick access to stored knowledge), designers and partners share responsibilities to assist beneficiaries in overcoming the hurdles (e.g., training in the use of knowledge-sharing software on mobile devices).

Based on the narratives from the Delphi study participants, we propose an activity checklist to assist stakeholders in the coordination of knowledge focused ICT4D projects. The checklist ascertains four foci points corresponding to the PPT perspectives:

1. Focus on defining the structure and nature of knowledge activities of the beneficiaries and the comprehensive assessment of factors that influence their engagement in KM.
2. Focus on defining the processes of managing knowledge and the comprehensive assessment of tools, resources, and social norms that influence KM.
3. Focus on the extent to which ICT may facilitate knowledge activities and knowledge processes, subject to availability and allocation of resources.
4. Focus on the overall transformation targeted by the ICT4D project so that the knowledge outcomes are meaningful, goal-oriented, and sustainable.

The multi-stakeholder engagement framework that we propose along with the activity checklist would serve as a valuable guide for stakeholders, especially in the early stages of planning and development of the ICT4D project.

8 | CONCLUSION

Our study discussed the underlying reasons limiting the translation of theoretical KM foundations developed in the western world to resource constrained settings of the ICT4D context. Through a Delphi study, we identified a manageable set of factors that influence KM in ICT4D. We then synthesized 16 KM factors that are most relevant to three key stakeholder groups (partners, beneficiaries, and designers). Our study thus contributes to the body of knowledge by providing insights into the differing views of stakeholders related to KM practices in ICT4D projects. Finally, building upon the study results, we proposed a multi-stakeholder engagement framework for KM in ICT4D. The rich narratives provided by the study participants were used to develop an activity checklist corresponding to the PPT perspectives of KM. Stakeholders may use the framework and the activity checklist to coordinate KM activities and combine efforts in value-adding areas of KM initiatives in ICT4D projects.

The study is not without limitations, one of which is particularly worth mentioning owing to its potential relevance for future studies. In the Delphi study, we observed that different panelists described similar factors using different terms or different factors using similar terms. For example, in many instances, access and availability of technologies (e.g., hardware, software, and infrastructure) were used interchangeably and the distinctions were not consistent across the respondents. We took two steps to address this issue. First, we used an iterative approach to code the responses of the panelists. During each iteration, we refined the codes till all statements were consistently coded. Second, at the end of every phase of the study, we created a summary document that included a glossary of terms and definitions. The document was distributed to the panelists to validate that their inputs were correctly represented and mapped. This also ensured that all panelists had a common point of reference prior to starting the next phase of the study. While these steps were taken to reduce inconsistencies, it is not clear whether the participants' mental models conformed uniformly to what they perceived as factors influencing KM in ICT4D. We caution researchers considering Delphi studies against this potential pitfall.

A related challenge that emerged from the study was how the factors identified through the study can be put

into practice. The stakeholder responses are based on "mental models" of what KM ought to be, and likely to deviate from the contextual realities. Argyris and Schön (1997) distinguished between the mental models used by people (theory-in-use) and the behavior themselves (espoused theory). More research is needed to assess this distinction in knowledge focused ICT4D projects. Another observation from our study was that the importance of stakeholder engagement was mentioned only by designers and partners. The beneficiaries not considering the relevance of stakeholder engagement in their assessment of KM is intriguing and may suggest that ICT4D is taken for granted or perceived as a one-way engagement. More research is required to examine these viewpoints. Additionally, the activity checklist we proposed may imply that KM project activities are analyzed and incorporated as part of the overall project in the early stages. Our study did not seek inputs from the participants regarding the timing of KM actions. Including a temporal component would help to ensure that the KM actions are appropriately sequenced, budgeted, and staffed, rather than an afterthought of the project.

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ENDNOTES

[1] The term "beneficiaries" is a contentious topic. Our definition follows the convention used by the UK Independent Commission for Aid Impact (ICAI) that identify "intended beneficiaries" as individuals or organization for whose benefit the development intervention is undertaken. It does not include other stakeholders or recipients involved in other stages of the development project (Groves, 2015; ICAI, 2014).

[2] A stakeholder group may rank a factor to be important, but the group may not be best positioned to address the specific factor.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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