The usage and effectiveness of IT and non-IT tools on knowledge management practices maturity in construction non-profit volunteer organisations (CONVOs)

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Abstract: The management of both tacit and explicit knowledge is gaining popularity as a critical factor which leads to organisational development. Using information technology (IT) tools and non-IT techniques for knowledge management (KM) has been widely documented in the for-profit construction sector. Accordingly, this paper presents research conducted to investigate the current usage and effectiveness of KM tools in construction non-profit volunteer organisations (CONVOs), specifically Canadian Habitat for Humanity (HFH) affiliates. The aim is to determine KM tools' influence on knowledge management practices maturity (KMPs maturity). Respondents from an online survey indicate a level three (defined) maturity out of 5 maturity levels by 68% of HFH CONVOs. Microsoft Office tools are predominantly used but face-to-face meetings deemed most effective. Further, KMPs maturity is influenced by organisational capacity, competencies and operational outputs. The survey results are further used to identify a focus group for the adoption of action research principles to identify the most appropriate KM tools for application and to demonstrate its impact on future KMPs maturity. The research's ultimate goal is to develop a practical guide for the adoption of KM tools in Canadian HFH CONVOs.

1   Introduction

Construction organisations undertake dynamic projects that generate new shared knowledge which is often displaced as teams disband upon completion of the project (Ribeiro and Ferreira, 2010). Construction managers (CMs) often encounter various levels of workers' skills and expertise. Some of this knowledge can be explicitly codified through the use of either information technology (IT) or non-IT techniques, otherwise refered to as knowledge management (KM) tools. However, there are instances where valuable tacit knowledge excapes codification especially when project teams are quickly disbanded or in fast-paced construction projects with temporary labour supply. These unique circumstances make KM in construction particularly challanging. Workers' knowledge has the potential to influence best practices and contribute to enhanced performance of organisations only if recognised as important and managed accordingly (Debowski, 2006). Some researchers have identified knowledge as a strategic asset to an organisation (Dwivedi *et al*., 2011; Pathirage *et al.,* 2007; Zhang *et al.,* 2006 and Anumba *et al.,* 2005). In construction however, temporal labour supply makes KM arduous as the high turnover rate complicates KM processes. As a result, many construction organisations recognising this factor prefer to invest in KM where there is a stable supply of labour and ignore more complex project environments that are more typical of construction projects. Furthermore, the majority of KM research in the construction industry has focused efforts on the for-profit sector. However, global natural and anthropogenic (human-induced) disasters increasingly affect the built environment in both developed and developing nations and the role of non-profits has never been more vital (Perreira and Rankin, 2011). The provision of shelter solutions by construction non-profit volunteer organisations (CONVOs) has led to hundreds of these

unique organisations collaborating with major international alliances such as the United Nations for example. In this instance, CONVOs such as Habitat for Humanity (HFH) often operate in dynamic environments characterised by combinations of blitz builds[1], large volumes of unpredictable volunteer labour, rigid construction durations, and ever changing project objectives.

Canadian HFH CONVOs provide simple, affordable shelter solutions and services in over 300 improverished communities nationwide. These CONVOs partner with families for homeownership; secure resources; manage the construction of Habitat homes; and engage community volunteers, all the while raising awareness about the issue of affordable housing in Canada (Habitat Canada, 2012). HFH affiliates' staff and volunteer workers' knowledge has the potential to influence best practices and contribute to enhanced performance of their organisations only if recognised as important and managed appropriately. Securing and managing a stable supply of skilled labour is particularly challenging in any organisation (Collyer and Warren, 2009). Likewise, HFH CONVOs are challenged to secure a stable workforce since many individuals are volunteers. This high turnover of the labour force may hinder development of best practices on account of differing values and capabilities of each new volunteer. Without labour stability, sourcing knowledge of workers who are essentially an unstable supply of volunteers is difficult and jeopardises knowledge capture, conversion, dissemination and reuse (Debowski 2006). Information technology (IT) tools and non IT techniques have been explored to facilitate knowledge management practices in the construction industry (Anumba *et al.,* 2005 and Al-Ghassani *et al.,* 2002). However, limited research emphasising its impact in CONVOs is evident and therefore requires exploration. The researchers' hypothesise that HFH CONVOs lack the requisite processes and practices essential to knowledge management (KM) since they are also compounded by combinations of fragmented collaboration practice; non-standardisation; and poor long term strategising. Furthermore, for-profit construction industry practitioners who have a KM strategy are immature and must secure adequate budgets, time, staff and an IT infrastructure to ensure successful implementation (Al-Ghassani *et al.,* 2002).

Accordingly, this paper explores the usage and effectiveness of IT tools and non-IT techniques on KMPs maturity in CONVOs, in this case, Canadian Habitat for Humanity (HFH) affiliates. There are currently sixty nine (69) Canadian HFH CONVOs. These organisations demand no down payments or mortage interests, only the total cost of construction for their builds. Building operations are dependent on funding from generous sponsors; cooperate donors and thousands of volunteers, both skilled and unskilled. A three-part self-administered online questionnaire survey of Canadian HFH CONVOs revealed varying KM maturity influenced by their size and operational outputs, and provided insight into their KMPs. The results are used to identify potential candidates for action research (AR) collaboration for the adoption of KM tools to investigate their impact on overall KMPs.

The authors report results from the data collection phase in this paper. A survey pilot test was conducted using four (4) Atlantic Canadian HFH CONVOs before administering the survey to collect data from a remaining population of 65 HFH CONVOs. The survey focused on *identifying the key performance indicators (KPIs)* and *critical success factors (CSFs) for KM*; *identifying various KM tools (IT technologies and non-IT techniques) utilised*; and *assessing affiliates' knowledge management practices maturity*. A modified general knowledge management maturity model (G-KMMM) (Pee and Kankanhalli 2009) is used to assess each HFH CONVO's KMPs maturity. The results of the survey are particularly relevant not only to management officials in Canadian HFH CONVOs, but also those in academia and industry practitioners interested in the area of KM.

2   Research Methodology

Prior to data collection, a CONVO KM assessment framework was established following a gaps' identification in previous research literature (Perreira and Rankin 2011). This framework, a combination of the *construction assessment model (Fayek et al. 2008); principles of total quality management (Deming 1998)* and *construction project phases*, identified the critical success factors (CSFs) for KM in CONVOs.

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[1] The quick construction/erection/assembly of simple, affordable houses for the poor using high volumes of volunteer labour (Eastwood, N. Habitat for Humanity, 2011)

Self-administered questionnaires and interview schedules were developed and pilot tested with four Atlantic Canadian HFH CONVOs. Their participation provided insight on the KM practices which aided the revision of the instruments. Data presented in this paper was collected during April 2nd to July 25th, 2012 from three (3) online self-administer questionnaires using Zoomerang (2012). The following is a list describing each questionnaire:

- **Questionnaire 1:** Collect general data on KMPs and perceptions of KM in the organisation
- **Questionnaire 2:** Collect data on the usage and effectiveness of IT & non-IT KM tools & CSFs for KM
- **Questionnaire 3**: Collect data regarding the knowledge management maturity of the organisation

Upon administering the survey to 65 Canadian HFH CONVOs, a combination of qualitative and quantitative methods was used to collect and analyse the data. The majority of respondents were executive directors (EDs) with a response rate of 43% based on the total population of **65**. However using the representative sample size *(i.e., a sample with less than 4% error bound and 95% confidence interval)* which amounts to **59** affiliates, the total response rate would be considered 47% (see table 1). In addition, table 1 illustrates how the response rate is distributed based on HFH Canada's categorisation of affiliates.

Table 1: Distribution of survey respondents

HFH Categories	Sample	Responses	(%)
(**LU**) Large Urban *(541K)*	11	4	36
(**MU**) Medium Urban *(161-540K)*	16	10	62
(**SU**) Small Urban *(121-160K)*	9	3	33
(**RR**) Rural/Regional *(120K or less)*	29	11	38
From total population	**65**	**28**	**43**
From total error bound sample size	**59**	**28**	**47**

K* denotes population in thousands served by affiliate

3   Some main findings of survey

This section of the paper presents a brief summary of the main findings of the survey in bullet point format under three sub-headings as follows.

3.1   Perceptions of Knowledge Management (KM)

The research investigated the perceptions of KM in an effort to better understand how these CONVOs operate. Data analysis determined that:

- Ninety percent of respondents concur both tacit and explicit knowledge are important, but perceptions of its impact on organisational development need to be justified. This fact is similar to what many for-profit companies believe as well.
- Although operational manuals are readily available, there are opportunities to improve the relevance and accuracy of its content.
- Few HFH CONVOs have a dedicated person revising operational manuals, but some rely on expert input and this provides opportunities for collaborations and facilitates knowledge processes. Many for-profits require direct economic benefits from knowledge assets (i.e. human expertise). However, CONVOs rely on volunteer labour (whether skilled/unskilled) and therefore stand-alone knowledge management officers (KMOs) may appear as a necessary or affordable investment.
- Less than a third of respondents are familiar with 'all' construction aspects and although the majority of HFH CONVOs have an organisational flow chart, less than 50% agree on its effectiveness.
- Computers are mostly used pre-project, slightly declining throughout the building cycle. Further, the majority of HFH CONVOs use traditional construction methods, but there is also potential for blitz building practices. While many for-profits also utilise traditional construction methods, blitz building

requires major scheduling expertise and resources (both human and financial), inputs which are often scarce for HFH CONVOs.
- Collection of skills information deviates amongst volunteers (i.e. site vs. office volunteers). The current availability and construction competencies of office and site workers and volunteers vary but can be improved. In addition, although project data is collected, the type and consistent collection throughout project phases needs enhancement.
- Different people collect different types of project data which need to be simplified in order to ensure adequacy and efficiency.
- Familiarity with the KM terminology is fair but improvement is needed for actual management of knowledge.
- Collaboration amongst communities of practice (COPs) exists, but more can be done to improve its KM capacity.

3.2   Critical success factors (CSFs) for knowledge management (KM)

The comparison of key performance indicators (KPIs) using a likert scale illustrated certain dichotomies amongst the critical success factors (CSFs) for the **people, practices** and **product** aspects of the organisation. In other words, some CSFs which were identified as important in actuality were not so indicated during analysis. The most significant findings for CSFs for KM in Canadian HFH CONVOs were:
- The most important KPI for **product** appears to be '*function*' (i.e., of houses), not '*quality*', as perceived by respondents.
- *Lessons learned programs* (LLPs) are perceived and validated as the most critical KPI for KM **practices.** Interestingly, LLPs in for-profit construction companies are increasingly popular as well, but their potential for savings and improvement still need to materialise (Caldas et al., 2009).
- Though the '*availability*' of human resources is perceived as most important, their '*quantity*' is most critical for the organisations' operations. This particular result may be unique to HFH CONVOs in comparison to for-profits because '*quality*' and not necessarily '*quantity*' may be the most critical KPI.
- The CSF **people** appear to have the most variations among KPIs, followed by **product** and then **practices**.

3.3   Knowledge management practices (KMPs) maturity

Pee and Kankanhalli's (2009) maturity model was modified and used to determine the overall KMPs maturity of respondents which the main conclusions revealed that:

- Level 3 is the highest maturity level (i.e., *Defined* maturity) accomplished by 68% of respondents.
- Knowledge '*process*' is the least mature knowledge area followed by *environment, technology* and *people.*
- Only 25% of LU HFH CONVOs need improvement with their *process* and *environment* knowledge areas, but 100% were above the maximum average maturity for both *people* and *technology* aspects.
- There is room for improvement in MU, SU and RR HFH CONVOs in all knowledge areas.

4   Usage & Effectiveness of KM Tools in CONVOs

A combination of the first author's work experience with HFHs; a pilot test with four Atlantic Canadian HFH CONVOs; and Egbu and Botterill's (2002) work influenced the creation of a list of KM tools. These tools comprised *IT (information technology) technologies (both hardware and software) and non-IT based techniques*. Respondents were asked to indicate the frequency of usage *(i.e., always =5, often =4, sometimes =3, rarely =2, and never =1)* and for which knowledge process (i.e., knowledge creation, conversion, transfer and storage) each tool was utilised. In addition to usage, respondents were asked to rank the effectiveness *(i.e. highly effective = 5), effective = 4, neutral= 3, some effect =2 and no effect =1)* of the KM tools in all three project phases *(i.e., pre, during and post construction)*. Table 2 presents the mean scores for each KM technology and technique. The most prominent IT tool is Microsoft Office

(mostly MS Word, MS Excel and/or MS project) and face-to-face meetings are the preferred choice of the non-IT techniques.

**Table 2: Usage & effectiveness of KM tools in Canadian HFH CONVOs**

USAGE	RANK		EFFECTIVENESS
Microsoft Tools	1	1	Face to face meetings
Face to face meetings	2	2	Email
Email	3	3	Telephones/smart phones
Desktops	4	4	Laptops
Laptops	5	5	Desktops
Databases	6	6	Databases
Reports/bulletins	7	7	Microsoft Tools
Telephones/smart phones	8	8	Internet
Internet	9	9	Workshops/seminars
Informal networks	10	10	Reports/bulletins
COPs	11	11	COPs
Storytelling	12	12	Storytelling
Workshops/seminars	13	12	Informal networks
Lesson learned programs	14	14	Lesson learned programs
Intranet	15	15	Knowledge maps
Knowledge maps	16	16	Apprenticeships
Apprenticeships	17	17	Intranet
Multimedia rooms	18	18	Multimedia rooms
Multimodal tools	19	19	Multimodal tools

Although face-to-face meetings rank second for usage, it is considered most effective compared to emails, smartphones and laptops which fall close behind. A potential reason for this may be the perception that information is better communicated during social interaction (Davenport and Prusak 1998). Interestingly, HFH Canada utilise a database called ShareNet 2.0 to collect and share information and facilitate monthly meetings inter-organisationally. However, many affiliates complain about its complexity, untidiness, accessibility restrictions, un-user-friendliness and poor structure. Intranets ranked 15th and 17th for usage and effectiveness respectively among respondents. In addition, while 61% of all staff has access to computers, daily usage pre, during and post project phases account for 68%, 61% and 61% respectively. Alarmingly, the use and effectiveness of LLPs are ranked 14th for respondents, but 42% said they participate in COPs which ranked 11th. This proves contradictory to the data given by respondents where LLPs are reported and validated as most critical to the organisation. Further, respondents reported 58% pre, 68% during and 35% post collaboration with 'for-profit' organisations, compared to only 19%, 10%, and 13% respectively that collaborate with fellow Canadian HFH CONVOs. Therefore, there are potential opportunities for improvement in the lesser ranked non-IT KM techniques. However, the organisational operational context (i.e., structure, type of product, resources, etc.) largely dictates the types of KM tools management invest in (Egbu and Botterill 2002). Notwithstanding, it is the lesser ranked tools and techniques which may be more effective for knowledge processes given the organisational dynamics of HFH CONVOs. For example, COPs have the potential for networking and knowledge transfer since members share a common language and therefore encourage a collective-knowledge base (Hurley and Green, 2005).

5   KM tools' impact on knowledge management practices maturity

Maturity modelling is adopted to describe the development of any entity over time and can be used as a basis for comparison (Pee and Kankanhalli, 2009). These models are necessary to assist organisations embarking on KM which require clear roadmaps for long-term visioning. Maturity models are characterised by various levels which certain KPIs must be fulfilled before progression to the next (higher)

level is achieved. Pee and Kankanhalli (2009) conducted a morphological analysis of fifteen KM maturity models using dimensions and options comprising: context and applicability (i.e., general, organisational, industry, sector); stages (i.e., 4, 5, 6, 8); assessment (i.e., subjective, objective, unknown); validation methods (i.e., case study, empirical, unknown) and key areas (i.e., general or specific). As a result of their in-depth analysis, the general knowledge management maturity model (GKMMM) was selected for this research due to its generic applicability at an organisational context, its 5 stages *(i.e., initial, aware, defined, managed and optimised),* and its empirical validation of specific KM areas *(i.e., people, process and technology).* However, the researchers added the fourth KM area (i.e. *environment*) to the GKMMM to account for the unique environmental context which facilitates KM in HFH CONVOs. Figure 1 illustrates the average maturity of each KM area (i.e., *people, process, environment, technology*) for each category of Canadian HFH affiliate. Knowledge **process** is the least mature area followed by **environment**, **technology** and **people** with standard deviations of 0.81, 0.75, 0.64 and 0.42 respectively. The radar chart (figure 2) shows the overall KMP maturity in descending order for each respondent based on HFHC classification. The highest average maturity level reached is level 3 (i.e., *defined level*) by 68% of respondents compared with the *technology* knowledge area at a 3.2 average. A level 3 maturity simply indicates that senior management provides a basic infrastructure for KM through strategies to formally facilitate knowledge processes by experimenting with pilot projects and providing incentives to manage knowledge (Pee and Kankanhalli, 2009).
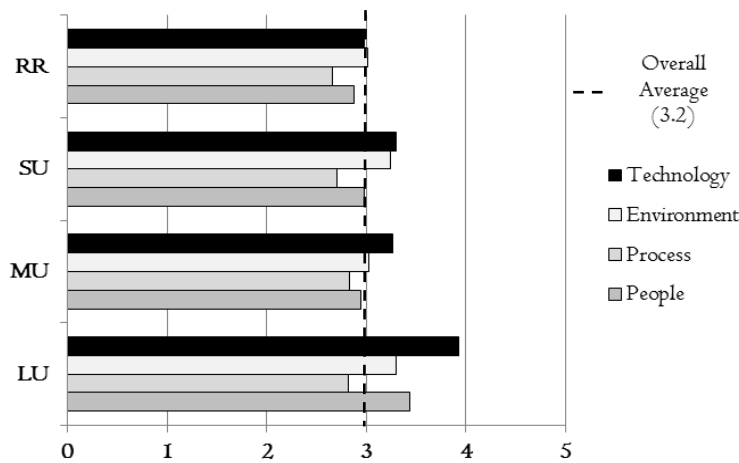
Figure 1: Knowledge areas and overall maturity comparison
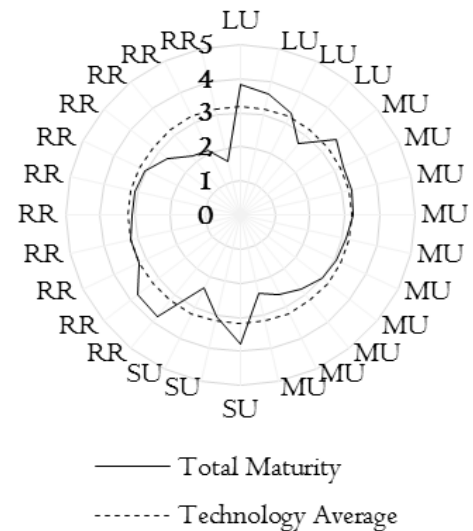
Figure 2: KMPs maturity compared with technology maturity

Generally, the data indicates that 75% of Canadian HFH CONVOs' *technology* maturity surpasses their overall KMP maturity ranking. Notwithstanding *processes* and *environment*, *technology* also influences how these knowledge areas collectively affect overall KMPs maturity. In addition, only 11% of respondents have similar *technology* and overall maturity, while 14% show lower maturity. Of this 14%, ¾ are the regional/rural affiliates. Table 3 illustrates the *technology* portion of the modified GKMMM used to assess the KMPs maturity of HFH CONVOs. It shows the type of KPIs used to determine maturity and technology further divided into corresponding maturity levels. Respondents were asked to indicate their degree of agreement (i.e., *strongly agree, agree, neutral, disagree*, or *strongly disagree*) with each KPI. Responses were further evaluated using a likert scale (i.e., from 1 to 5) to determine the level of maturity. Level 1 requires the existence of pilot projects for KM supported by IT infrastructure which is integrated with the organisation's business units. Whereas, level 3 is characterised by technology which connects inter-and intra-organisation and is used to create organisational memory (e.g., such as in a database). Thirteen (46%) respondents displayed a defined maturity for level 1 and a managed maturity for level 3. However, many respondents still find themselves in the initial and aware levels for *technology* maturity. Reasons for this may be hindrances in IT adoption attributed to a perception that IT is complicated, expensive, time consuming to implement and manage, and to a lack of motivation/incentive to use IT for routine processes and practices.

Table 3: Maturity in technology knowledge area of survey respondents

Levels	TECHNOLOGY Knowledge Area *key performance indicators* (**KPIs**)	Maturity levels					
		Initial	Aware	Defined	Manage	Optimised	**Total**
1	*1a*- There are pilot projects that support KM. *1b*- There is a technology infrastructure in place that supports KM. (e.g. Intranet portal or environments supporting virtual teamwork) *1c*- The technology system supports only the business units.	3	8	**13**	4		**28**
2	*2a*- The KMS supports the entire organisation. *2b*- The KMS is tightly integrated with the business processes. *2c*- The existing systems are continually improved upon.	4	9	**10**	4	1	**28**
3	*3a*-Technology links all members of the enterprise to one another and to all relevant external publics. *3b*-Technology creates an institutional memory that is accessible to the entire enterprise.	1	1	11	**13**	2	**28**
4	*4a*-Technology brings the organisation closer to its customers. *4b*-The organisation fosters development of "human-centered" IT.	1	4	9	**12**	2	**28**
5	*5a*-Technology that supports collaboration is rapidly placed in the hands of employees. *5b*-Information systems are real-time, integrated, and "smart".	2	5	**11**	9	1	**28**

It is evident, that improvement for the *technology* area exists in all levels. However, it would be advantageous that all respondents aim to advance to the 'managed' level in terms of their overall KMPs maturity.

6   Future use of KM tools in CONVOs

While Microsoft Office, laptops, emailing and face-to-face meetings are predominantly used and perceived most effective for Canadian HFH CONVOs; there is a need to invest in existing services like ShareNet 2.0 (i.e., HFHC's database), and other technologies to enhance LLPs, COPs, storytelling, knowledge mapping and apprenticeship initiatives. Survey respondents agree that any KM tool adopted should be "*user-friendly, accessible, compatible*, and *facilitate easy continuous transfer of knowledge*". However, some barriers identified were "*confidentiality* and *legal issues of information sharing, lack of overall support and incentives, motivation* and *unclear policies and procedures for knowledge processes*". Green and Hurley (2005) insist that a knowledge friendly organisational culture is a pre-requisite for successful KM. Siemieniuch and Sinclair (2004) suggest drivers such as a learning strategy; a flexible structure; blame free culture; shared vision, knowledge creation and transfer; and team work are critical to ensure learning outcomes. However, historically construction organisations have not considered the learning culture of both technology and people due to the temporary nature of projects (Ribeiro and Ferreira, 2010). HFH CONVOs are therefore susceptible to barriers of change and the introduction of unfamiliar technologies. Notwithstanding, it may be expedient that respondents aim to reach at least the '*managed*' phase (level 4) of overall maturity if they are to advance their KMPs. Table 4 describes the criteria of the '*managed*' maturity level, where it is characterised by well-established KM initiatives, common strategies and training for KM, quantitative measures for productivity, motivated employees facilitating organisational learning, and technology adoption for KM.

Table 4: Characteristics of level 4 maturity in the modified GKMMM

Maturity Level	General Description	Key knowledge process areas description			
		People	Process	Environment	Technology
4 Managed	Organisational KM initiatives are well established	There are common strategies and standards for KM and more training for KM	Metrics are used for measuring productivity	Organisational learning is facilitated by managers' and workers' initiatives	KM systems are used and some KM projects are piloted

IT tools such as documentation and web-based technologies (e.g., data exchange protocols, internet, intranet, groupware, and database) can create an integrated environment for knowledge sharing and dissemination (Zhang *et al.,* 2006). However, technology management requires actively working (i.e., emersion) with non-profits to develop their socio-technical infrastructure and capacity to support change since it is often not an explicit aspect of their organisational practice (Merkel *et al.,* 2007). Internet, intranet, and databases (e.g., ShareNet 2.0) are already used in Canadian HFH CONVOs. However, their effectiveness has not been fully leveraged, thus providing an opportunity to explore the affiliates' capacity for improvement in the adoption of these IT tools. Information communication technology (ICT) may also complement certain non-IT techniques such as LLPs or COPs. Fong (2005) and Boh (2007) purport that learning mechanisms are needed in project based-organisations which facilitate knowledge sharing and dissemination. Such learning mechanisms instigate knowledge sharing through individualised and institutionalised knowledge processes (i.e., creation, collection, codification, and dissemination). In HFH CONVOs, the CSFs for the implementation of non-IT techniques such as LLPs and COPs include leadership, lessons collection, analysis, implementation, resources, maintenance and improvement, and culture (Caldas et al., 2009). In addition, Hurley and Green (2005) recommend that non-profits adopt a within (intra) and between (inter) approach to leverage knowledge and thus avoid coercive effort for future funding by soliciting a neutral entity who acts as a facilitator such as a university. This prospect intrigues the researchers as it provides an opportunity to implement its action research approach. While LLPs appear promising as a non-IT technique, its application must be assured by an economic baseline for comparison and quantifying downstream benefits in order to justify its implementation (Caldas *et al.,* 2009).

7   Conclusions

An empirical survey was conducted using Canadian HFH CONVOs to *identify the key performance indicators (KPIs) and critical success factors (CSFs) for KM*; *KM tools (IT technologies and non-IT techniques) used and their effectiveness*; and *assess the KMPs maturity* using a modified general knowledge management maturity model (G-KMMM). The top ten most effective KM tools comprised both IT (both hardware and software) and non-IT techniques which included face-to-face meetings, email, telephones/smartphones, laptops, desktops, databases, Microsoft Office, internet, workshops/seminars, and reports/bulletins. Unlike for-profit construction companies, HFH CONVOs survey respondents did not utilise complex IT tools such as a KMS for example. Many respondents agree that though knowledge is important and a strategy may exist, not much effort is placed on its management. The reason is a lack of 'know-how' regarding KM practices, unpredictable volunteer turnover and limited finances. For-profit construction companies differ perhaps because unpredictable labour (i.e. volunteers) is not much of a concern and they may have more enticing incentives to offer to encourage KM. Notwithstanding, the use of KM tools in Canadian HFH CONVOs may offer opportunities for knowledge management. Corporate databases such as ShareNet 2.0 for example can supplement techniques such as LLPs, COPs, and seminars/workshops to facilitate knowledge creation, conversion, capture and dissemination. It is also evident that *people, technology, environment* and *processes* knowledge areas' must be simultaneously integrated into any KM strategy for CONVOs since they affect overall KMPs maturity. It is interesting that respondents predominantly consider face-to-face meetings most effective, demonstrating that socialisation stimulates verbal communication and thus transfers tacit knowledge amongst individuals. This is important, since many for-profit organisations tend to invest in practices which encourage people

to share their knowledge for both personal and organisational development. Practitioners both in the profit and non-profit construction industries may find this research intriguing as the differences in perceived challenges are quite similar. However, CONVOs appears to focus on the 'quantity' of labour as opposed to its 'quality'. In contrast, 'quality' is highly critical in for-profits since remuneration and work expertise are often inseparable. In the end, KM researchers seem to all agree that the 'people' factor remains most critical as an investment to ensure KM success. The challenge for CONVOs is their high volunteer turnover which jeopardises efforts of enabling long-term knowledge processes. Moreover, although more sophisticated IT tools exist for KM, conventional tools like the telephone and email are highly adopted by Canadian HFH CONVOs. This may be due to the time and cost constraints of not only CONVOs but the general for-profit construction industry as well. Despite the fact that 68% of respondents have an overall 'defined' KMP maturity, there is still room for improvement in terms of its *technology* adoption. Familiarity often undermines change and therefore introducing new KM tools are susceptible to adoption barriers. Given the dynamic project-environments of Canadian HFH CONVOs characterised by an uncertain volunteer labour force, developing trust or maintaining networks and COPs is difficult even among fellow and international affiliates. It is recommended that HFH CONVO managers' at least attempt to acknowledge the potential benefits of adopting both IT and non-IT KM tools. Notwithstanding, this must be supplemented by identifying quantitative measures that are complementary to organisational requirements in order to validate its integration with existing practices. Finally, academics have much to contribute and gain from this research since they can act as neutral facilitators of KM in CONVOs as well as optimise theoretical and practical benefits as a result of engaging in industry.

Further research

The researchers have used this survey's data to identify potential participants for the application of action research in a focus group who will adopt both IT and non-IT KM tools in order to explore its impact on KMPs maturity compared to non-adopters.

Acknowledgements

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