Application of Boundary Objects in Knowledge Management Research: A Review

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Abstract: Knowledge is considered to be a corporate asset, but in practice it is grounded in different organisational functions and is stored in repositories and in individuals’ memories. Boundary objects have an important role in promoting knowledge sharing and transfer within and across social boundaries. These objects help individuals to learn from each other and to share their knowledge between and within groups. This study explores the nature of boundary objects as socio-technical constructs that relate to the practice of knowledge management. The researchers used a critical literature review of boundary objects use in the context of the knowledge management landscape. Relevant articles published in English between 2008 and 2018 were retrieved from Web of Science. Analysis of the selected studies indicated that boundary objects contribute significantly to the development of shared understanding, knowledge creation and innovative thinking. These objects play different types of role in supporting knowledge practices within and across organisations. The findings also show that, while performing similar enabling roles in different contexts, the impact and use of different types of boundary objects (i.e., semantic, syntactic, pragmatic and metaphoric) varied significantly. Boundary objects may also help to coordinate interaction in the absence of intended coordination by the actors. It is recommended that, in order to get maximum benefit from the power of boundary objects and to strengthen their role, it is important for an organisation to identify, create and facilitate its use in knowledge management.

Keywords: Boundary Object; Knowledge Management; Critical Review; Knowledge Management Practice

1. Introduction and Background

In recent years, organisations have been actively mobilizing their knowledge-based resources to create value in their business functions in a sustainable manner. This transformation changes the way people connect, collaborate, learn, and decide within and among organisations (North and Kumta, 2018). Therefore, knowledge has become an important resource of the contemporary organisations resulting both in the growth of knowledge workers and knowledge intensive organisations (Hislop, Bosua and Helms, 2018). Knowledge is explained as “a fluid mix of framed experience, values, contextual information, and expert insights that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the mind of knowers. In organisations, it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices and norms” (Davenport and Prusak, 1998 p. 5). Knowledge management is defined as “effective learning processes associated with exploration, exploitation, and sharing of human knowledge (tacit and explicit) that use appropriate technology, and cultural environments to enhance an organisation’s intellectual capital and performance” (Jashapara, 2004 p. 12). In sum, managing an individual’s knowledge and making it available as an organisational resource is at the core of knowledge management (Newell, et al., 2009).

In practice, since individuals within organisations do not hold every type of knowledge relevant to their organisation, they must interact and collaborate with other actors within and across organisations (Chen, Chen and Wang, 2014). To share, exchange, integrate and create new knowledge, individuals use artefacts known as boundary objects. These enable people to learn from each other, and to act as agents in co-generating, bridging and disrupting understandings, thus playing a role in making organisations more sustainable (Hawkins and Correia, 2017).
The concept of boundary object arose from a study of information practices at Berkeley’s Museum of Vertebrate Zoology (Star and Griesemer, 1989). The authors described boundary objects as translation devices capable of spanning intersecting social worlds, thereby helping to pave the way for effective communication, collaboration and cooperation. Star and Griesemer grouped boundary objects into four categories: namely, (1) repositories (e.g., ordered piles of objects), (2) ideal types (e.g., diagrams), (3) coincident boundaries (e.g., objects with the same boundaries but different contents), and (4) standardized forms (e.g., common communication methods).

Later, Carlile (2002) assigned three types of knowledge boundary to these categories of boundary object: (1) syntactic, (2) semantic, and (3) pragmatic. According to the taxonomy, boundary objects help to create particular contexts that help to translate, transfer and transform knowledge within a community of practice. Knowledge transfer is simply the processing of information, whereas knowledge translation is referred to as developing a common meaning to overcome interpretive differences between contexts (Tippmann, Scott and Parker, 2017). The knowledge transformation process refers to the conversion of knowledge into action and its application to organisational routines (Welo and Ringen, 2018).

Boundary objects, whether concrete or abstract, have different implications in different social worlds; however, the objects retain a common identity across the boundaries of these worlds. Boundary objects are characterised according to three dimensions: (1) interpretive flexibility, (2) the material/organisational structure, and (3) scale. In practice, researchers have focused mostly on interpretive flexibility; the other two dimensions have been less frequently discussed. More importantly, not every object is a boundary object. So, scale and scope should be considered in determining whether an entity functions as a boundary object in a given situation or not (Star, 2010). Furthermore, it may be possible that a boundary object works effectively in one context, but less well in a similar capacity in another context; and may even act as a hindrance to the sharing or transfer of knowledge (Kirby, 2006). Therefore, it is critically important to differentiate between ‘designated’ and ‘in use’ boundary objects for a specific context, and to select objects with reference to usability and adaptability to local needs (Levina and Vaast, 2005).

Boundary objects enhance communication among groups (Fong, Valerdi and Srinivasan, 2007; Huang and Huang, 2009) and help them to access knowledge that would otherwise be inaccessible. They are considered connectors between different groups and within communities, and allow them to improve their practices (Impedovo and Manuti, 2016) by sharing knowledge (Huvila, et al., 2017). Moreover, boundary objects contribute to learning in communities where people have diverse viewpoints and ways of working. Because of the effective role they play in communication and collaboration of information and knowledge sharing, these objects have got the attention of researchers from the field of organisational learning (Hawkins and Correia, 2017). In sum, boundary objects successfully contribute to the development of shared understandings, knowledge creation, and innovative thinking among diverse groups (Kanwal, et al., 2018). More specifically, their application is quite visible in various functions within organisations, such as computer-assisted tools (Forgues, Koskela and Lejeune, 2009), drawings, sets of rules, research projects (Kimble, et al., 2010), and organisational blogs (Daniel, Hartnett and Meadows, 2017).

The notion of boundary objects has become increasingly important in exploring the interaction between individuals and organisations. Researchers, e.g., Huvila, et al. (2017), have indicated that the study of Star and Griesemer (1989) received considerable attention from information and knowledge practices researchers.

According to Google Scholar, the study has been cited more than 6300 times by 2016. Recently, the citation of the paper has reached over 9600. This citation trend shows that research on the application of boundary objects in the information and knowledge landscape is increasing.

Scholars, especially from information sciences, management and engineering, and specifically in information technology and in computer supported cooperative work, have focused on the application of boundary objects in knowledge management practices (Trompette and Vinck, 2009). This critical review considers this growing trend and explores the extant literature, addressing two distinct but interdependent concepts; boundary objects and knowledge management practices. It contributes to discussions on the importance of boundary objects in knowledge management research, and suggests future research directions to expand the field.
The study aimed to explore the application of boundary objects in knowledge management research. To achieve this aim, the following four research questions were formulated:

RQ1. What types of artefact were theorized as boundary objects in knowledge management research?
RQ2. Which research strategies have been employed to investigate the role of boundary objects in knowledge management research?
RQ3. What is the role of boundary objects use in knowledge management practices?
RQ4. Which factors affect boundary objects in knowledge management practices?

The remainder of this paper is structured as follows: section two explains the research methodology chosen for this study; section three presents research findings; section four reports on findings; and section five provides the study's conclusions, followed by implications, limitations and directions for future research.

2. Research Methodology and Design

To achieve the study's aim, this research used a systematic selection of relevant studies, followed by a critical analysis of the selected studies. To retrieve relevant studies, we adopted a three-step strategy: (1) selection of keywords and formulation of search queries; (2) study inclusion and exclusion criteria; and (3) selection of relevant documents and data extraction. This strategy provided a systematic and transparent means of assessing and synthesizing the findings of relevant studies (Nunes, et al., 2009). Previous studies (e.g., Nunes, Kanwal and Arif, 2017; Sarka and Ipsen, 2017) also used the strategy to investigate similar phenomena in the knowledge management domain.

2.1 Search String

The first step in the extraction process was to produce a suitable query. For this purpose, the following string was developed: ("boundary object" OR "boundary objects") AND ("knowledge management").

2.2 Inclusion and Exclusion Criteria

When conducting a critical literature review, researchers should explore all relevant journals, regardless of impact status. It may happen that a useful paper is published in a low-ranked journal because it did not fulfill the review standard of an impact factor journal (Jesson, Matheson and Lacey, 2011). So, this study considered all journals and conference proceeding indexed in the Web of Science database. The selection of single comprehensive database helps to avoid duplication issues (Dwivedi, et al., 2011).

For this study, journal articles and conference papers written in English and published between 2008 and 2018 were included. To ensure that all the selected studies were relevant, and that they addressed the research questions of this study, a set of inclusion and exclusion criteria was adopted (see Table 1).

Table 1: Inclusion and exclusion criteria

<table>
<thead>
<tr>
<th>Included articles</th>
<th>Excluded articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available as full-text</td>
<td>Full-text unavailable</td>
</tr>
<tr>
<td>Published between 2008 and 2018</td>
<td>Outside the search timeframe</td>
</tr>
<tr>
<td>Written in English</td>
<td>Non-English research paper</td>
</tr>
<tr>
<td>Related to the research questions</td>
<td>Not related to the research questions</td>
</tr>
<tr>
<td>Articles in information and knowledge domain</td>
<td>Duplicate studies</td>
</tr>
<tr>
<td>Published in journals indexed in Web of Science</td>
<td>Review papers, editorial reviews, and book chapters</td>
</tr>
</tbody>
</table>

2.3 Search Strategy and Selection of Relevant Studies

After finalizing the inclusion and exclusion criteria, we used the search string shown in section 2.1 to search Web of Science. In total, the systematic search produced 513 records. After performing specific checks, and applying the inclusion and exclusion criteria, e.g., scrutinizing titles and abstracts, and checking duplication, redundancy, and unavailability of 14 full-text papers, finally 33 studies were selected for this critical review. A list of these studies are presented in Appendix A. Only those empirical studies were selected which addressed
the application and/or usage of boundary objects in information and knowledge domain. The entire process of the systematic extraction of the studies is sketched in Figure 1.

Figure 1: Study selection process

2.4 Analysis of Relevant Studies

A critical review should be original, insightful and analytical rather than a systematic attempt to gather and elaborate literature. For this, Jesson and Lacey (2011) outline three-step specific criteria; (1) fair selection of sources, (2) critically compare and contrast ideas and evidence, and (3) research gaps identification. Moreover, a priori coding process during the initial literature review helps to develop a conceptual framework for the phenomenon being studied (Nunes and Al-Mamari, 2008). Thus, for this study, a review and thematic analysis were carried out following the guidelines of Jesson and Lacey (2011) and Nunes and Al-Mamari (2008).

Specifically, the research reported in this paper critically analyzed 33 selected studies (Figure 1 explains study selection process) for methodological approaches, significant findings related to artefacts theorized as boundary objects, their role in knowledge management practices, and factors affecting the use of boundary objects in knowledge management practices. Furthermore, this research also identified research gaps and limitations in the selected studies and provided recommendations and future directions for research. The data extraction and analysis were completed using Microsoft Excel.
3. Research Findings

3.1 Artefacts Theorized as Boundary Objects

To answer RQ1, the selected studies were analysed to identify the artefacts theorized as boundary objects in knowledge management research. The artefacts that were interpreted analytically as boundary objects consisted of physical and virtual objects, and of activities. Table 2 lists the artefacts identified and the corresponding studies, presented in chronological order.

Table 2: Artefacts theorized as Boundary Objects

<table>
<thead>
<tr>
<th>Artefacts: Boundary Objects</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagrams, visual metaphors, charts, sketches</td>
<td>Bresciani, Blackwell and Eppler (2008)</td>
</tr>
<tr>
<td>Referrals, laboratory reports, instructions for specimen taking and specimen handling</td>
<td>Maaninen-Olsson, Wismen and Carlsson (2008)</td>
</tr>
<tr>
<td>Excel workbooks</td>
<td>Cacciatori (2008)</td>
</tr>
<tr>
<td>Process management model</td>
<td>Hayes and Fitzgerald (2009)</td>
</tr>
<tr>
<td>Repositories, standardized forms and methods objects, models, and maps, figurative</td>
<td>Huang and Huang (2009)</td>
</tr>
<tr>
<td>language and symbolism, non-verbal expressions, and visionary objects</td>
<td></td>
</tr>
<tr>
<td>Computer-assisted collaborative tools</td>
<td>Forguès, Koskela and Lejeune (2009)</td>
</tr>
<tr>
<td>Coding, seminars and forums, and patient files</td>
<td>Kimble, Grenier and Goglio-Primard (2010)</td>
</tr>
<tr>
<td>Software specification and project management tools</td>
<td>Barrett and Oborn (2010)</td>
</tr>
<tr>
<td>Tasks for students on work placement</td>
<td>Garraway, et al. (2011)</td>
</tr>
<tr>
<td>Physical repositories, reports, databases, standardized forms, models, and maps,</td>
<td>Huang and Huang (2011)</td>
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<tr>
<td>diagram, Gantt charts, milestone charts, Program Evaluation Review Technique (PERT) charts,</td>
<td></td>
</tr>
<tr>
<td>project timelines drawings, sketches, figurative language and symbolism, conceptual</td>
<td></td>
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<tr>
<td>objects, visionary objects, and nonverbal expressions</td>
<td></td>
</tr>
<tr>
<td>Decision support systems</td>
<td>Eastwood, Chapman and Paine (2012)</td>
</tr>
<tr>
<td>Virtual objects</td>
<td>Miller, et al. (2012)</td>
</tr>
<tr>
<td>Email and instant messaging</td>
<td>Peng and Sutanto (2012)</td>
</tr>
<tr>
<td>Operation research models</td>
<td>Franco (2013)</td>
</tr>
<tr>
<td>Physical repositories, reports, databases, standardized forms, models, and maps, diagram,</td>
<td>Huang and Huang (2013)</td>
</tr>
<tr>
<td>Gantt charts, milestone charts, PERT charts, project timelines drawings, sketches,</td>
<td></td>
</tr>
<tr>
<td>figurative language and symbolism, conceptual objects, visionary objects, and non-verbal</td>
<td></td>
</tr>
<tr>
<td>expressions</td>
<td></td>
</tr>
<tr>
<td>Sketches, drawings, resumes, descriptions of customer wishes, spreadsheets, and economic</td>
<td>Koch and Thuesen (2013)</td>
</tr>
<tr>
<td>calculations</td>
<td></td>
</tr>
<tr>
<td>Animated stories, images, documents, symbols, digital archives, storyboards, and records</td>
<td>Chen, Chen and Wang (2014)</td>
</tr>
<tr>
<td>Digital and physical modes of visualizing</td>
<td>Eppler and Pfister (2014)</td>
</tr>
<tr>
<td>Standardized forms, a prototype, and a collaborative workspace</td>
<td>Rehm and Goel (2015)</td>
</tr>
<tr>
<td>Model representations and conceptual artefacts</td>
<td>Fragou and Kameas (2015)</td>
</tr>
<tr>
<td>Management plans, a template for a management plan, an interim plan</td>
<td>Stange, van Leeuwen and van Tatenhove (2016)</td>
</tr>
<tr>
<td>Presentation, metaphors, memos, pictures and blueprints, and factory tour</td>
<td>Maenpaa, Suominen and Breite (2016)</td>
</tr>
<tr>
<td>Building information modelling</td>
<td>Oh, et al. (2016)</td>
</tr>
<tr>
<td>Value models</td>
<td>Bertoni, Panarotto and Larsson (2016)</td>
</tr>
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</table>
### 3.2 Research Strategies

To answer RQ 2, the selected studies were examined carefully to learn about the research strategies employed to investigate the application of boundary objects in knowledge management research. The findings disclosed that 19 studies (58%) applied a case study method and used several data collection tools, such as semi-structured interviews, observation, document analysis, and so on. A minority of the studies (27%) applied other research strategies, such as surveys, grounded theory, experiments, action research, and participatory design research. The remaining studies (15%) collected data through qualitative techniques and did not mention a particular research strategy. Overall, case studies seemed to be preferred to other methodologies, a finding which needs further investigation (Figure 2).

![Figure 2: Research strategies adopted in the selected studies](image)

### 3.3 Role of Boundary Object use in Knowledge Management Practices

The findings confirm the aforementioned argument that boundary objects support transfer, translation and transformation of knowledge between and among diverse social groups. The boundary objects are categorized under four knowledge boundaries; syntactic, semantic, pragmatic and metaphoric. The literature posited that under these knowledge boundaries, the boundary objects played various roles, such as mediator, facilitator, enabler, and platform during knowledge management practices in organisations and communities. The following sections address RQ 3 by discussing the role of boundary objects in knowledge management practices.
3.1.3 Boundary object as mediator

A key attribute of a boundary object reported in the literature is its role as a mediator. According to Senyoni and Jorn, 2017, boundary objects allow diverse actors to communicate and cooperate with each other. In a case study based on a health information system in East Africa, they found that a scorecard developed as a tool for managing maternal and child health, acts as mediator for communication and knowledge sharing amongst the collaborating organisations in different countries. The scorecard helped to overcome country differences and facilitated shared understanding between a variety of healthcare providers and recipients.

They also suggested that their findings could be useful in identifying unintended challenges to, or benefits of, the adoption of new knowledge according to specific country guidelines and practices.

Stange, van Leeuwen and van Tatenhove (2016) also indicated that in collaborative activities where actors have diverse knowledge and interests, boundary objects mediate knowledge exchange through their support of boundary activities. However, for an artefact to mediate collaborative activities between actors from different social worlds, there is a need to consider individual differences, goals and motivations connected with those activities (Randhawa, et al., 2017).

3.1.2 Boundary object as platform

The role of boundary objects as facilitators of knowledge management practices was highlighted by Daniel, Hartnett and Meadows (2017). According to them, boundary objects are evolving in nature, and their use is increasing over time. They explored the use of social media platforms and suggested that the platforms functioned as intra-organisational boundary objects because they enabled staff posted at various geographical locations and operating at different grades to share knowledge and develop new insights. However, boundary objects can operate not only across geographic and social boundaries, but also across boundaries arising from different competencies and backgrounds. Panarotto, Bertoni and Bertoni (2016), within the context of product-service systems, found that the value models that formed part of the design process, helped to facilitate cross-boundary discussion in the early phases of the design process, and to provide a common platform for knowledge sharing within a cross functional team.

From another aspect, in cross boundary knowledge sharing, the researchers studied the role of boundary objects through the lens of translation, transformation, and transcendence in the use and production of innovative knowledge during the course of cooperation. In addition to Carlille’s studies (Carlille 2002, 2004), this study discovered the way that boundary objects used in knowledge sharing involve the transformation of conflicts into creativity, which ultimately resulted in transcendence of the artefacts’ symbolic meaning and attainment of their cultural meaning. Transcendence involves the use of boundary objects to establish trust, tolerate conflict, and achieve a creative state. In their study, boundary objects used for this purpose included animation technology, laws and regulations, and conference records (Chen, Cheng and Wang, p. 2224).

Other good examples of boundary objects contributing to the conversion of tacit knowledge into explicit knowledge can be found in areas as diverse as agriculture and policing. A decision support system for precision dairy farming in Australia facilitated knowledge sharing among farmers (Eastwood, Chapman and Paine, 2012).

Furthermore, boundary object role was highlighted as platform in knowledge visualization process. In this context, the findings suggested that organisations are required to pay special attention while selecting an artefact as boundary object and should also consider its compatibility with the visualization software (Eppler and Pfister, 2014).

3.1.3 Boundary object as facilitator

Miller, et al. (2012) suggest that technology has the potential to transform social interactions and collaborative work if it addresses the needs of its users. They support the use of visual models to facilitate knowledge sharing among different social actors, and argue that these models allow knowledge to be shared across and between disparate stakeholder communities. Forgues, Koskela and Lejeune (2009) also focused on the role of technology in facilitating transformational learning. They found that boundary objects facilitate knowledge sharing in collaborative work by breaking socio-cognitive barriers. According to Bertoni, Panarotto and Larsson (2016), boundary objects serve many purposes in an IT project design by encouraging cross-boundary discussions. These objects contribute to innovative content by helping to negotiate hardware versus service
trade-offs. They can also reduce the amount of re-working arising from misinterpretation of requirements. In the construction industry, Oh, et al. (2016) note that boundary objects promote the knowledge sharing needed for collaborative activities such as building information modelling.

Problems arising from cross-cultural difference can also be addressed, in part, with boundary objects. Barrett and Oborn (2010) examined the role of software specification and project management tools in a Jamaican-Indian software team. They reported that, in some situations, use of boundary objects can become a focus for conflict, and so reduce knowledge sharing. For example, in software development, the requirements specification and flexible use of timelines contributed to the exchange of tacit knowledge in the early phases of development. Later, however, “these project management tools as temporal boundary objects decreased attention on the collaboration needed in expertise coordination around the spec and led to an adverse impact limiting team interactions among themselves and with users (p. 1214)”.

In another study, Peng and Sutanto (2012) explored the role of wikis, email and instant messages, teleconference interactions, and face-to-face interactions as ‘boundary spanners. In this capacity, such media facilitate knowledge sharing, but the nature of the influence varies depending on the medium being used. As a result, apart from identifying the role of boundary objects, it is also necessary to ensure that the right boundary object for a particular set of circumstances is selected (Kimble, Grenier and Goglio-Primard, 2010).

Virtual boundary objects have been found to play a role in building development. The abstract representation of an idea in the form of drawings, spreadsheets, and economic calculations helps clients and construction companies to exchange ideas, leading to improved decisions (Koch and Thuesen, 2013). Other virtual boundary objects include documents of communications, negotiations and agreements at the beginning of the commercialization cycle. Hayes and Fitzgerald (2009) report that these may act as a structural intervention to decrease the likelihood of inter-occupational and inter-organisational miscommunication. Virtual boundary objects in the form of conceptual visualizations, for example, diagrams, visual metaphors, charts, and sketches, also support collaborative knowledge work and facilitate creation and the sharing of knowledge within teams (Bresciani, Blackwell and Eppler, 2008; Franco, 2013). Another example is an Excel workbook, which presents knowledge across occupations and provides memories that span projects (Cacciatori, 2008).

3.2 Factors Affecting the Role of Boundary Object

Many of the studies referred to above also mentioned factors which affect the role of boundary objects in knowledge management practices (RQ4). Several authors (e.g., Rehm and Goel, 2015) mentioned that these objects cannot always be used in isolation, but need to be linked with each other to mediate in the knowledge exchange or transfer process. For example, team members in an organisation regularly exchange knowledge about relevant and interesting aspects of their work. These exchanges may involve information generated from multiple processes that require formal and/or informal interactions with other units of organisations (Rehm and Goel, 2015). Moreover, multiple organisational factors can affect the formation and use of boundary objects. Randhawa, et al. (2017) discuss the importance of supportive leadership and motivations for transformation in objects, while factors that might adversely affect the use of boundary objects include cross-culture differences, negative image, lack of professional relationships among employees, and an atmosphere of mistrust (Barrett and Oborn, 2010).

Often, a relevant artefact is a standardized procedure made tangible in some way. However, an important consideration when using these standardized procedures is to create an appropriate link between organisational activities and knowledge management processes. Otherwise, knowledge management effort will result in waste of time and resources (Peng and Sutanto, 2012). The representational capacity of boundary objects is essential if they are to perform their functions. Boundary objects also need to have enough common structure to ensure consistency, but cannot be too structured, as they need to adapt to local needs (Cacciatori, 2008). Therefore, it is important to identify, create and facilitate the use of boundary objects specifically in relation to their environment, people and type of knowledge (Huang and Huang, 2009). Moreover, human brokers play an important part in using boundary objects to mediate in knowledge transfer (Maaninen-Olsson, et al., 2008). The role of brokers is also important in relation to the impact of boundary objects in knowledge sharing (Kimble, et al., 2010).
4. Discussion

This study critically reviewed the application of the emerging concept of boundary objects in knowledge management research and discussed some of the various types of object that have been identified as boundary objects. These objects can be categorized according to whether they operate at syntactic, semantic, pragmatic (Carlile, 2002, 2004) or metaphorical boundaries (Koskinen, 2005). Each category of boundary object performs differently, and the choice of artefact working as a boundary object depends upon the context and nature of interactions (Huang and Huang, 2009, 2013). Various research strategies have been adopted to explore the use of boundary objects in knowledge management practices, with case studies proving to be the most popular.

Collaborative activities take place both inside organisations (among members), and with outside partners, customers and suppliers. During these activities, actors communicate and exchange ideas (Huang and Huang, 2013) and integrate professional knowledge, experience and skills into their business functions (Chen, et al., 2014). Some boundary objects have been found to facilitate this sharing process (Forgues, et al., 2009), not only across functional boundaries, but also across geographical ones (Peng and Sutanto, 2012). Where boundary objects enhance communication among actors, it is important to identify them and to encourage their use, taking into consideration their relation to their environment, to people and to type of knowledge (Maenpaa, Suominen and Breite, 2016). It is also suggested that consideration should also be given to circumstances which may lead to boundary objects limiting knowledge sharing (Barrett and Oborn, 2010).

Boundary objects have been found to work differently, according to context. Their different functions have been classified as (1) transference, (2) translation, (3) transformation, and (4) transcendence. Actors operating within an organisation whose exchange of knowledge leads to a mutual understanding in which interpretations are aligned, have overcome syntactic boundaries (Rehm and Goel, 2015). However, in activities where actors from different social worlds collaborate, the simple transfer of knowledge is not enough to achieve the collaborative goals of organisations and external communities (Randhawa, et al., 2017). In this type of situation, there is a need to recognize the difference in the agents’ understanding and world views, and to select and employ boundary objects that can overcome semantic boundaries by acting as “translation devices” (Eppler and Pfister, 2014). However, to promote innovation, it is insufficient simply to span syntactic and semantic boundaries. To bridge different interests within and between organisations, and diverse perceptions of key issues, it is necessary to find means of overcoming pragmatic and metaphorical boundaries (Koskinen, 2005; Abraham, Aier and Winter, 2015). Often, various types of boundary objects come together to enable productive interactions and exchanges. Sometimes, an artefact on its own will be ineffective, but, in combination with others, it becomes part of a cluster that forms a boundary object. These clusters emerge from the interplay between artefacts, uses, practices, and knowledge (Rehm and Goel, 2015).

The research exposed the multiple factors affect the use and usability of boundary objects within and across organisations. Organisational factors that can have an impact on the formation and use of boundary objects include environmental factors, such as supportive leadership, level of motivation (Randhawa, et al., 2017), cross-culture differences, the quality of professional relationships, and the atmosphere and culture of organisations using the objects (Barrett and Oborn, 2010). In addition, the nature of boundary object itself is important. Cacciatori (2008) notes that it must have enough common structure to ensure consistency, but must be sufficiently flexible to adapt to local needs. Koskinen (2005) also discussed structure. According to him, when a boundary object is weakly structured, it can play a significant role in the sharing of tacit knowledge and understanding between the people involved. By contrast, when a boundary object is strongly structured, it can function as a coordinating mechanism in explicit knowledge communication. By implication, when a boundary object becomes more structured, it contributes less to creativity and to the communication of tacit knowledge.

The application of boundary objects is supported by brokers who help to ensure the objects’ performance. The interplay between activities and boundary objects creates spaces within which actors share, transfer and translate their knowledge. In these spaces, actors learn from each other’s interests and perspectives (Stange, van Leeuwen and van Tatenhove, 2016). Similarly, brokers play an important role in using boundary objects to mediate in the transfer of knowledge (Maaninen-Olsson, et al., 2008). The role of brokers is also important in relation to the impact of boundary objects on knowledge sharing. They have the power to make information...
available to members of a particular community and can influence the direction of the community by controlling the flow of information (Kimble, et al., 2010).

5. Conclusions

The effective sharing of knowledge and information is vital. Since boundary objects contribute to that sharing, they too are important. A review of the extant literature reveals that there is lack of research exploring the current status of boundary objects in the knowledge management domain. This critical review sought to fill this gap by considering instances, based on 33 empirical studies, in which the highly theoretical concept of boundary objects was applied to knowledge management practices.

The findings confirmed that boundary objects enable different actors within and across organisational levels to share, transfer, exchange, and integrate knowledge into their work practices. Different types of boundary objects work across various knowledge contexts and boundaries. Each object has unique characteristics and is suitable for particular contexts and knowledge processes. The role of boundary objects can be extended with the support of organisational leadership, which can initiate activities at boundaries, and can enhancing the role of knowledge brokers. Boundary objects perform one or more of four roles: transference, translation, transformation, and transcendence and are subject to varying degrees of interpretative flexibility. The proposed classifications relating to boundary objects could help applied researchers and practitioners to make more informed decisions in their selection of socio-technical solutions for knowledge management.

5.1.1 Recommendations

This study also provides the following useful directions for future explorations of the role of boundary objects in knowledge management:

1. Researchers have tended to focus on the interpretive flexibility of boundary objects. Less attention has been paid to their structure and scope. These are aspects that would benefit from further investigation.
2. Additional research should be conducted to explicate how and why boundary objects operate, and to help identify and understand which factors enable or inhibit their capacity to perform their intended role.
3. Researchers should seek to identify the impact of different types of boundary objects in facilitating knowledge sharing in higher education, an area which has been neglected in the extant literature.
4. An in-depth analysis of knowledge sharing practices could help to improve understanding of the roles and characteristics of boundary objects from the perspectives of knowledge-based organisations perspectives.
5. There was a clear preference for case studies. Studies based on other research strategies, such as mixed-methods, might provide further details of the use of boundary objects in knowledge management.
6. In addition to looking at boundary objects, researchers should also examine the role of brokers in their selection and use.

5.1.2 Limitations

The main limitation of this critical literature review is the scope of the search. It reviewed only journal articles and conference papers written in English, and only those published between 2008 and 2018. In addition, the search was limited to just one database: i.e., Web of Science.

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References


Reading: academic conferences and publishing international limited.


Appendix A


Decentralizing Knowledge Management: Affordances and Impacts

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Abstract: Personal Knowledge Management (PKM) is envisaged as a decentralizing Knowledge Management (KM) revolution and as a vital educational concern. The objective of a current design science research (DSR) undertaking is, thus, the conceptualizing and prototyping of PKM Systems, but rather as the means to foster a fruitful co-evolution. This article expands on a recent paper focussing on the integrating twelve renowned models of knowledge creation in a three-dimensional dynamic ‘public-transport-like’ map of holistically portrayed complementing work flows. In further detailing the impacts and benefits for a prospective PKMS user community, the article highlights the major radical changes of the PKM approach according to the decentralization, mobilization, accessibility, granularity, traceability, transdisciplinarity, transparency, diffusibility, negentropy, and synergies of knowledge. The results reaffirm the DSR concept of theory effectiveness aspired to in terms of the system’s utility and communication as well as the PKMS as a sustainable intervention to confront opportunity divides independent of space (e.g., developed/developing countries), time (e.g., study or career phase), discipline (e.g., natural or social science), or role (e.g., student, professional, or leader).

Keywords: Personal Knowledge Management (PKM); Knowledge Management (KM); Knowledge Creation Theories; Knowledge Worker; Knowledge Society; Radical Innovation; Digital Platform Ecosystem (DPE).

1. Systems thinking and the Feedback Loops substantiating Knowledge Creation Theories

Crane’s critical review of forty-two Organizational Knowledge Management (OKM) theories (dispersed over the nine inner cells of the 3x3 matrix in Table 1) reveals a sharply divided field “positioned on two bisecting continua: organizational versus personal knowledge, and objectification of knowledge versus knowledge as social action” which form “often the site of considerable debate and contradiction, characterised by accusations of misinterpretation and misrepresentation” (Crane, 2015).

Table 1: A 3x3 Taxonomy of 42 KM Theories (Source: Crane, 2015) plus further 9 Models to be applied

<table>
<thead>
<tr>
<th>Focus: Knowledge as Object</th>
<th>Organizational Knowledge Focus</th>
<th>Social Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 theories reviewed, including: Earl 2001; b.</td>
<td>2 theories reviewed</td>
<td>13 theories reviewed, including: Blackler 1995</td>
</tr>
<tr>
<td>0 theory reviewed, excluding: e.</td>
<td>1 theory reviewed, including: Snowden 2002; excluding: d. g.</td>
<td>4 theories reviewed, including: a.</td>
</tr>
<tr>
<td>0 theory reviewed, excluding: j. k. l.</td>
<td>1 theory reviewed, excluding: f. i.</td>
<td>4 theories reviewed, including: c.; excluding: h.</td>
</tr>
</tbody>
</table>

The scope of the 42 KM Theories assessed by Crane (2015) ranges from static life-cycle categorizations to dynamic multi-dimensional frameworks. Most KM notions acknowledge the significance of knowledge types (tacit/implicit versus explicit) and knowledge carriers (individual/group/organization/society) although inevitably disagree on basic premises and related effects. These incompatibilities among KM notions have prevented the emergence of an “universally accepted framework or model” (Curado & Bontis, 2010).

By reconciling the selected twelve dynamic theories and models, this article contributes to a current design science research (DSR) undertaking. Its objective is to conceptualize and prototype a Personal Knowledge Management (PKM) System (PKMS). As a longitudinal stream of research (typical for a DSR project), the author published over forty multi-disciplinary papers (exceeding 400 external references) at appropriate times in
terms of the continually evolving prototype and design theories, including a publication justifying the DSR paradigm (design as an artefact as well as a search process) as evidence of its problem relevance, utility, research rigor, contribution, design evaluation, and publishability in IS research outlets (Schmitt, 2016b). Several prior findings and references are, hence, cited and summarized to avoid reiterating considerable detail.

Table 2: Twelve KM Theories/Models utilized in this paper (with references used in the further tables/figures)

<table>
<thead>
<tr>
<th>Legend (copied also in figure 1):</th>
<th>Knowledge Creation Theories/Models:</th>
<th>Sources:</th>
<th>Table &amp; Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*</td>
<td>Information-Space, SLC, Knowledge Assets</td>
<td>Boisot (2004)</td>
<td>a</td>
</tr>
<tr>
<td>*</td>
<td>SECI-Spiral, Ba, Knowledge Assets</td>
<td>Nonaka, Takeuchi (1995); Nonaka, Toyama, Konno (2000)</td>
<td>b</td>
</tr>
<tr>
<td>+</td>
<td>'Seven Waterfalls', ARME, and OEAM Spirals</td>
<td>Wierzbicki, Nakamori (2007ab); Nakamori (2011)</td>
<td>d</td>
</tr>
<tr>
<td>+</td>
<td>Foraging and Sensemaking Process</td>
<td>Pirolli, Card (2005)</td>
<td>e</td>
</tr>
<tr>
<td>+</td>
<td>Experiential Learning Model</td>
<td>Kolb (1984)</td>
<td>f</td>
</tr>
<tr>
<td>+</td>
<td>Holistic KM Framework</td>
<td>Yang, Zheng, Viere (2009)</td>
<td>g</td>
</tr>
<tr>
<td>+</td>
<td>Tacit and Explicit Knowledge</td>
<td>Collins (2010)</td>
<td>h</td>
</tr>
<tr>
<td>+</td>
<td>Self-Transcending Knowledge</td>
<td>Uotila, Melkas (2008)</td>
<td>i</td>
</tr>
<tr>
<td>+</td>
<td>Inferencing: Abduction, Induction, Deduction</td>
<td>Shank, Cunningham (1996); Chow, Jonas, Schaeffer (2009)</td>
<td>j</td>
</tr>
<tr>
<td>+</td>
<td>Cumulative Synthesis</td>
<td>Usher (1954, 2013)</td>
<td>k</td>
</tr>
<tr>
<td>+</td>
<td>Memetic Evolution</td>
<td>Dawkins (1976, 2006)</td>
<td>l</td>
</tr>
</tbody>
</table>

Legend: *: theories/models covered by Crane +: theories in this paper not covered by Crane, but added to her 3x3 taxonomy above [#] The letters in columns T1, F1, and F2 correspond to the notions and connectors discussed and visualized within the text, table 1, figure 1 & 2. The Connector's letters may be followed by a number to indicate sequence or sub-notions depicted (figure 1).

Although the aim of PKMS departs from today’s centralized institutional solutions and strengthens individuals’ sovereignty and collaborations, it is not meant at the expense of Organizational KM Systems but rather as the means to foster a fruitful co-evolution between the systems. The envisaged PKM concept and system, hence, attempts to adopt an ‘Emergent Innovation’ approach (Peschl & Fundneider, 2013, p.1,3-5) by trying to ease the challenging tension between a radically new (Personal) KM perspective and its fit with already existing structures. Hence, Blackler’s notion of Encultured Knowledge (1995), Snowden’s Cynefin Model (2002), and Earl’s Schools of Knowledge Management (2001) have been touched on in prior publications in the context of knowledge types, ignorance, and PKM-OKM-synergies suggesting fruitful potentials for co-evolution (Schmitt, 2014a; Schmitt, 2018c; Schmitt, 2018a).

Moreover, Nonaka’s SECI and Ba Model (Nonaka & Takeuchi, 1995; Nonaka, Toyama, & Konno, 2000), Boisot’s Information-Space (2004), and Gaines’ expansions (1989) on Popper’s Three Worlds (1978) have informed a three-dimensional knowledge mapping (Schmitt, 2017) which further included the Seven Waterfalls Model (Wierzbicki & Nakamori, 2007a; Wierzbicki & Nakamori, 2007b), the Foraging and Sensemaking Process Model (Pirolli & Card, 2005), and the Experiential Learning Model (Kolb, 1984) (see rows a.-f. in table 2’s legend and positionings). The map’s aim is to “provide a visual meta-perspective of the novel PKM Concept and prototype application. In focusing on time, space, and causality, the bottom-up approach taken, pictures the relevant Personal and Organizational Knowledge Spaces as a substitute for the intangible KM territory and provides a guiding map for knowledge workers and KM education” (Schmitt, 2017). Its topography emphasizes how the
models represent the external environment in which the PKM devices are expected to operate in and which of the workflows suggested are suitable for supporting the internal PKMS processes.

As a common forte, the KM notions chosen (and to be complemented in this article) employ a system thinking approach by providing positive feedback loops (effects in support of causes in a self-referencing self-reinforcing manner) featuring as cycles, circles, and spirals and dynamic connectors of [knowledge] stocks and flows across distinctive levels of diffusion. This article provides a cumulative synthesis by integrating six further KM notions and by connecting their dots (see rows g.-l. in table 2’s legend) to result in a narrated visualization comparable to a ‘public-transport-like’ map with an emphasis on the envisaged supporting features of the PKM System for individual knowledge workers, organizations, and society. Each of the twelve KM notions chosen is referenced in table 2 (which is also copied in figure 1) and is pictured individually in figure 1. Their particular differences and complementing features are visualized in the cumulatively synthesized map (figure 2) and discussed in the accompanying text (incorporating a recent conference paper (Schmitt, 2018d)).
Figure 1: PKM Concept's Integrated Twelve Knowledge Creation Frameworks shown individually (Schmitt, 2018d)
2. Motivating the Map as a Means for Emergent Innovation and KM Education

Although put forward as a complementing (emergent although radical) concept and system, the novel PKM design represents wide-ranging changes compared to traditional KM System (KMS) configurations. However, a user-centred needs analysis (as part of a conventional ‘pull’ approach of incremental and sustaining product/service adjustments) has not been undertaken. This is common for radical innovation proposals since the socio-techno-cultural contexts in which clients are immersed tend to limit their interpretations to just those states and prospects within their actual perspectives (trapped in current paradigms). Instead, a product-engineering-based ‘push’ approach (pushing the envelope for breakthrough functional innovations) has been employed complemented by DSR-related (Schmitt, 2016b) and ‘design-driven’ philosophies (outside-the-box thinking for breakthrough meaning innovations) aiming for ‘technology epiphanies’ (table 3). The latter implies radical changes in the underlying socio-techno-cultural regimes while their prospects and risks “might be understood only by looking at long-term phenomena with a broader perspective” (Verganti, 2008).

Table 3: Dimensions, Types, and Interdependencies of Innovations (Norman & Verganti, 2014)

<table>
<thead>
<tr>
<th>Radical Change &amp; Innovation based on: Novelty, Uniqueness, Impact*</th>
<th>Features and Functionalities</th>
<th>Meanings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental Change &amp; Innovation</td>
<td>Technology Epiphanies</td>
<td>Engineering-Research (Technology-Push)</td>
</tr>
<tr>
<td>Without Considering Practicality</td>
<td>Human-Centred Research (Market-Pull)</td>
<td>Design-Driven Research (Novel Meanings)</td>
</tr>
<tr>
<td>Tinkering (Bricolage)</td>
<td>Basic Design Research (Vision Driven)</td>
<td></td>
</tr>
</tbody>
</table>

For a newly framed solution to be technologically radical, it has to be novel and unique (condition assessible ex ante market introduction) and to be able to impact on future technology (ex post condition met after an invention served as an influential change agent) (Dahlin & Behrens, 2005). As the Change-Equilibrium Model (Leavitt, 1965) and the KM Framework Clusters (Heisig, 2009) show, change in any one of four clusters (technologies: artefacts including storage devices; human factors: people, culture, leadership; organizational aspects: structures & processes; tasks and management: operations and controlling) is likely to affect any of the other three. Any change process, hence, needs to consider the potential interdependencies to be effective; the introduction of PKMSs, however, directly impacts all four clusters (Schmitt, 2015a).

3. The Integration of Twelve Knowledge Creation Notions in a Single Knowledge Map

Trying to proactively ease the challenging tension between the PKM and OKM perspectives is vital for gaining system acceptance and includes providing transparency of existing approaches with their shortcomings and instructions and visualizations of how new features fit into the current KM landscape. After detailing the three-dimensional dynamic ‘public-transport-like’ knowledge map, the article, hence, highlights the major radical changes of the PKM approach impacting on the granularity, traceability, transdisciplinarity, decentralization, mobilization, accessibility, transparency, diffusibility, negentropy, and synergies of knowledge.

Boisot’s three-dimensional Information-Space [a] forms the base of Figure 2. With its codification axis tipped horizontally and divided in four sections (from left to right: uncodified-tacit-emotional, uncodified-tacit-intuitive, codified-explicit-rational, and captured-explicit-PKMS), its diffusion and abstraction axes provide the lattices for positioning the other eleven notions [b-I]. However, only Boisot’s Social Learning Cycle (SLC) [a] and Pirolli’s and Card’s Foraging and Sensemaking Loops [e] align to the latter axis (from concrete to abstract) and appear dispersed over the full sections, whereas the remaining models are all placed in the middle of the abstraction axis and spread only across the diffusion dimension (from top to bottom: undiffused-individual, diffused-group, diffused-collective/organization/community/society). Eight icons (octagons) symbolize the relevant knowledge types in each corner (in line with the tacit/explicit, concrete-abstract, and diffused/undiffused combinations) supported by the exemplification of knowledge assets (ellipses). The three segments along the diffusion axis of the left section (uncodified-tacit-emotional) also corresponds to Collins’ differentiation of tacit knowledge and its explicable [h]. Kolb’s Experiential Learning Model [f] is displayed at
Ulrich Schmitt

the top between the two left sections to avoid illegible overlays, while Popper’s Three Worlds [c] is placed at the mid bottom and linked to the notions of Heritage Knowledge.

Wierzbicki’s and Nakamori’s Spirals [d] which integrate Nonaka’s SECI-Spiral [b] are stretching from top to bottom across all the three left sections. Yang’s Holistic KM Framework complements the map by adding terminology and further connections [e] although some terms (namely: internalization, externalization, and indoctrination) are used differently. Uotila and Melkas link self-transcending knowledge [i] to the SECI Spiral by incorporating processes of disembodying (sensing) and embodiment (located between the two left individual tacit sections) for visualizing (imagining ‘ba’) and subsequent potentializing (futurizing ‘ba’) the presence of potentials which do not yet exist. This emphasis on intuition leads straight to Shank’s and Chow’s conception of abduction with its six levels of inference [j] complementing the induction and deduction approach.

Usher’s (1954, 2013) Cumulative Synthesis [k] and Dawkins’ Memetic Evolution (1976, 2006) [l] accentuate – as the notions of the previous paragraph – the role of personalized and objectified knowledge. The former presents the emergence of novelty “as an accumulation of many individual items over a relatively long period of time. The magnitude of the individual item is small, but through [processes of] ‘Cumulative Synthesis’ the product becomes important” (Usher, 2013, p.61). Not every individual knowledge item, idea or meme captured might be of immediate utility, but, what might be considered to be irrelevant or misguided at a given time may turn out to be valuable later, and vice versa (Garud et al, 2016). Usher convincingly couples the activities of researchers and entrepreneurs by entailing a generic iterative sequence: (1) The perception of a problem or opportunity as an incomplete or unsatisfactory pattern, (2) which prompts the setting of an appropriate stage to assemble all the data essential to a solution, (3) in order to facilitate acts of insight, (4) followed by critical revision and full mastery of the new pattern (including prototyping), (5) as one of the prerequisites for a successful innovation (Usher, 2013, p.65). The approach (located between the three left individual sections) fits well with memetic evolution as well as with solving so-called ‘wicked’ problems, defined by Rylander (2009) as open-ended in the sense “that they are ill defined and characterized by incomplete, contradictory, and changing requirements and complex interdependencies and that the information needed to understand the problem depends upon one’s idea for solving it.”

Dawkins (1976, 2006) originally introduced ‘Memes’ (e.g. idea, tune, catch-phrase, skill, technology) as basic units of cultural transmission or imitation that evolve over time through a Darwinian process of variation, selection, and transmission (in analogy to genes). This sequence [l] is located in the right (captured-explicit-PKMS) section (figure 2) since the PKMS departs from current document-centric storing traditions which are “unnecessarily replicating content via copy and paste operations” and instead opts for “digitally embedding and reusing parts of digital documents via structural references” (Signer, 2010). The right section, hence, represents the PKMS repository which is further segmented (from top to bottom) according to classifications (meta-memes), relationships (structural references), entities (meme labels), and content (memes’ subject matter) residing in decentralized PKMS devices networked via Heritage of Memes’ Repositories at individual/institutional (iHomer) or world (wHomer) level of aggregation (symbolized as icons on the right). The PKMS Knowledge Map from the Knowledge Worker’s Perspective

The challenges facing today’s knowledge workers have been addressed in the light of the shifting spheres of work, the lack of personalized tools, the growing world-wide opportunity divides, and the accelerating information abundance (Schmitt, 2013; Schmitt, 2014b). As a consequence, the PKMS aims “for (1) managing/growing the intellectual, social, and emotional capitals of individuals, (2) by supporting their creative authorship throughout their academic and professional careers anywhere as contributors and beneficiaries of organizational and societal performance, educational services, and the world’s collective extelligence, (3) and by fostering creative conversations among teams, organizations, and communities for mutual benefit and competitive advantage via network and cloud technologies” (Schmitt, 2018c).

The knowledge worker’s central position (marked by a transparent purple donut in the individual segment of the codified-explicit-rational section) affords him/her full access to the methodological processes described.
Figure 2: Integrated Twelve Knowledge Creation Frameworks presented as ‘public-transport-like’ Map (Schmitt, 2018d)
• Individually, his/her actual state of knowledge in this position might demand further analysis for full understanding and reflection which either lead to documenting the lessons learnt [d2] or to follow the path of Cumulative Synthesis [k123]. Alternatively, particular action (e.g. implementations, experiments) might be required where the subsequent outcomes need to be tested, reviewed, interpreted, or predicted, followed by a decision or selection [d3] which might trigger the need for or emergence of sensing [i] or abduction [j1-6] processes to add self-transcending creative insights [i, j] before results can be documented [d3]. The actual state of knowledge might not be deemed adequate necessitating a search for further evidence and information (4e, 2e) or the identification of relations, sources, and/or locations (3e, 1e) able to further inform the knowledge worker by following the Foraging Loop [e1234]. If satisfied, the material gathered can be utilized to build a case or devise a report to tell a story by either presenting it to an audience or publish it [e56] to be followed up by receiving feedback leading to a re-evaluation and a potential need for revisions and/or additional support (6e, 5e). If the material is already sufficient, it can be directly published to what-is-labelled as the explicit Human Heritage Knowledge which, in turn, can also be accessed for learning [d0]. If other opinions or collaborations are called for, a debate or discourse might have to be initiated to fully inform the group in order to detect concerns, determine priorities, and/or select options to move closer to a suitable, feasible, and acceptable solution [d4]. To facilitate collective creativity, the existing state of knowledge has to be verified and justified to a group in order to initiate phases of divergent and convergent thinking after which the results of the brainstorming or brainwriting sessions need to be crystallized and recorded [d5].

In following the SECI Spiral, the material might need to be thoroughly internalized/routinized (exercising ‘ba’) before it can be shared/socialized with the group to create new ideas (originating ‘ba’) which have to be formalized/externalized (interacting ‘ba’) and productively combined/in-doctrinated (systemizing ‘ba’) [d6]. The Holistic KM Framework differs from the SECI Spiral by terms as indicated [g] and puts forward a reverse CES flow differentiated as institutionalization (from individual explicit to collective explicit), routinization (to collective tacit), and internalization (to individual tacit). The status quo might also lead to a need to revise the overall goal or strategy of the endeavour, requiring the sharing of the knowledge and a (re-)setting of objectives, their breaking down into operative process steps to be supported by the implementing agents involved and the final documentation in form of strategies, policies, procedures, or guidelines [d1]. Boisot’s Social Learning Cycle (SLC) focuses on field research by scanning concrete tacit (embodied and embrained) knowledge to be codified and abstracted [a123] and subsequently diffused in order to be absorbed by the relevant people to hopefully facilitate the impact intended [a456].

• At the meta-level, the IS-Spiral [d7] advises to collect intelligence (explicit), consult and involve people (tacit intuitive), and reflect and imagine together (explicit emotional) in order to integrate the findings for realizing an appropriate intervention for the problem or task at hand [d7]. In terms of an aggregated perspective of human civilization, the forms of knowledge (rectangles [d0]) accumulate as human experiences and culture and are “preserved as the Intellectual Heritage of Humanity (or the Third World according to Popper) with its emotive, intuitive, and rational parts”. “Our Emotive Heritage consists of an explicit part, such as artistic products (music, paintings, literature, movies), as well as a tacit part: the collective unconscious, archetypes, myths, and instincts of humanity. Our Intuitive Heritage contains, e.g., the a priori synthetic judgments of Kant, not necessarily true but nonetheless very powerful in stimulating scientific creativity, determining our hermeneutical horizons. Our Rational Heritage contains all recorded experience and results of the rational thinking”. This heritage exists “independently from the human mind in libraries and other depositories of knowledge” (Wierzbicki & Nakamori, 2007b). The interrogation of this Intellectual Heritage of Humanity (IHH) might lead to the innovating of new theories and tools (like the PKMS) which – being evaluated – update the IHH and are applied in reality [d9abc]. Their real-world application may entail targets and their control to modify reality which - if met – change existing reality. In the process, conclusions are drawn regarding the performance of the applied new theories and tools which further inform the IHH stored about them [d9def]. Popper’s Worlds (1978) differentiate reality into three distinct spheres [c]: “World:1 comprises the concrete objects and their relationships and effects in the real physical world. World:2 refers to the
results of the mental human thought processes in the form of subjective personal knowledge objects. World:3 represents the thought content made explicit in the form of abstract objective knowledge objects which express the products of World:2 mental processes” (Schmitt, 2016b). All three worlds are highly interactive: “World:2 acts as an intermediary between World:3 and World:1. But it is the grasp of the World:3 object which gives World:2 the power to change World:1” (Popper, 1978).

Successfully dealing with change, thus, constitutes an essential virtue and Yang et al (2009) position KM to be an appropriate tool for managing the dimensions and dynamic interactions of technical (TK: explicit), practical (PK: tacit intuitive), and critical (CK: tacit emotional) knowledge in an organization.

- Considering the particularities of the critical knowledge and its interdependencies \([g, d0]\) with the other two forms (TK, PK) and within the relationships between individual (I), groups (G), and organizations (O) becomes increasingly important and involves self-motivating (PKI by CKI) and determined/resolving (CKI by PKI), inspiring/indoctrinating (CKI by CKG) and integrating (CKI into CKG), realizing (PKG by CKG) and deliberating (CKG via PKG), orienting (TKG by CKG) and evaluating (CKG via TKG), composing/creating/performing in artistic/publicizing/transforming contexts (CKI to CKO) and interpreting (PKO into TKG) (Yang et al, 2009), (Wierzbicki & Nakamori, 2007a).

By citing Motycka’s theory of scientists’ creative behavior in time of scientific crisis or revolutions, Wierzbicki & Nakamori (2006) stress that irrational factors can also become relevant. Accordingly, the ARME Spiral \([d8]\) provides for the case of scientists who intuitively perceive a crisis of their discipline unable to be remedied by abstracting to intuitive heritage (PKG to PKO). As a way out, they revert to collective unconsciousness and regress to myths and instincts (PKO to CKO) which then requires influencing the emotional group feelings in order to obtain creative stimulation of novel disciplinary approaches (mythologization: CKO to CKG). However, the transition to and impact on group intuition necessitates specific discussions that have empathic understanding as its main goal (CKG to PKG).

The resulting map demonstrates that diverse and seemingly incompatible KM notions (table 2) are capable of mutually complementing and supporting each other by synthesizing their distinctive positive feedback loops to comprehensively cover the continua of tacit and explicit knowledge where – in the world view of process theory – “all that exists is indivisible, interrelated, and unbounded in time and space. Human beings are [likewise] interrelated in an extensive continuum, with their own past and future as well as that of others. The individual stands in the present moment holding past experiences within and unites with experiences of the self and others to transcend the self to a new unity” (Nonaka, Toyama, & Hirata, 2008, pp. 242-243). Integrating the structures and visualizations depicted together with the supported human interactions in the PKMS workflows as well as in the envisaged PKM e-learning content allows for adopting the ‘Emergent Innovation’ approach alluded to.

4. The PKMS Concept and System as an Extension of Traditional Knowledge Management

Traditional Organizational Knowledge Management Systems (OKMS) are based on monolithic technologies requiring large investments and costly maintenance. Their institutional focus and top-down approach call for prohibitive restrictions and ring-fenced user communities. Although first-generation content-based OKMS have been broadened by collaborative community-oriented systems, shortcomings of insulated incompatible silos lacking integration and acceptance persist. While current KM technologies are capable of locating vast amounts of digital information, adequate tools for selecting, structuring, personalizing, and making sense of the ever-increasing digital resources available to us are missing (Kahle, 2009). Accordingly, the opportunity divides for connecting and empowering knowledge workers are widening.

KM’s current status quo versus the envisaged PKM perspective has been further assessed utilizing the SVIDT methodology (Strengths, Vulnerability, and Intervention Assessment related to Digital Threats) (Schmitt, 2018b). By substantially breaking with current KM paradigms and practices, the PKMS rather qualifies as a disruptive General-Purpose-Technology (GPT) than a sustaining innovation (Schmitt, 2015b; Schmitt, 2019b).

It, hence, not only allows individuals and institutions to better focus their time and attention on exploiting their knowledge and on its further exploration, but also affords appealing opportunities for stakeholders
engaged in the contexts of education, curation, and research (Schmitt and Saade, 2017), professional practice (Schmitt, 2018c), development (Schmitt, 2016a), and entrepreneurship (Schmitt, 2018a). The following subsections summarize promising key features by focusing on ten knowledge-related qualities, each closely aligned to six digital ecosystems and their subsystems (Schmitt, 2016b) deemed relevant for the PKMS development.

4.1 Knowledge Granularity, Traceability, and Transdisciplinarity for Impacting Future Extelligence

“Economies don’t merely evolve over time, they coevolve. What people believe affects what happens to the economy and what happens to the economy affects what people believe. This positive feedback loop is the signature of coevolutionary learning” (Batten, 2000, pp.6) responsible for the exponential growth of knowledge further reinforced by advancing technologies propelled by humans in pursuit of affordances. Although positive feedback and co-evolutions share similar outcome properties, a key difference attributed to them is that the former is predictive-causal, whereas the latter is reactive-unpredictable (McKelvey, 2002).

The advance of knowledge saw the successive emergence of the tacit-emotional, tacit-intuitive, and explicit-knowledge types in concert with their respective positive feedback loops, knowledge stocks and flows (as synthesized in figure 2). Initially based on the evolution of intelligence (table 1 bottom-left; Dennett, 1995, pp.373-380), the further progress can be aligned to a sequence of co-evolutions (table 1 bottom-right) each based on the interaction between physical (top row) and social (bottom row) aspects facilitated by an enabling catalyst or driver (middle row) (Schmitt, 2018b). At each transitional stage, human progress had been running into constraints which could only be overcome by adding an even more powerful co-evolution triggered by the emergence/invention of capacitating general-purpose technologies (#1-#10) (Schmitt, 2014a; Schmitt, 2015b; Schmitt, 2019b). Due to its own transformational muscle, the current 4th co-evolution (digital revolution) is again approaching a stage of severe constraints (e.g. information overload, fake-facts and post-truths, lack of personal tools and opportunity divides) which signify—in the author’s view—the presently emerging and most crucial barriers to the educational and work-related transformations essential for individual and collective development.

As a remedy, the conceptual scheme of ‘Memes’ (a driver from the very first co-evolution on) allows adopting the useful metaphor of ‘Living Organisms’ for knowledge and ideas whose survival depends on enduring in their medium of education and on the endurance of the medium itself. In terms of Popper’s Three Worlds [c] and the SECI Spiral phases [b] alluded to: “They, currently, either need to be encoded in inanimate durable world:1 vectors (such as buildings, machines, products, software, storage devices, books, great art, or major myths) spreading at times unchanged for millennia, or to succeed in competing for a living host’s world:2 limited attention span (such as people, teams, corporations, or economies) to be subjectively and tacitly memorized (internalization) until forgotten, codified (externalization) in further [concrete] world:1 objects ([via objective abstract world:3 objects]) or spread by the spoken word to other hosts’ world:2 brains (socialization) with the potential to mutate into new variants or form symbiotic relationships (combination) with other memes (memeplexes) to mutually support each other’s fitness and to replicate together” (Schmitt, 2018b).

Granularity (extelligence ecosystem – codification): Since memes and their inbuilt ideas flourish in the virtual ‘Ideosphere’ (as maintained by Memetics) as well as in the visualized three-dimensional KM mapping (as exemplified by the SECI Spiral), the PKM repository is dwelling in the same space (figure 2 right) and is mimicking the memetic ideosphere with its rich resources and structural relationships (instead of storing redundant content in documents). Three of the repository’s four connecting workflows [I1ab, I4b] square straight with the knowledge worker’s central position (top transparent purple donut), while the forth [I4a] ties into the realm of the Human Rational Heritage (bottom transparent purple donut) and connects with the knowledge workers via the Foraging Loop and Learning. In consequence, a PKMS affords an alternative to the traditional document-centric storage paradigm which over-simplistically models digital documents “as monolithic blocks of linear content with a lack of structural semantics” (Signer, 2010). Instead, the PKMS repository offers a significantly finer granularity and easier re-use of the referenced ‘atomic’ and ‘combined’ information units (memes and memeplexes instead of documents).

Traceability (extelligence ecosystem – container): The cumulative synthesis of these unique memes within PKMSs forms bi-directional relationships between them with enhanced traceability and metrics. Traceability, already, acts as a back-bone of modern manufacturing by tracing the history, application or location of any entity and sub-entity by creating an as-built-genealogy across diverse value chains and sources. In PKMS terms,
memes correspond to entities, knowledge assets to as-built-genealogies, value chains to authorship and classifications, and sources to outputs across disciplines.

Transdisciplinarity (extelligence ecosystem – context): As a consequence, Popper’s abstract non-interrogatable World Three (world:3, figure 1c) is transformed into a concrete tangible interrogatable knowledge base named ‘World Heritage of Memes Repository’ (WHOMER) (right section in figure 2). Since anything (in a standardized memetic format) is expressible, combinable and curatable, linked distinctive memes of diverse disciplines are able to mature - with a growing user and shared meme base over time – into a single unified transdisciplinary digital knowledge repository of the world’s extelligence with distinctive benefits (to be further alluded to).

4.2 Knowledge Decentralization, Mobilization, and Accessibility for Impacting Human Development

Stewart and Cohen (1999, pp. 243-245, 288-289) termed this cumulative archive of human cultural experience and know-how ‘Extelligence’, the external counterpart to the intelligence of the human brain/mind which deals in information whereas intelligence deals in understanding; together they are also driving each other in a complicit process of accelerating interactive co-evolution. This accumulating knowledge heritage, however, can only be accessed, augmented, and further accrued by individuals with the know-how and means to utilize the KM topography depicted. Unfortunately, the current status quo of KM theories, practices, and tools does not meet this precondition, an assessment supported by a multiplicity of qualitative surveys and forecasts (which have guided the PKMS prototype design decisions), including:


Decentralization (knowledge worker ecosystem): Levy’s call for a decentralizing KM revolution giving “more power and autonomy to individuals and self-organized groups” (Levy, 2011, 127) not only advances a solution to the shortcomings by aiming to educate more people better to narrow opportunity divides (Giebel, 2013) but also supports Wiig’s (2011) assertion that any (institutional as well as societal) viability and advancement is based on innumerable small ‘nano-actions’ by individuals (knowledge workers) which govern, if effectively combined, the organizational (knowledge economy) and societal performances (knowledge society). The scope of knowledge workers, in this context, is not confined to the socio-economic criteria of an individual’s type of work (e.g Florida’s Creative Class (2012)), but embraces the virtue of individual responsibility for one’s work life by continually striving to understand the world around, by modifying one’s work practices and behaviours to better meet personal and organizational objectives, by seeing the benefits of working differently for oneself, and by driving improvement (Gurteen, 2006). The quantity and quality of productive ‘nano-actions’, nevertheless, depend on the competences and skills of people and their individual intellectual, social, emotional, and structural capitals (Wiig, 2011) which together determine their personal absorptive capacity (ability to recognize, assimilate, and apply new valuable information).

Mobilization (knowledge-driven institutions ecosystem): Organizational leadership is eager to mobilize these potential absorptive capacities (as dispersed individually over the knowledge workers employed) to benefit their firm’s realized absorptive capacity, since “their success rests on converting tacit into explicit actionable knowledge, on aggregating individual into organizational performance, and on balancing between the exploiting of current capabilities versus exploring new ventures (to become an ambidextrous organization), all by dealing with unfamiliarity and perceived difficulties” (Schmitt, 2019a).

Accessibility (knowledge societies ecosystem): In addition to the widening opportunity divides alluded to, knowledge societies are challenged with disruptive trends driven by advancing digital communication
technologies (DCT). As a consequence, shifting demands for flexible amounts of labour (rather than discrete units) are transferring the control over when, where, how, and with whom to offer one’s time and competencies to the individual supplier and alters the granularity of labour markets (Bhatt, 2017) accompanied by rising competitive pressures, evolving domain-specific knowledge and specializations as well as growing needs for flexible skill sets and self-development (Gratton, 2011). Guided by a PKM for Development (PKM4D) framework (Schmitt, 2016a), PKMSs address the ensuing concerns. They afford access to content and devices, further individual proficiencies, facilitate collaborations, empower to contribute to the world’s record, and aid self-transcendence while ensuring individuals’ attention preservation, knowledge retention, and privacy protection.

4.3 Knowledge Transparency, Diffusibility, Negentropy, Synergies for Impacting Technology and Innovation

Profound innovations are based on new ideas that forever alter existing technologies and systems (incl. products, processes, relations, and cultures) into which they are introduced. They eliminate incremental sustaining approaches to innovation and “radically restructure the relationship among manufacturers, distributors, consumers and any others in the supply chain” (Garon, 2012, 442-446). PKMSs, in this regard, are a response to the currently failing KM promise of “enabling people to obtain relevant, context-rich information, and connection with appropriate experts easily, when they need it, so that they can be more effective doing their unique jobs” (Pollard, 2008).

Transparency (technology ecosystem - autonomy): Today’s network economy is generating a snowballing information granularity by differentiating between content creation, delivery, and distribution services, by unbundling the message from the medium, by re-bundling these components to configure output off-the-rack, on-demand, or tailor-made (Bhatt, 2017). Constantly fed by social media users and other causes (e.g. associated platform algorithms, popularity of personal blogs and web sites, self-publishing, academic publisher-or-perish policies), the content and feedback created entail an ever-increasing share of distracting and attention-consuming entropy in form of duplications of original content (redundancy), partial (fragmentations) or erroneous (inconsistencies) replications or deletions of records, non-disclosure or subsequent erasure of sources (untraceabilities), unsuitable alterations of content (corruptions), lacking curation and maintenance (decay), as well as outdated (obsolescence) and falsified statements (fake facts) (Schmitt, 2018c). The resulting abundance is threatening the finite attention individuals’ cognitive capabilities are able to master. As a remedy, the PKMS approach is closing in on the over seven decades old inspiring but still unfulfilled vision of the ‘Memex’ (Bush, 1945). Bush reminded us that the human mind operates by association (meme-based approach), not by indexing (‘book-age’ document-centric paradigm). Applying Bush’s concept of ‘Associative Indexing’, hence, fosters transparency by affording the forward/backward tracking of relation/trails captured and by enabling knowledge-enriched and entropy-reduced scholarship as any “inheritance from the master becomes, not only his additions to the world’s record, but for his disciples the entire scaffolding by which they were erected” (Bush, 1945).

Diffusibility (technology ecosystem - collaboration): Current DCTs are based on networks of instantly, continuously, and ubiquitously connected agents empowered to collaboratively create and directly share information without the need of market intermediaries (Bhatt, 2017) but constrained by humans’ finite attention capabilities and further restricted by a multiplicity of concerns (e.g. confidentiality, copyrights, commercial interests, and market dominance strategies based on service barriers, captured audiences, walled garden approaches) and deficiencies (e.g. incompatibilities, lack of tools and functionalities). As an alternative, the PKMS’s bottom-up approach is based on the cumulative synthesis of collectively shared human capital and creative acts. Its meme trajectories are closely aligned to the SECI and Ba model. It, hence, yields strong synergies with its traditional top-down-OKM-correspondent allowing for collaboratively interlinking knowledge bases and for collectively tracing, harvesting, and utilizing accumulated knowledge subsets more productively for personal as well as organizational benefit. The granular record structure and interdisciplinary classification system of the WHOMER repository, thus, allows not only for effectively combining the individual ‘nano’ actions referred to but also support Nielsen’s call (2011) to reduce current barriers preventing potential contributors from engaging in a wider sharing and faster diffusion of their ideas, sources, data, work-in-progress, preprints, and/or code for the benefit of more rapid iterative improvement.

Negentropy (idesosphere ecosystem - design): The design of the PKMS structures, workflows, and functionalities is aiming to reverse entropy (to strive for negative)entropy by affording order and organization. Once ideas
and content collected or received succeed in competing for a PKMS user’s attention to be understood and made sense of as original or mutated memes, he/she can capture them using his/her PKMS device [figure 2: l1a]. These securely stored memes may be modified and/or related to each other to form symbiotic memeplexes (e.g. classifications, draft documents, knowledge and learning assets) to replicate together [l2]. By voluntarily sharing memes with the PKMS community, they are assimilated as extelligence in the WHOMER knowledge base [l3a] where additional curation services focus on eliminating redundancies (by merging identical memes), consolidating traceabilities (by preserving all unique relationships of the memes merged), computing relevant metrics, and effectuating access and creative conversations benefitting the PKMS community [l4a]. The trails captured in the unified transdisciplinary WHOMER repository can also be utilized to forward feed information about an ancestor-meme’s obsolescence, authenticity, and validity to their subsequent uses and users.

Synergies (ideosphere ecosystem - implementation): A PKMS affords a central service structure (Digital Platform Ecosystem or DPE – figure 3) able to instantiate a digital version of the real-world ideosphere as alluded to. DPEs are meant to accommodate social actors with highly diverse ambitions and skills who expect to gainfully utilize the DPEs’ resources and potential in their personal and local contexts (Eck and Ueberrnickel, 2016, p.13). The PKMS-DPE blueprint depicted (figure 3) follows Levy’s (2011) envisaged decentralized KM Revolution alluded to by facilitating the emergence of distributed processes of collective intelligence, which in turn feed them via creative conversations. Its bird’s-eye-view depicts the technological infrastructure “available to a social actor with the decentralized PKM devices (right) and the PKMS user community (left) depicted at the bottom, the cloud-based World Heritage of Memes Repository (WHOMER) where content is voluntarily shared and centrally curated (to reduce information entropy and assure associative integrity) on the middle-left, and the Personal Learning Environments (PLE) with their e-learning functionalities on the top-right” (Schmitt, 2019a). Synergetic interactions with external Organizational Knowledge Management Systems (OKMS) and Learning Management Systems (LMS) complete the broader technological ecosystems.

Figure 3: PKMS as a Digital Platform Ecosystem (DPE) (Schmitt, 2019a)

Further synergies may be realized by utilizing WHOMER’s meme-based content to develop learning assets for the PKMS-aligned Learning Management System (LMS) [l3b and figure 3] to foster an envisaged novel e-Learning approach [l4b] (Schmitt, Saade, 2017; Schmitt, 2019c). The envisaged Personal Learning Environment (PLE) plans utilizing three-dimensional topologies as non-linear navigation/interaction spaces to offer learners suitable choices of where to start and how to proceed with their transdisciplinary learning experience
(Schmitt, 2018b). Also, once sets of memes repurposed in an e-learning asset have been studied, they also become ‘active’ in the learner’s PKMS device for utilizing WHOMER’s added connectivity, for learning retention, or for repurposing them in assignments or any other aspect of the learner’s further career.

5. Conclusions and the Road ahead

In summary, PKM has been envisaged as a decentralizing KM revolution and as a vital educational concern aiming at strengthening individuals’ sovereignty and collaborations - not at the expense of OKMSs but rather as the means to foster a fruitful co-evolution. Based on distributed networked personal devices, bottom-up, curation, and feedback approaches, and structurally-referenced meme-centric repositories (substituting document-based storage practices), the PKMS concept supports creativity and human capital formation throughout individuals’ academic and professional careers independent of space (e.g., developed/developing countries), time (e.g., study or career phase), discipline (e.g., natural or social science), or role (e.g., student, professional, or leader).

The negentropic granularity and its associative integrity of the WHOMER repository is further enhanced by reducing the attention-consuming entropy referred to and by curation and context aggregation (memes inherit the relationships of their redundant identical copies). The connectivity between these unique, enduring, unalterable memes creates a virtual ideosphere (concretization of Popper’s World Three); it dynamically evolves with further use and inputs, provides pathways for exploitation and exploration without requiring intermediaries (e.g. digital libraries, search engines), and allows focusing on non-redundant search results.

A follow-up on this paper (Schmitt, 2019d) confirmed these findings by applying the psycho-social notion of generativity - which recently stimulated contributions in technology and innovation - in its technical, informational, and social interpretations of generative fit and capacities and by cumulatively synthesizing a wide range of KM models with generativity-related concepts and perspectives.

While the document-centric ‘book-age’ paradigm compels us to experience our nonlinear holistic world via linear disciplinary-divided fragments, the information-and-trajectory-rich WHOMER base provides extensive associative multi-disciplinary pathways for exploration which can also be productively utilized in the context of personal learning environments and innovative e-Learning approaches. Besides, in taking on knowledge and skills as portable and mobile, professionals - while moving from one project or responsibility to the next – are afforded the autonomy to safeguard and develop their personal expertise systematically and sustainably and to voluntarily share it with associates and institutions close to them.

Figure 2 adds a further visualized map (labelled PKM for Action (PKM4A) framework) to the educational PKMS provisions which cover PKM for Empowerment (PKM4E) to address ignorance issues (Schmitt, 2018c), PKM for Development (PKM4D) to provide a heuristic for reflecting on the user’s ambitions the PKMS serves and for assessing KM interventions (Schmitt, 2016a) as well as PKM for Impact (PKM4I) and for Sustainability (PKM4S) (both in-progress). After completing the test phase of the prototype, its transformation into a viable PKMS device application and a cloud-based WHOMER server based on a rapid development platform and a noSQL-database is estimated to take 12 months.

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Management Change Impact on Organizational Learning in a Business School

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Abstract: Management is one of the key factors of ensuring and developing the organizational learning ability. The paper analyses the impact of changes in management on organizational learning (hereinafter OL) in a business school of a public university. A fundamental change in the management system was carried out in one public university in Estonia, which replaced the academically democratic elections of the rector, deans and directors with a management model that is typical for business organisations, where the heads at all levels are nominated. To identify the impact of changes in management on the organizational learning, Watkins’ and Marsick’s learning organization questionnaire (DLOQ) has been used in the research. This research differs methodically from the classical application of DLOQ, which measures the absolute value of organizational learning. Therefore the members of business school were asked to evaluate changes in OL using DLOQ in comparison with the period prior to the reform. For that, the respondents were asked to rate the DLOQ characteristics on a scale from -3 to +3, where a negative score means that the characteristic has become worse after the reform and positive scores imply that they are now better. The results show that changes in the management affects the most the part of OL that is measured by DLOQ dimensions “foster inquiry and dialogue” and “promote collaboration and team learning”. The reasons pointed out are the loss of confidence in the organization as well as sharpening of competition between the employees. The sample size was not adequate to draw reliable conclusions about the whole organization but was sufficient to analyse tendencies. On this basis it is argued that at least in short-term perspective, replacement of academic democracy with the management model typical of a business organization has rather a negative effect on organizational learning.

Keywords: Organizational learning, learning university, learning business school, university management, management change, Dimensions of Learning Organisation Questionnaire (DLOQ)

1. Introduction

In the growing international competition in the higher education sector, it is extremely important that universities and business schools have competencies that enable them to respond more effectively to changes in their environment. The implementation of organizational changes in business schools requires that business school members obtain new skills and change attitudes and manners. All this happens in the process of organizational learning. Business schools, as well as people, should learn to be able to change as fast as the surrounding environment requires. As such, educational institutions can only respond to external challenges and pressures when they meet the criteria of the learning organization. The constant development and improvement of their organization, which requires learning capacity from the organization, is a precondition for any business school to cope with the challenges they are facing.

Several authors have suggested that in the increasingly sharpening international competition universities and business schools should also be learning organizations (Lorange 1997, Mulford 2000; Willcoxson 2001, Dill 1999; Kristensen 1999; Martin 1999, Patterson 1999, Boyce 2003, Portfelt 2006). Most of them describe either some models or various characteristics of the learning organization at universities: university structure, culture, the role of leaders and teamwork, the role of the university in the society. According to Peter Lorange (1997), organizational learning should be a strategic development component of the business school. Lorange points out that organizational learning can be expected to be a key driver for any leading business school that wants to advance and respond to the customers. Business schools are influential institutions. As such, their governance matters. Good governance requires a stronger faculty commitment to the long-term development of their schools. Good governance needs to give faculty an appropriate role in business schools, one that neither blocks change nor makes faculty members alienated from the management of the school (Canals, 2010).
Learning is one of the management areas in a learning organization. Development into a learning organization depends on the managers, who create an environment to support knowledge sharing, management and creation (Moilanen 2001, Senge 1990). Recently several authors have paid attention to the relationship between organizational learning and university management (Gentle et al., 2017; Gouthro et al., 2018, Friedman et al., 2017; Lauer et al., 2017). Learning is seen as a strategic process, which with capable and purposeful management is aimed at organizational development and constant improvement (Pedler et al 1991). Leaders should ensure the creation of strategies, systems, and methods for achieving performance excellence, stimulating innovation, building knowledge and capabilities, and ensuring organizational sustainability. The values and strategies should help guide all of the organization’s activities and decisions (Baldridge 1983).

Changes in the university that was selected for this study provide a worthy and a rare opportunity to study the impact of changes in management on organizational learning. The management of the university changed radically in 2014 when the University Act was passed. The initial model of the university, reflected academic democracy, where leaders at all levels are elected by representative bodies comprising employees of the organization. This was replaced by a management model typical of business organizations. According to the new Act the highest decision-making body of the University is the Board of Governors. The members of the Board of the Governors shall be partially appointed by the Minister of Education and Research (5 members) and partially elected by the University Council (5 members). One member shall be appointed by the Estonian Academy of Sciences. The Board of Governors elects the Rector. Obviously, this means a completely different organizational culture, different relationships between leaders and people they should lead, as well as different attitudes of employees toward the organization’s goals. Considering the importance of management from the aspect of organizational learning, our study hypothesised that such a radical change in an organization’s management affects the organizational learning. Changes taking place during a short period of time enabled employees to evaluate changes in management based on its impact on organizational learning, as the factors that influence organizational learning were well remembered from the previous system and the impact of changes on these factors was clearly visible and perceptible by employees.

The current study continues the authors’ work in the area of organizational learning of business schools (Voolaid and Ehrlich 2012, 2014, 2017) and analyses the impact of changes in the management system on the organizational learning of a business school.

In this paper the authors investigate the radical changes in the management system of the business school under study and the impact of the changes in management on the organisational learning at the business school. Changes in organisational learning are analysed at the selected case using Watkins’ and Marsick’s Dimensions of the Learning Organisation (hereinfter DLOQ) instrument. This instrument has been used before to measure and compare the organisational learning in higher education institutions (Voolaid, Ehrlich 2010).

The paper is structured as follows: In the first section, a theoretical framework in relation to the role of managers in a learning university and business school are provided. The second section describes the research object and methods used and the third section is dedicated to the main results, discussion and conclusions.

2. Role of management in a learning business school

The role of leaders is most important while developing either the school or university into a learning organization. Organization’s leaders should set directions and create a student-focused, learning-oriented climate; clear and visible values; and high expectations. According to White (2005), educational organizations are notoriously slow to change. Truly inspired leadership is needed to work within the norms of consensual governance to support any amount of innovation and adaptation. Leaders must discover how to employ both traditional governance structures and structures more characteristic of learning organizations, e.g. faculty task forces and other consensus building initiatives, to support curriculum innovation and enhance the institution’s financial viability and responses to changing external environments (Drugovich et al 2004).

The keys to change in structure, designed to increase organisational learning, are therefore university leaders’ capacity and willingness to model collaborative action and inquiry, to involve all staff in the initial setting of directions, to maintain enthusiasm for a broadly shared vision and to cede to staff authority and responsibility.
for development and implementation of ideas. The effective leader is therefore less necessarily a charismatic visionary than a collaborating designer (of organisational values, policies, strategies and learning), a steward (who leads by explicitly and visibly serving the interests of the organisational and wider community) and a teacher (who helps others discover their assumptions about the world and develop their full potential) (Senge 1996; Tichy & Cohen 1998). Good leadership, while essential at the top, needs also to be seeded throughout the organisation. Thus, leadership training and team building activities, focusing on enhancing interpersonal communication, conflict resolution and problem-solving skills (Cummings & Worley 1997) must involve people from the highest to the lowest levels of staffing if an institution-wide learning potential is to be created.

Leadership in a learning university is the activity in which all people employed by the university are involved: managerial staff, teaching staff, students as well as those who are not directly involved in teaching. In a learning university, the leader is also a leader in learning, i.e. leads him/herself as well as others, and conditions are created by the top management for the development of the mission, vision, values, policies and strategies. A learning university constantly analyses and updates the university development plan, and university leaders encourage employees and students to take part in setting objectives, implementation of changes and in betterment activities by inviting them to work in work groups and decision-making bodies (Voolaid, Venesaar 2011).

The key of structural changes is in the managers’ hands. It is primarily a business school leader’s responsibility to ensure that the structures and systems in place maximise the opportunity for organizational learning through encouraging the expression and adoption of diverse ideas, and to ensure that their own actions provide both models and opportunities for organizational learning (Willcoxson 2001).

In the global competition of the business education market business school leaders are responsible for the whole process of organizational learning at business schools. They have to lead the process of organizational changes in the business schools, adopt strategies that allow them to distinguish themselves from their competitors. Business school leaders have to fill many important tasks and by the management process they need to take into consideration those specific features in order to create a learning organization. In order to survive in the global competition business school leaders need to therefore provide powerful learning environments and build on learning processes that co-focus on academic/scientific methods and practice/applied connections (Sattelberger, 2011).

In a learning business school the leaders should continuously upgrade and improve the teaching and learning processes and create and distribute new knowledge (Willcoxson, 2001). Business school leaders should be increasingly more aware of the need to involve members of the organization in the process of creating a common vision. All employees should participate in formulating the objectives of the business school and they should have a common understanding of the business school’s mission and vision (Canals, 2010).

Business school leaders need to build internal and external partnerships to better accomplish overall goals.

Internal partnerships might include cooperation among senior leaders, faculty, and staff. Partnerships with faculty and staff might entail workforce development, cross-training, or new organizational structures, such as high-performance work teams (Baldridge, 1983). Internal partnerships also might involve creating network relationships among your work units to improve flexibility, responsiveness, and knowledge sharing. External partnerships might be with other schools, suppliers, businesses, business associations, and community and social service organizations – all stakeholders and potential contributors. Strategic partnerships or alliances are increasingly important kinds of external partnership (Baldridge, 1983). Dealing with organisational development challenges inside the institution, handling the expectations from the external world while allocating scarce resources and enabling the validity of business school activities requires true leadership (Sattelberger, 2011). According to Sattelberger the role of leaders in their institutions will become more important and more complex. More diversity is a plus at all level in business schools: in the board, in management, faculty and staff, and in the student body; diversity also in a geographical, religious and gender sense (Sattelberger, 2011).
3. Research Design and Methodology

3.1 The Choice and Description of the Selected Case Study

The university under investigation is a public university in Estonia where prior to reform management was based on so-called academic democracy, which is typical of Estonian public universities and is characterized by bottom-up elections of all academic level leaders. In the university under study, the rector was elected prior to reform by a special electoral body comprising students and professors, the faculty deans were elected by the faculty council and heads of departments by the council of the respective department. The so-called academic democracy based management system has its strengths and weaknesses, but it definitely ensures broad-based involvement of academic staff in the university’s management at all levels and accountability of the elected leadership to the electorate. Under such a management system, the rector takes into consideration the opinions of professors and students who elected him, in both the university council and management of the university; the dean represents the faculty which elected him in the governing bodies of the university and the department head represents the department which elected him in the faculty council and in other governing bodies. Having been elected, the leaders at all levels should reckon with the interests of the institutions which elected them and represent them effectively in order to be re-elected.

Academic democracy provides individual faculties a relatively high degree of independence in the university. This is especially important for such faculties as the faculty of economics (in essence, an international business school) which are affiliated to and operate independently in international professional organizations and networks and apply for specific accreditations of business schools (e.g. Central and East European Management Development Association, CEEMAN).

A few years ago, a special law was adopted for the university under study and new statutes corresponding to the new law entered into force, which changed the management system radically. The Board of Governors, which so far had been the rector’s advisory body, was turned into the highest governing body of the university. Half of the members of the Board of Governors are appointed by the Minister of Education and Research.

According to the new law and statutes, the rector is not elected any more, but appointed by the Board of Governors. Analogously with the rector’s office, the faculty deans and department heads are not elected any more either. According to the new statutes, the faculty deans are appointed by the rector and the heads of departments also by the rector, on the proposal of the deans appointed by him. In addition to the disappearance of the function of leadership elections, according to the new financial rules, the role of collective governing bodies (faculty council and department councils) has diminished or quite disappeared in the decision-making over the university finances and over the faculty and department budgets respectively.

The above shows that radical changes have occurred in the management system of the university under study, which provide an opportunity to investigate the impact of the changes in management on the organizational learning at the university.

3.2 Research Instrument

Changes in organizational learning are analysed at the example of the selected business school, using Watkins’ and Marsick’s (Watkins and Marsick, 1996) Dimensions of the Learning Organization (hereinafter DLOQ) instrument. DLOQ is a tool to ascertain employees’ opinions about learning at the organization on three levels: individual, team and organizational level. The questionnaire consists of 43 single questions, which are divided into seven dimensions: 1) provide continuous learning opportunities, 2) foster inquiry and dialogue, 3) promote collaboration and team learning, 4) create systems to capture and transform learning, 5) foster movement toward a collective vision, 6) connect the organization to its external environment, and 7) provide strategic leadership for learning (Watkins and Marsick, 1996). Many researchers of the learning organization have later specifically used Watkins and Marsick’s questionnaire in their research (Hernandez and Watkins, 2003; Basim et al., 2007; Jamali et al., 2009; Akhtar et al., 2011). The DLOQ is a structured questionnaire that fits well with P. Senge’s theory of the learning organization (Senge, 1996) and has been internationally tested.

The DLOQ has also been revised many times and scientifically validated to be reliable (Yang, 2005). The methodology of this research is based on Watkins’ and Marsick’s DLOQ as the organizational learning measurement instrument. DLOQ is used for the assessment of changes in the organizational learning due to
changes in the management system. A seven-point scale with answer options -3, -2, -1, 0, 1, 2, 3 instead of the 6-point Likert scale, which is typically used in the case of DLOQ, was used. The answer -3 is defined as “has turned much worse”, -2 “has turned worse”, -1 ”has turned slightly worse”, 0 “has remained the same”, 1 “has turned slightly better”, 2 “has turned better” and 3 “has turned much better”.

3.3 Methodology

The methodology of the current research is based on a survey. The survey sample has been compiled so that it would contain members of the business school from various positions. The sample was formed so that all university staff groups (management, academic and administrative staff) were represented. The studied institution had a total of 120 employees. The Watkins and Marsick’s questionnaire was distributed to 43 employees. The selection was made on the principle that the respondents were employed long enough to know well both the old and new management system, and secondly, that they worked in the same position under the previous and current management system. This would enable respondents to decide over the changes in the organisational learning without being affected by a different view of the organisation due to a different position. For the same reasons, the respondents who had gained or lost in occupational position with the new management system, were excluded. 28 completed questionnaires were returned, which makes the respondent rate of 65%. Interviews were performed in the spring of 2018.

Interviews were carried out using the DLOQ questionnaire, which was distributed to the employees in the sample. The employees are asked to evaluate changes in all DLOQ characteristics compared to the previous management system on the scale from -3 to +3. Tables 1-7 provide the numerical values of average differences by characteristics. The results provide information about the impact of management changes on the organisational learning. The limitation of the study is that the survey sample is not sufficient to draw any conclusions about the organisation as a whole.

4. Results and discussion

Data used in the empirical part of this paper, seeking to show the impact of changes in the management system of the HEI under study on organisational learning, are presented in Tables 1-7. The data have been obtained by interviewing a sample of employees using the DLOQ measurement instrument, while changes in the learning level compared to the previous, so-called academic democracy-based management system, where leaders at all levels were elected by representative bodies, rather than the organisational learning was measured. The data in the table implies that after changes in organization occurred, the characteristic turned either better or worse, in the opinion of the survey sample. Negative value means deterioration of the respective characteristic and a positive value implies improvement in comparison with the situation prior to changes in the management system.

4.1 First dimension: Provide continuous learning opportunities

The results of the first dimension are shown in Table 1.

Table 1: Organisational learning rate change in comparison with previous management system. First dimension “Provide continuous learning opportunities”

<table>
<thead>
<tr>
<th>Individual level</th>
<th>Average change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. provide continuous learning opportunities</td>
<td>-0.39</td>
</tr>
<tr>
<td>2 In my organization, people openly discuss mistakes in order to learn from them</td>
<td>-1.2</td>
</tr>
<tr>
<td>3 In my organization, people identify skills they need for future work tasks</td>
<td>-0.2</td>
</tr>
<tr>
<td>4 In my organization, people help each other learn</td>
<td>-0.5</td>
</tr>
<tr>
<td>5 In my organization, people can get money and other resources to support their learning</td>
<td>-0.8</td>
</tr>
<tr>
<td>6 In my organization, people are given time to support learning</td>
<td>0</td>
</tr>
<tr>
<td>7 In my organization, people view problems in their work as an opportunity to learn</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Source: Authors
The average change in characteristics of the first out of three levels of DLOQ, the individual level first dimension “Provide continuous learning opportunities” is -0.39. Out of seven characteristics in this dimension only the 6th characteristic “In my organization, people view problems in their work as an opportunity to learn” improved slightly (0.2) after establishing the new management system. This outcome may reflect the staff’s reaction to an increasing amount of problems they face in their work in the new situation, where in order to cope with the situation, people try to give a positive meaning to the problems and find ways to learn from them. The first characteristic in this dimension, “In my organization, people openly discuss mistakes in order to learn from them”, has declined the most and was rated by respondents on average at -1.2 points. The outcome in this case is significant because it characterises indirectly the organization’s inner atmosphere. The situation where employees are not discussing mistakes openly may imply both alienation of the employees from the organization in connection with the new management system and the leaders nominated, as well as lack of confidence between employees due to fear and uncertainty, which does not allow discussing mistakes openly with colleagues. The next, by absolute value of change (-0.8), is the fourth characteristic, “In my organization, people can get money and other resources to support their learning”. The deterioration of the rating of the resources available for learning may not express an objective decline in resources for that but the rating of the situation where after changes in the management system, management of resources has been moved farther away from employees, who themselves dare not ask money for learning.

4.2 Second dimension: Foster inquiry and dialogue

The results of the second dimension are shown in Table 2.

Table 2: Organisational learning rate change in comparison with previous management system. Second dimension “Foster inquiry and dialogue”

<table>
<thead>
<tr>
<th>Individual level</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. foster inquiry and dialogue</td>
<td>-1.53</td>
</tr>
<tr>
<td>8 In my organization, people give open and honest feedback to each other</td>
<td>-1.8</td>
</tr>
<tr>
<td>9 In my organization, people listen to others’ views before speaking</td>
<td>-1.6</td>
</tr>
<tr>
<td>10 In my organization, people are encouraged to ask “why” regardless of rank</td>
<td>-1.4</td>
</tr>
<tr>
<td>11 In my organization, whenever people state their view, they also ask what others think</td>
<td>-2</td>
</tr>
<tr>
<td>12 In my organization, people treat each other with respect</td>
<td>-1.2</td>
</tr>
<tr>
<td>13 In my organization, people spend time building trust with each other</td>
<td>-1.2</td>
</tr>
</tbody>
</table>

Source: Authors

The second individual level dimension, “Foster inquiry and dialogue”, received -1.53 points, which was an average for this dimension and is affected the most by management changes among the seven characteristics.

All characteristics in this dimension were rated lower than minus one. Hence, the impact of changes in management on this dimension cannot be accidental and deserves special attention.

The first characteristic in the 2nd dimension (overall 8th) “In my organization, people give open and honest feedback to each other”, received -1.8 points. This characteristic is somewhat similar to the lowest rated 1st characteristic in the previous dimension. The decline in open and honest feedbacking was caused by changed organization culture due to the new management system. In the conditions where organization’s priority is to achieve objectives formulated by the leadership rather than employees’ welfare, like it was with leaders elected by the employees, colleagues view each other as rivals and therefore do not give open and honest feedback to each other. Some employees may be desisted from giving open feedback also because of their distrust of colleagues and fear of leaders, who under the new management system are no more dependent on employees.

The next, 9th characteristic “In my organization, people listen to others’ views before speaking” has also considerably worsened (-1.6). This is somewhat unexpected as listening does not involve communication of information and inflicting (hypothetical) damage to one’s individual competitiveness under sharpening competition. Probably, the decreased listening was a reaction to that they do not expect and hope that the
partner would share the thoughts openly and honestly. The negative change in the 10th characteristic, “In my organization, people are encouraged to ask ‘why’ regardless of rank” is -1.4. The setback in this characteristic may be directly due to the new, vertical management system where leaders are appointed and do not depend on the employees and hence have no need to have a dialogue with the employees as before and encourage them to ask “Why”. The biggest change (-2) among the characteristics of this dimension was in the 11th characteristic, “In my organization, whenever people state their view, they also ask what others think”, implying that people are much less interested in asking opinions from colleagues. This may be due to the above-mentioned alienation from the organization and the feeling that “my opinion would not change anything” and therefore, they avoid giving their opinion. Also, they do not expect that colleagues express their opinion sincerely and honestly, which is due to similar reasons as the unwillingness to express one’s opinion.

The 12th and 13th characteristic have deteriorated slightly less (-1.2), which is due to building mutual respect and trust in the organization. It is difficult to explain the reasons for declined respect and trust between employees, at least at first view, because notwithstanding the changes in the management and organizational culture, many colleagues were the same when the survey was carried out. Obviously, reasons for the decreased trust between colleagues are similar to the reasons for negative changes in this dimension's characteristics, i.e. sharpening competition between the employees, preferring the focus on organization and achievements to the focus on employees and overall atmosphere in the organization. To summarise the individual level 2nd dimension, it may be argued that the negative change for all characteristics was greater than -1, implying that management and consequently changes in the organizational culture have (at least in the beginning) a noticeable effect on (open) dialogue between people, which in turn has a negative impact on organizational learning at individual level.

4.3 Third dimension: Promote collaboration and team learning

The results of the third dimension are shown in Table 3.

Table 3: Organisational learning rate change in comparison with previous management system. Third dimension “Promote collaboration and team learning”

<table>
<thead>
<tr>
<th>Team or group level</th>
<th>4.84</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. promote collaboration and team learning</td>
<td>-1.32</td>
</tr>
<tr>
<td>14 In my organization, teams/groups have the freedom to adapt their goals as needed</td>
<td>-1.4</td>
</tr>
<tr>
<td>15 In my organization, teams/groups treat members as equals, regardless of rank,</td>
<td>-0.8</td>
</tr>
<tr>
<td>culture, or other differences</td>
<td></td>
</tr>
<tr>
<td>16 In my organization, teams/groups focus both on the group's task and on how well</td>
<td>-0.4</td>
</tr>
<tr>
<td>the group is working</td>
<td></td>
</tr>
<tr>
<td>17 In my organization, teams/groups revise their thinking as a result of group</td>
<td>-1.4</td>
</tr>
<tr>
<td>discussions or information collected</td>
<td></td>
</tr>
<tr>
<td>18 In my organization, teams/groups are rewarded for their achievements as a team/</td>
<td>-1.5</td>
</tr>
<tr>
<td>group</td>
<td></td>
</tr>
<tr>
<td>19 In my organization, teams/groups are confident that the organization will act on</td>
<td>-2.4</td>
</tr>
<tr>
<td>their recommendations</td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors

On the next, team or group level, there is only one dimension, “Promote collaboration and team learning”, which together with the previous dimension, “foster inquiry and dialogue” is one out of two where the negative change (-1.32) is greater than -1. Although changes in all characteristics in this dimension are negative, the differences in a few characteristics compared to the previous dimension are bigger, between -0.4 and 2.4. The biggest negative change among all characteristics in the questionnaire was experienced by the 19th characteristic “In my organization, teams/groups are confident that the organization will act on their recommendations” (-2.4). The rating clearly indicates the lack of confidence that the staff’s opinion is taken into consideration in organizational management. Such opinion has not formed of nothing but is based on employees’ personal experiences. Namely, the employees could express their opinion about the new regulatory documentation (e.g. statutes) under the new management, but actually these opinions were not taken into consideration in the documents. Moreover, they could not utter their opinion regarding amendments like elected councils of structural units under the old management system. Only some of the
bodies appointed by the new management had some decision-making power. All this strongly shook the employees’ confidence that their opinion might be taken into account in the organization’s activities.

The next by the size of negative rating (-1.5) is the 18th characteristic “In my organization, teams/groups are rewarded for their achievements as a team/group”. This rating is based on the lack of confidence; achievements at the group/team level may be noticed and rewarded. A decision made by the new management that affected all groups was dissolution of the established formalised groups. Obviously, people had not become used to the new system of groups by the time the interviews were carried out, which also caused a negative rating of several other characteristics in this dimension, for example 17th, “In my organization, teams/groups revise their thinking as a result of group discussions or information collected” (-1.4) and 14th, “In my organization, teams/groups have the freedom to adapt their goals as needed” (-1.4). The latter is also affected by a change in the organizational culture under the new management, where both individuals and groups should be guided in their activity by organization’s objectives set by the new management. The negative change (-0.8) was smaller in the 15th characteristic “In my organization, teams/groups treat members as equals, regardless of rank, culture, or other differences” and 16th characteristic (-0.4) “In my organization, teams/groups focus both on the group’s task and on how well the group is working”. This implies that solidarity within a group, equal treatment and focus on group tasks have been affected the least by the management change among the characteristics measured in this dimension.

To sum up the 3rd dimension, the lowest rated are changes in these characteristics which measure group relationships to the organization’s objectives and possibilities of the group to influence these objectives.

Analogously with the individual level characteristics, this also shows the employees’ alienation from the organization’s objectives, in the development of which both employees and groups have participated less under the new management than previously. The effect of the new management has been smaller on employees’ relationships within groups.

4.4 Fourth dimension: Create systems to capture and transform learning

The results of the fourth dimension are shown in Table 4.

Table 4: Organisational learning rate change in comparison with previous management system. Fourth dimension “Create systems to capture and transform learning”

<table>
<thead>
<tr>
<th>Organizational level</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. create systems to capture and transform learning</td>
<td>-0.50</td>
</tr>
<tr>
<td>20 My organization uses two-way communication on a regular basis, such as suggestion systems, electronic bulletin boards, or town hall/open meetings</td>
<td>-0.4</td>
</tr>
<tr>
<td>21 My organization enables people to get needed information at any time quickly and easily</td>
<td>-1</td>
</tr>
<tr>
<td>22 My organization maintains an up-to-date data base of employee skills</td>
<td>0</td>
</tr>
<tr>
<td>23 My organization creates systems to measure gaps between current and expected performance</td>
<td>-0.4</td>
</tr>
<tr>
<td>24 My organization makes its lessons learned available to all employees</td>
<td>-1.2</td>
</tr>
<tr>
<td>25 My organization measures the results of the time and resources spent on training</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: Authors

The most negative rating of changes (-0.50) was given to the 4th dimension “Create systems to capture and transform learning”. In this dimension the change in two characteristics is at least -1. These are the 21st characteristic “My organization enables people to get needed information at any time quickly and easily” (-1) and 24th characteristic “My organization makes its lessons learned available to all employees” (-1.2). Both of these characteristics concern information exchange and making it available. Definitely, such a rating reflects the situation in the organization at the time of the survey; however, it may not be directly caused by changes in the management but the fact that most of the key persons who had information left (or were forced to leave by new leaders) and people no longer knew who to contact for information. Neither did the upgrading and modification of IT systems with plenty of errors contribute to increasing the accessibility of information.
Still, it may be assumed that problems related to the availability of information are temporary and are solved when the new management becomes firmly rooted. Another thing is the availability of so-called strategic information (principles of budget allocation etc.), which probably can be used by a limited number of people under the new management.

4.5 Fifth dimension: Foster movement towards a collective vision

The results of the fifth dimension are shown in Table 5.

**Table 5:** Organisational learning rate change in comparison with previous management system. Fifth dimension “Foster movement toward a collective vision”

<table>
<thead>
<tr>
<th>Organizational level</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5. foster movement toward a collective vision</td>
<td>-0.38</td>
</tr>
<tr>
<td>26 My organization recognizes people for taking initiative</td>
<td>0</td>
</tr>
<tr>
<td>27 My organization gives people choices in their work assignments</td>
<td>-0.2</td>
</tr>
<tr>
<td>28 My organization invites people to contribute to the organization’s vision</td>
<td>0</td>
</tr>
<tr>
<td>29 My organization gives people control over the resources they need to accomplish their work</td>
<td>-2</td>
</tr>
<tr>
<td>30 My organization supports employees who take calculated risks</td>
<td>0.4</td>
</tr>
<tr>
<td>31 My organization builds alignment of visions across different levels and work groups</td>
<td>-0.5</td>
</tr>
</tbody>
</table>

Source: Authors

A relatively small change (-0.38) has been in the 5th dimension, “Foster movement towards a collective vision”. A strong negative rating of the change (-2) was earned by the 29th characteristic of this dimension, “My organization gives people control over the resources they need to accomplish their work”. Such a rating is a good reflection of the situation where the decision-making over the resources and their allocation has been moved farther away from the staff and has been made similar to that of a business organization where senior management decides the resources. Moreover, the principles and mechanism of allocation are rather incomprehensible for the employees and they do not sense control over the resources compared to the previous management system. However, it may be argued that greater control over the resources together with centralization for the sake of more effective functioning of the organization was one of the objectives of the management reform. Its negative impact on organizational learning should be considered as an inevitable side effect of the centralization of power and resources.

4.6 Sixth dimension: Connect the organization to its external environment

The results of the sixth dimension are shown in Table 6.

**Table 6:** Organisational learning rate change in comparison with previous management system. Sixth dimension “Connect the organization to its external environment”

<table>
<thead>
<tr>
<th>Organizational level</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6. connect the organization to its external environment</td>
<td>+0.05</td>
</tr>
<tr>
<td>32 My organization helps employees balance work and family</td>
<td>-0.4</td>
</tr>
<tr>
<td>33 My organization encourages people to think from a global perspective</td>
<td>0.6</td>
</tr>
<tr>
<td>34 My organization encourages everyone to bring the customers’ views into the decision making process</td>
<td>0</td>
</tr>
<tr>
<td>35 My organization considers the impact of decisions on employee morale</td>
<td>-0.5</td>
</tr>
<tr>
<td>36 My organization works together with the outside community to meet mutual needs</td>
<td>1</td>
</tr>
<tr>
<td>37 My organization encourages people to get answers from across the organization when solving problems</td>
<td>-0.4</td>
</tr>
</tbody>
</table>
The 6th dimension “Connect the organization to its external environment” is the only one where the average change of characteristics is slightly positive (0.05). This result is quite expected because the need to connect the organization to its external environment better than so far was one of the main arguments of the management change. Surprising rather is that the positive change is so small. At the same time, better connection of the organization to its external environment is not something that can be implemented rapidly and the benefits of which members of the organization would immediately recognize. The most positive rating of change in this dimension (1) was earned by the 36th characteristic “My organization works together with the outside community to meet mutual needs”. The positive rating shows that the attempts of the reformed organization to co-operate more with the outside community have been successful and are also felt by employees. From this aspect at least, organizational learning has improved due to the new management. The same may be said about the positively changed (0.6) 33rd characteristic “My organization encourages people to think from a global perspective”. A more global perspective is a natural side effect of the organization’s greater coherence with its external environment.

A setback in the 6th dimension is registered in the 35th characteristic “My organization considers the impact of decisions on employee morale” (-0.5) and 37th characteristic “My organization encourages people to get answers from across the organization when solving problems” (-0.4). A slight negative change again indicates weakening of the connection between the employees and management (which is one expression of alienation) and the decisions taken by the management; their effect on employees’ morale has not been sufficiently taken into consideration. The slightly negative change in the 37th characteristic is due to the accessibility of information and interacting within the organization. A slight negative change (-0.4) has been detected also in the 33rd characteristic “My organization helps employees balance work and family”, which may be due to the sharpening competition in the organization and increased control over the fulfillment of organization’s objectives, which makes the employees work also outside the working hours.

4.7 Seventh dimension: Provide strategic leadership for learning

The results of the seventh dimension are shown in Table 7.

<table>
<thead>
<tr>
<th>Organizational level</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. provide strategic leadership for learning</td>
<td>-0.17</td>
</tr>
<tr>
<td>38 In my organization, leaders generally support requests for learning opportunities and training</td>
<td>0.4</td>
</tr>
<tr>
<td>39 In my organization, leaders share up to date information with employees about competitors, industry trends, and organizational directions</td>
<td>0.2</td>
</tr>
<tr>
<td>40 In my organization, leaders empower others to help carry out the organization’s vision</td>
<td>-2</td>
</tr>
<tr>
<td>41 In my organization, leaders mentor and coach those they lead</td>
<td>0.4</td>
</tr>
<tr>
<td>42 In my organization, leaders continually look for opportunities to learn</td>
<td>0.4</td>
</tr>
<tr>
<td>43 In my organization, leaders ensure that the organization’s actions are consistent with its values</td>
<td>-0.4</td>
</tr>
</tbody>
</table>

In the last, 7th dimension of the questionnaire, “Provide strategic leadership for learning”, the average change in characteristics is slightly negative (-0.17), while in many as four characteristics it has been rated positive.

The change measured in this dimension is especially important for learning, as strategic leadership should have been changed the most under the new management executed by the appointed leaders. A slightly positive overall change in this dimension, which is important in the management change context, is strongly backfired by the 40th characteristic “In my organization, leaders empower others to help carry out the organization’s vision”, the negative change rating of which is -2 points. Such a negative change rating of downward
delegation of rights testifies to that the leaders appointed based on the new management system do not trust members of the organization who have not elected them. The decline in downward delegation of tasks to carry out the organization’s vision probably is a side effect of the centralization of management and resources, where strategically less important tasks that are not directly connected with the implementation of the vision are more likely to be delegated downwards. Slightly negative (-0.4) in the 7th dimension was also the rating of the change in the last, 43rd characteristic “In my organization, leaders ensure that the organization's actions are consistent with its values”. The rating again implies distrust of members of the organization against leaders not elected by them and throws doubt upon the ability of the leaders to abide by the values of the organization.

The characteristics with a slightly positive rating (0.2-0.4) are 38, 39, 41 and 42. Significant are the positive change ratings in the 38th characteristic “In my organization, leaders generally support requests for learning opportunities and training” (0.4) and 42nd characteristic “In my organization, leaders continually look for opportunities to learn” (0.4), implying that new leaders comprehend the importance of organizational learning, as well as, in a narrow sense, of their own learning. Along with a positive change (0.4) in the 41st characteristic “In my organization, leaders mentor and coach those they lead”, it gives hope that when employees get used to the new management, communication of information improves and lack of trust toward the appointed leaders decreases, the other aspects of organizational learning also have a potential to improve. However, it is hard to imagine that employees would perceive the organization as their own under the vertical management that is typical of a business organization, as it was the case with the bottom-up election of leaders and with structural units having the decision-making power and relatively independent control over the resources, which was typical of the previous management system and organizational culture.

5. Conclusions

Major changes in the organization's management system are rarely anticipated and therefore their impact on organizational learning has not been studied so far. The radical change in the management system of the organization under investigation provided a good opportunity to study this. After changes in the management system of the institution under investigation, the authors hypothesized that changes have an impact on organizational learning. To test the hypothesis, a study was conducted to measure changes in organizational learning. The Dimensions of the Learning Organisation Questionnaire by Watkins and Marsick (DLOQ) was used as a measuring instrument. The DLOQ questionnaire can measure not only the absolute value of organisational learning, but can also be used to measure relative changes. In practice, the cases where an organization's management system changes radically are rare, therefore, it is not possible to detect the impact of changes in the management system on organizational learning to similar cases occurring elsewhere.

However, the study conducted suggests that changes in the management system have at least some effect on organizational learning, confirming the authors' research hypothesis.

To sum up, the impact of the new management system, the main elements of which are appointed leaders instead of bottom-up election of the leaders and centralisation of the decision-making power and resources, on organizational learning has been rated rather negatively by the interview sample. Out of seven dimensions of DLOQ, 6 dimensions worsened and only one, 6th dimension „Connect the organization to its environment” improved with the change in management. A distinct change in organizational learning greater than one point due to the change in management occurred in the 2nd dimension “Foster inquiry and dialogue” (-1.53) and in the 3rd dimension “Promote collaboration and team learning” (-1.32). The fact that all aspects of the organizational learning dimension „inquiry and dialogue” have deteriorated considerably implies that the changes in the management have affected not only the relationships between the employees and the leaders but also the relationships between the employees themselves, their confidentiality and openness. The negative impact of the new management is the biggest on dialogue between the staff and leadership, how members of the organization identify themselves with the organization’s objectives, exchange of information between leadership and employees and overall atmosphere of distrust toward the leaders about whom it can be said (in the context of the entity under study) that none of them would have been elected under the previous management system. Neither do the employees feel that they can control their resources, which is an inevitable side effect of centralisation. Another problem from the organizational learning perspective is shifting of the administrative power farther away from employees together with the diminishing decision-making power from below and increasing control from above.
Although the use of DLOQ to measure organizational learning changes is considered by the authors to be appropriate, in practice such changes are very rare. Only time can tell what are the effects on organizational learning caused by adaptation difficulties and which are permanent. In the future, as the new management system is better rooted in the institution under study, the authors intend to repeat the study in the same institution and compare the results with this study. The results of the work allow for the organizational management system changes to pay special attention to aspects of organizational learning that are most affected by changes in the management. This will prevent the loss of organizational learning in case of changes in the management system. Although the results are based on a survey of an educational institution, we argue that the results can be used by organizations in other fields.

References


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Teaching Innovation to Strengthen Knowledge Creation in a Digital World

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Abstract: The aim of this paper is to demonstrate design principles for a teaching and learning environment that will strengthen the ability of students to become competent digital innovators. The impact of digital transformation on business and society is palpable, forcing organisations to become more responsive, agile, creative and innovative. Moreover, competitiveness is determined by the ability to apply new knowledge to facilitate innovation through the use of digital technologies. A two-year research study was conducted at a university in South Africa to develop a framework for digital innovation skills. The data were analysed in a four-phase design-based research study that applied mixed-methods research. The research has important implications for the design of a learning environment that facilitates knowledge creation in a digital world.

Keywords: Future skills, Digital innovation, New world of work, Authentic learning, Life-long learning, 21st-century skills, Higher education institutions

1. Introduction

The interactivity and pervasiveness of digital technologies are changing the discourse on the importance of knowledge creation and innovation for organisational success (O Riordan, 2013). Within the digital economy, organisations require a culture that encourages continuous business model innovation enabled by digital technology (Amit and Zott, 2012). The digital future demands a new type of employee who is able to work in unstructured and unpredictable circumstances that are often complex and involve constant change.

Furthermore, demographic changes will result in an ageing workforce and it will become necessary to continuously update skills in all careers via relevant training opportunities to facilitate lifelong learning (Redecker, et al., 2011).

University students need to be prepared for this expanding, interconnected world through the design of a participative, digitally enabled, collaborative learning environment. Higher education institutions (HEIs) are therefore forced to experiment with new formats and strategies for learning and teaching to be able to offer relevant, effective, innovative and high-quality learning experiences (Alexander, et al., 2019). Educators in HEIs need to have the skills to manage and teach digital technologies and, more importantly, to assist their students to become capable of collaborating, solving problems and being creative in the use of digital technologies. A move beyond the current horizons of knowledge and skills within a specific discipline is required in order to be adaptable in the future (Laurillard, 2012).

In the light of these considerations, this paper provides an empirical contribution in the form of a teaching and learning framework to teach digital innovation skills. The framework will help address the discrepancies in competencies being developed in formal education versus the requirements of industry in a digital world.

The paper proceeds as follows. First, the literature reviews the new world of work within the digital economy, and the skills sets required. This is followed by a discussion of the design of the learning environment to enable the development of digital skills. Second, the method used to empirically verify the draft design principles is presented. Next, the research results are presented and discussed, prior to the conclusion of the full study. The outcome of this study is design principles for a teaching and learning environment in HEIs that will enable the cultivation of digital innovation skills to support knowledge creation in a constantly changing world.

2. Skills for the New World of Work

Digitisation requires a more flexible workforce with the ability to change and adapt within a complex global economic environment. This requires an innovative and entrepreneurial spirit, combined with an agile mindset of lifelong learning (Philbeck, Davis and Engtoft Larsen, 2018). Thus, what is required is skills sets to easily
transfer from one type of job to another by being responsive to unexpected circumstances, and to un-learn and re-learn quickly. To be adaptable, individuals will require a combination of certain cognitive (critical thinking, problem-solving) and socio-emotional skills (curiosity, creativity) (Djankov, et al., 2019). Thus, a workforce proficient in new technologies is important, but the skills sets that equate to “human skills such as creativity, originality and initiative, critical thinking, persuasion, and negotiation will likewise retain or increase their value” ... “emotional intelligence, leadership and social influence will, however, increase in prominence” (World Economic Forum [WEF], 2018, p.12). This requires tertiary systems that are more flexible, more successful at producing transferrable higher-order skills, and more able to actively facilitate innovation (Djankov, et al., 2019).

The importance of collaboration among individuals, organisations and even industries is another requirement for future business that is strongly emphasised in the literature. Collaboration gives rise to the sharing of ideas, innovation, and the ability to make changes faster. The requirement for collaborative knowledge exchange between colleagues and peers, and between older and younger, experienced and inexperienced workers, needs to be foregrounded in order to drive experimentation and rapid iteration (Manyika, et al., 2017).

Hierarchies need to be broken down and collaboration platforms need to be created to share information. A digital workplace requires flexibility to work anywhere and anytime using any device, with a focus on work outputs.

Digital transformation poses opportunities for economic growth and social progress, yet depends on reform in education and training, labour market policies, business skills development, and existing social contracts (WEF, 2018). The review of the changing employment landscape emphasises the importance of advanced cognitive skills (such as complex problem-solving), socio-emotional skills (collaboration, team work), and skill combinations that are predictive of adaptability (resilience and the ability to cope with change) (Djankov, et al., 2019; Phillips, et al., 2018).

The umbrella term used to describe the type of skills that students will need to develop in the digital economy is “21st-century skills” (21st CS). A number of frameworks have been developed to define 21st CS, and studies by Dede (2010), Kereluik, et al. (2013), Adamson and Hammond (2014) and P21- Partnership for 21st CS (2019) compared different frameworks to define the primary skills required. In this review, the necessary skills that are predominant for digital innovation were explored, and the framework of Kereluik, et al. (2013) was deemed to be the most comprehensive. This framework consists of foundational, meta- and human knowledge, as illustrated below.

![Figure 1: Synthesis of 15 different 21st-century learning frameworks in one visual image (Kereluik, et al., 2013)](image-url)
As seen in Figure 1, foundational knowledge consists of core content, cross-disciplinary knowledge and digital knowledge. Meta-knowledge is knowledge “to act” using creativity, innovation, problem-solving, critical thinking, communication and collaboration. In the framework, human knowledge includes job and life skills, emotional intelligence and cultural awareness.

3. Teaching Innovation

As discussed above, the diffusion of digital technology is opening up opportunities to innovate (implementation of ideas), and innovation is increasingly being regarded as the skill that separates students who are prepared for the challenges of increased complexity in the digital world from those who are not (P21, 2019). Furthermore, individual innovativeness is no longer viewed as a trait, and studies have proven that it can be learned via effective training in innovation skills (Celuch, Bourdeau and Smothers, 2014).

In the process of learning to innovate, students need to be prepared to think creatively, work creatively with others, learn to implement innovations, reason effectively, use systems thinking, make judgements and decisions, solve problems, communicate clearly, and collaborate with others (P21, 2019). Using a simpler description, one might say that innovation skills cover three basic areas: thinking (customer-focused thinking and problem-solving), telling (getting others on board and storytelling), and doing (learning through experimentation). Cobo (2013) explores this further by identifying the elements necessary for an innovative society and stresses the criticality of developing skills for innovation in education. These include:

- The shift from what we learn to how we learn to better understand how knowledge is co-created and re-constructed. Furthermore, the ability to filter information to develop the skills to think scientifically.
- The fluctuating relationship between digital technologies and content to assist students in how to think, and not to tell them what to think.
- Education needs to be participative and to utilise technology that digitally enables collaboration.
- The changing conceptions of space-time and the emphasis on lifelong learning. These aspects talk to what Castells (2004, p.36) terms “timeless time”, shaped by the “space of flows”. In the digital economy, work becomes much more flexible and unstable, transforming space and time.
- The development of soft skills or social behavioural skills, such as those depicted in Figure 1.

Higher education institutions need to prepare graduates for an evolving job market that promotes a culture of entrepreneurial thinking and innovation. Pedagogies that foster hands-on, real-world experiences for learners, where they become partners in learning inventions, and knowledge creation are required (Becker, et al., 2018). Such activities are a key element of authentic learning, are active and experiential, and provide learners with many of the skills they need when they enter the world of work. The principles of authentic learning, as outlined in Herrington, Reeves and Oliver (2010), are:

- Provide authentic contexts that reflect the way the knowledge will be used in real life.
- Provide authentic task/s that have real-world relevance, are ill defined, continue over an extended period and are integrated across subject areas.
- Provide access to expert performances and the modelling of processes by allowing students access to experts within the industry, collaboration with other students and facilitation by the lecturer.
- Provide multiple roles and perspectives to move away from a linear method of instruction.
- Support the collaborative construction of knowledge tasks.
- Promote reflection to enable abstractions to be formed by students whilst they are working within the authentic context and completing authentic tasks.
- Promote articulation to enable tacit knowledge to be made explicit.
- Provide coaching and scaffolding by the teacher at critical times to support students in their learning.
- Provide for integrated assessment of learning within the tasks to provide the opportunity for students to demonstrate their acquired knowledge as the learning progresses until the final product is delivered.

The review of the new world of work provided context for the skills requirements in a digital world and this, in turn, informed the design of a potential learning environment. The next step in the study was to test the incorporation of draft design principles into the learning environment.
4. Methodology

A design-based research (DBR) study was undertaken to develop design principles that can be applied in higher education settings to aid students in the development of capabilities for a digital world. The goal was to apply a methodology that will not only evaluate the effectiveness of the educational interventions, but also provide design guidelines for implementing such interventions (Herrington, Reeves and Oliver, 2010). In DBR, the researcher collaborates with participants and other stakeholders to improve teaching and learning practices in an interactive, systematic, flexible and iterative way within real-world settings (Herrington and Reeves, 2011). A four-phased DBR approach was applied, as depicted in Figure 2.

![Design-Based Research](image)

**Figure 2:** Predictive and design-based research approaches in educational technology research (Reeves, 2006)

The first phase commences with a review of the literature and interaction with different stakeholders in order to base the initial design (phase 2) on sound theoretical principles. In the iterative cycles (phase 3), the theory is enriched and updated based on the data collected in each cycle and the experiences of the designers (Herrington and Reeves, 2011).

Following this approach, the study commenced with a review of the new world of work in order to provide context for the skills requirements in a digital world. This provided context for the design of draft principles for a learning environment that will enable knowledge creation. The draft principles developed during the second phase are depicted in Table 1.

Drawing on the draft principles, a course was designed in which students were required to partner with industry and manage projects within teams to implement a digital innovation in the client’s business. An overview of the content development for and assessment of the first iteration is depicted in Table 2.

**Table 1: Draft design principles**

<table>
<thead>
<tr>
<th>Draft design principle</th>
<th>Requirements</th>
<th>Skills sets required by principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encourage collaboration</td>
<td>Students need to perform tasks in teams. Ensure that students collaborate to solve problems in class and in projects. Use peer reviews.</td>
<td>Collaboration and communication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Digital/ICT knowledge</td>
</tr>
<tr>
<td>Have students produce real products for a real audience</td>
<td>Require students to do a team-based project with organisations within their community and where they are required to implement a real solution. Work within a specific industry that needs assistance with digital innovation.</td>
<td>Problem-solving and critical thinking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Life/job skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Emotional intelligence (EQ) and ethics</td>
</tr>
<tr>
<td>Allow students to find their own solutions within an authentic context</td>
<td>Encourage innovation by letting students take their own initiative. Do not put too much structure in place, use some scaffolding when required.</td>
<td>Creativity and innovation</td>
</tr>
</tbody>
</table>
Draft design principle | Requirements | Skills sets required by principle
--- | --- | ---
Implement exercises that encourage reflection | Design learning tasks that will enable students to reflect on their learning, for example via a blog. Provide guidelines via rubrics on content to be included in the blogs, such as weekly reflections on what has been learned, what they enjoyed and what they did not enjoy. | Problem-solving and critical thinking Digital/ICT skills Life/job skills
Allow for mistakes | Innovation requires the willingness to fail. A course needs to be designed in which students are encouraged to try different approaches and, when something fails, they need to try another approach without being penalised for it. | Creativity and innovation Problem-solving and critical thinking
Apply project-based learning to combine inquiry with accountability | Involve students in projects that are based on real-world, authentic problems that are meaningful and engaging. | Cross-disciplinary skills Collaboration and communication Life/job skills

<table>
<thead>
<tr>
<th>Subject</th>
<th>Assessments and requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective communication</td>
<td></td>
</tr>
<tr>
<td>Agile project management (Scrum)</td>
<td></td>
</tr>
<tr>
<td>Digital innovation</td>
<td>Pre-reading and podcast on learning management system (LMS) and Google Drive Individual questionnaire 1 in Google Forms Lateral thinking quiz in class</td>
</tr>
<tr>
<td>The business model canvas</td>
<td></td>
</tr>
<tr>
<td>Team presentations</td>
<td>Team presentation of current business model and digital innovation idea</td>
</tr>
<tr>
<td>The lean start-up</td>
<td>Pre-reading and podcast on LMS and Google Drive Individual blog 1</td>
</tr>
<tr>
<td>Scrum versus lean</td>
<td></td>
</tr>
<tr>
<td>The worker of the future</td>
<td></td>
</tr>
<tr>
<td>Team presentations</td>
<td>Project initiation document and presentation</td>
</tr>
<tr>
<td>Peer review feedback presentation</td>
<td>Peer review report Individual blog 2</td>
</tr>
<tr>
<td>Team progress and plans</td>
<td></td>
</tr>
<tr>
<td>Quiz</td>
<td>Pre-reading and podcast on LMS and Google Drive</td>
</tr>
<tr>
<td>Team progress and plans</td>
<td></td>
</tr>
<tr>
<td>The future of work</td>
<td></td>
</tr>
<tr>
<td>Team progress and plans</td>
<td>Teams present their current status and receive feedback from lecturer and other teams Individual blog 3 Individual presentation via a digital/photo story</td>
</tr>
<tr>
<td>Individual presentation</td>
<td></td>
</tr>
<tr>
<td>Final team presentation and project report</td>
<td></td>
</tr>
</tbody>
</table>

During the third phase of the DBR study, the draft design principles were tested and refined in three iterations over a period of two years.
4.1 Data collection

Design-based research supports the collection of qualitative and/or quantitative data in cycles of several weeks, semesters or years. This study used multiple data sources to ensure that evidence on the success of the design principles was collected from multiple angles.

During each iteration, data was collected from a student survey and from student blogs. Students were asked to fill in a survey on Google Forms at the start of the semester to test their perceptions prior to the course (Survey 1), and again at the end of the course to test their perceptions on the outcome of the course (Survey 2). The survey questions were adapted from the Student Success Toolkit (George, 2015) using a five-point Likert scale. The knowledge tested in the survey stems from the framework by Kereluik, et al. (2013), as illustrated in Figure 1.

The results provided the students’ perceptions of their capability development throughout the semester. All survey and reflection responses were transferred from Google to Excel spreadsheets. Students had the option of participating in the survey, with no consequences if they selected the option not to participate. An example of the survey can be viewed at https://forms.gle/xpUdD7pp65Aibz1p6

Students were further required to subscribe to a blog and submit three blogs during the semester. They could use any open source blog site such as WordPress. The blog posts were used as a space where they could reflect on their own progress during the semester, and they were also encouraged to share their experiences with other students, who could give feedback to them. The blog posts also included additional aspects, such as a personal inventory of their own strengths, weaknesses, opportunities and threats, emotional intelligence, personality and values. They were also asked to reflect on their journey in the first few years once they left the university, and what they wanted to achieve in the future. For an example of a student blog, see https://keanu341.wordpress.com/

The first iteration was with a group of 43 students registered for a postgraduate course in Information Systems (IS). The second iteration took place with a group of 40 third-year IS students during the second semester of 2016, and the third iteration took place with 40 third-year IS students during the second semester of 2017. The study obtained ethics clearance from the university's Research Committee prior to the commencement of the research.

4.2 Data analysis

Data analysis applied a mixed-methods approach to test the skills sets acquired by the students via a regression analysis and thereafter through a qualitative analysis of the student blogs. The regression analysis determined the relationships among nine variables (Figure 1) obtained in the survey results, and applied student assessment scores as the dependent variable. The analysis tested the reliance on certain skills during an initial assessment and again at the end of the course.

The analysis helped to identify the skills that were statistically significant using the p-value to test the null hypothesis. The null hypothesis estimated that all slope coefficients equal zero, with the alternative hypothesis projecting at least one of the slope coefficients not equal to zero. The hypothesis was rejected if at least one of the independent variables explained the value of the dependent variable by reviewing the p-value. If a variable has a low p-value (< 0.05), it indicates that the null hypothesis can be rejected and the variable therefore is a meaningful addition to the framework (Horton and Fitzmaurice, 2004).

The findings from the blogs were analysed to identify the themes, which were coded according to the nine skills sets (Figure 1). The first letter of the students’ names and the first letter of their surnames were used as pseudonyms to record the student answers, and a number was added to indicate the iteration. The researcher was actively involved in the data gathering in order to keep the data as close as possible to the actual events. The steps prescribed by Miles and Huberman (1994) with which to systematically organise the data were applied in the qualitative data analysis. These steps are the following:

- Reflecting on the data, organising and finding emerging patterns.
- Coding data in relation to the skills sets and sorting into potential themes.
- Applying an iterative approach, as prescribed in the DBR approach, which enables the researcher to develop a deeper understanding of the phenomenon as richer concepts emerged.
All datasets were analysed to look for patterns and similarities in the responses to ensure that they represented the views of the entire group.

5. Results

5.1 Quantitative analysis

As described above, students completed two surveys – one at the start of the course and one at the end to test their perceived development during the semester. The findings from the regression analysis to test the students’ skills development across the three iterations are illustrated in Table 3.

Table 3: Regression results

<table>
<thead>
<tr>
<th>Knowledge creation</th>
<th>Iteration 1: P-value</th>
<th>Iteration 2: P-value</th>
<th>Iteration 3: P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
</tr>
<tr>
<td>Foundation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Core content</td>
<td>0.034</td>
<td>0.764</td>
<td>0.325</td>
</tr>
<tr>
<td>Digital / ICT</td>
<td>0.231</td>
<td>0.701</td>
<td>0.756</td>
</tr>
<tr>
<td>Cross-disciplinary</td>
<td>0.050</td>
<td>0.407</td>
<td>0.003</td>
</tr>
<tr>
<td>Meta</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication / collaboration</td>
<td>0.320</td>
<td>0.898</td>
<td>0.410</td>
</tr>
<tr>
<td>Problem-solving / critical thinking</td>
<td>0.351</td>
<td>0.706</td>
<td>0.814</td>
</tr>
<tr>
<td>Innovation / creativity</td>
<td>0.117</td>
<td>0.047</td>
<td>0.803</td>
</tr>
<tr>
<td>Human</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life / job skills</td>
<td>0.493</td>
<td>0.516</td>
<td>0.040</td>
</tr>
<tr>
<td>Emotional intelligence</td>
<td>0.152</td>
<td>0.626</td>
<td>0.792</td>
</tr>
<tr>
<td>Cultural competence</td>
<td>0.437</td>
<td>0.811</td>
<td>0.639</td>
</tr>
</tbody>
</table>

Highlighted areas: p-value (< 0.05)

The values that stand out in the first and second survey are highlighted to indicate the skills that were statistically significant. This indicates that the students had an accurate perception of knowledge creation in the assessment pertaining to those skills, and furthermore that those skills were being assessed.

Foundational knowledge, as depicted in Figure 1, consists of core content, digital/ICT and cross-disciplinary knowledge. Core content knowledge, coupled with academic achievement, is frequently cited as an essential skill in the 21st century (Kereluik, et al., 2013). The content required to teach digital business innovation, as shown in Table 2, was analysed during the different iterations to test the validity thereof. Digital and ICT knowledge include, for example:

- New media literacy to critically assess and develop content that uses new media forms, and to leverage these media for persuasive communication,
- Cognitive load management, or the ability to discriminate and filter information by importance and to understand how to maximise cognitive functioning using a variety of tools and techniques, and
- Virtual collaboration, to work productively, to drive engagement and to demonstrate presence as a member of a virtual team (Davies, Devin and Gorbis, 2011).

Cross-disciplinary knowledge integrates information across different fields or domains, thus the need for the ability to understand, organise and connect vast amounts of information (Kereluik, et al., 2013).

Course design enabled students to apply the core content knowledge to a practical project, and to create tasks and assessments that facilitate the application of cross-disciplinary knowledge that they had obtained within the broader framework of their overall studies. Students need to be able to track changes in technology and to be familiar with the applications of new technology within a business environment. As such, students had to develop a digital innovation using a variety of potential technological solutions within an organisation.
In a review of the results from the regression analysis, foundational knowledge pertaining to core content and cross-disciplinary knowledge showed the most significance at the onset of the three iterations. When the survey was completed at the end of the semester, core content showed a statistical significance in iteration two and three. This is an improvement on the first iteration, because core content was still a significant skill in the final assessment. Interventions were undertaken after the first iteration to introduce design thinking. By following a design-thinking approach, students became involved in a process of collaboratively solving complex, real-world or wicked problems. A further advantage of this approach is the strong focus on collaboration and teamwork, as well as the cultivation of empathy and social interaction within the rollout of the design process (Koh, et al., 2015). Design thinking provided students with a much clearer idea in terms of the stages and rollout of their capstone projects.

**Meta-knowledge** is knowledge needed “to act” using creativity, innovation, problem-solving, critical thinking, communication and collaboration. This is the process of working with foundational knowledge.

Creativity and innovation can be encouraged via a wide range of ideation exercises, such as brainstorming. Students had to create a number of new ideas that could be useful, and then follow a process of analysing and refining the ideas to those that are appropriate for the client’s business.

The students collaborated to develop, implement and communicate new ideas within teams and to share these with other teams. It is important to encourage students to be open and responsive to new and diverse perspectives and to incorporate input and feedback. Assessments had to be designed to facilitate this process and to reward originality and inventiveness in work, whilst simultaneously testing for the feasibility of the project to make a tangible and useful contribution to the business partners. Mistakes during the process had to be accommodated, because failure is an opportunity to learn. Creativity and innovation are often a long-term, cyclical process of small successes and frequent mistakes (P21, 2019).

Problem-solving and critical thinking can be interpreted as the ability to make informed decisions based on information to resolve a specific problem or to achieve a specific end goal (Kereluik, et al., 2013). In order to achieve this, students had to be able to analyse and evaluate evidence, understand alternative points of view and make connections between information and arguments. Conclusions had to be drawn based on the best analysis, and students were required to reflect critically on learning experiences and processes.

Communication and collaboration can be seen as the ability to clearly express oneself via oral, written, nonverbal and digital means, and to interact respectfully with diverse audiences. Collaboration further requires flexibility, willingness to participate, and recognition of group and individual efforts and success (Kereluik, et al., 2013). In order to develop these skills in students, authentic tasks and assessments were developed to demonstrate that these skills had been acquired.

The results show that students had an accurate perception of the requirement for creativity and innovation in the final assessment using their core content knowledge. The fact that more skills sets did not show a statistically significant outcome during the first two iterations points to the fact that the course design required refinement. In the first two iterations, students could select their own partners from a particular industry, i.e. creative industries. In the third iteration, students were allocated to entrepreneurs within start-ups who were selected from a business incubator. Students felt more empowered to work within the start-up environment because there was less of a hierarchy within the organisations and the student teams were seen as valuable contributors.

**Human knowledge** includes life and career skills, emotional and ethical awareness, and cultural awareness.

Life and career skills encompass aspects such as flexibility and adaptability to change in terms of different roles, jobs or responsibilities. Students need to develop initiative and self-direction in order to function in a climate of ambiguity. As discussed, the future world of work requires a commitment to lifelong learning.

Emotional and ethical awareness requires individuals to be able to imagine themselves in someone else’s position and to engage in ethical decision-making (Kereluik, et al., 2013). In the future world of work, individuals will require the ability to form a deep understanding of human emotions and to be able to interact...
successfully with other humans. In this world of work, autonomy, machine learning, artificial intelligence, etc. will become part of daily life, stressing the importance of interpersonal skills.

Cultural competencies expand with effective communication and collaboration to include an appreciation of the ideas and emotions of all types of individuals (Kereluik, et al., 2013). The diversity of the South African cultural landscape, coupled with the impact of globalisation on the workforce, requires these competencies in our future workforce.

The results obtained for the perceived development of human knowledge showed a significant improvement in the third iteration. This can be attributed to changes in the choice of industry partners and to more explicit instruction in EQ and ethics in the course. To improve the development of human knowledge, students were required to do personality tests and EQ tests and write about the findings in their blogs.

5.2 Qualitative analysis of student reflections

The reflections from the student blogs were analysed to validate the findings from the quantitative data as they pertain to skills development. From each student’s blog, evidence of their personal reflections was organised according to foundational knowledge, meta-knowledge and human knowledge (Figure 1). This occurred during each iteration to assist in identifying the areas that needed to be improved upon. The findings are summarised in the sections below, and illustrated by extracts from student blogs.

5.2.1 Foundational knowledge

The incorporation of design thinking to assist teams with the development of innovations in collaboration with industry partners from the second iteration was cited by students as very beneficial, as it assisted with the retention of their core content knowledge. One of the students had the following to say about the value of design thinking during the second iteration:

“What really interested me was the design thinking process to help me understand the content. It made me look at how to be creative or incorporate creativity when thinking about things from a business and IT perspective. It showed me how to address problems from a new point of view and be more liberal when it came to finding solutions to problems. (FA2)

Cross-disciplinary knowledge is a requirement for all study areas in which one wants to future-proof the curriculum. The development thereof was facilitated via group work and interaction with industry partners from the onset of the course. As depicted in Table 3, these skills sets were drawn on from the start of the course. A quote about the students’ experience regarding this engagement highlights this:

“I have always worked in groups, but the group work we did in this course was different to what I’m used to, it was much more practical and it reflected the work environment more than the usual group work we did. I think this is because this time we actually worked with a real business, which gave us a real professional feel. (AS3)

Findings from the quantitative analysis did not show a significant improvement in ICT/digital skills. Although the students were required to develop blogs using an online platform, other aspects, such as the use of wikis, digital stories and similar assessments that require digital techniques, can also be incorporated into the design.

For example, students can be tasked with creating their own websites for their blogs and encouraged to use graphics, video clips and other multimedia. However, working in a team and being tasked to develop a system exposed the students to more advanced digital and ICT knowledge, as comments from some students show:

“I had no prior technical experience when developing an actual system, just theoretical knowledge; the main assignment has helped me to develop some programming and developing skills with regard to a system. (SM1)

What I enjoy more is that we are doing practical work, which prepares us for life after this course; the tasks done in this course help us to be more creative/innovative and help us to gain some technical skills that will work to our advantage in the workplace. (ND2)
During the assignment preparation I have grown interested in programming. After learning that our group could not provide an application for our client, I have started looking at many ways to develop an application and I am in the process of learning about HTML. (KM3)

5.1.2 Meta-knowledge

An analysis of the quantitative data pointed to discrepancies in the perceived development of communication and collaboration skills, as there was no statistically significant improvement over the three iterations. From a review of the feedback, it can be surmised that a big factor that contributed to this was the expectations of students of working as a team. This was a big learning curve for many students, as the following extracts show:

I must first say it has not been a very easy road because I had to work with people I did not know who have different personalities and attitudes. However, I have learned a lot during this project about myself it showed my strongest character as I need to be able to handle different issues and working under pressure. I am very thankful of the knowledge I have received in this project as I will use it for future endorsement and apply it on the actual working environment. (NW2)

By doing this assignment I have learnt the importance of teamwork and being a team player. As team members we had to improvise and put aside any personal agendas especially those that would sabotage the success of this project. Being in a group and working as a group, I believe it prepares us for the working or the corporate world. It is essential that we are aware of each other’s strengths and weaknesses and be able to accommodate each other. (DM3)

The cultivation of creativity and innovation was stimulated via the encouragement of students to experiment with different solutions and to present the findings to their facilitator and peers. Teams received feedback on their progress and were encouraged to change, update, and start brainstorming again if required. An environment needs to be created in which student teams are encouraged to experiment, make mistakes and learn in order to cultivate creativity. Findings from the quantitative analysis pointed out that this area showed a statistically significant improvement across the three iterations. In an analysis of the student blogs it was also cited by students as an important factor in their perceived skills development:

Personally this course has taken me out of my comfort zone and taught me how to think creatively, as well as that no idea is a stupid idea. During one of the teachings in the lectures, our lecturer said that “think of any idea and put it in a sticky note, it does not matter what it is just put it in a sticky note and stick it to the board” it was amazing to know that whatever idea that one has in class won’t be posed as a stupid idea. This is one of the reasons that I enjoy and find this module interesting. (AB2)

I enjoyed that we had to think outside the box and had no limitations when brainstorming. The solutions to the company’s problem had to bring value to the business but also consider the capacity we have as full-time students. A final solution or conclusion was reached by funnelling all the ideas. (TT3)

Opportunities need to be provided for students to find their own solutions, as this learning environment encourages students to solve problems using a variety of resources. The students were unfamiliar with this type of learning and needed some coaching to immerse them in the projects. In the third iteration, different industry partners were chosen and this proved to be beneficial to students in the development of their critical thinking and problem-solving skills. One of the students said the following:

What I enjoy the most and interest me the most is that the course challenges me to think out of the box and to constantly find new solutions to problems that some organisations are facing on an operational level. (BM3)

5.1.3 Human knowledge

During the first two iterations, the cultivation of human knowledge was problematic, specifically for the development of emotional intelligence (EQ) and cultural skills. An intervention undertaken was to include more exercises to build awareness and to partner students with entrepreneurs within start-ups to cultivate life and job skills. During the final iteration, learners were made aware of EQ, and time was spent during one
lecture to conduct a test and discuss individual findings. Learners were further encouraged to do another online assessment and to report the findings in their reflective blogs.

*I think knowing your type of emotional intelligence or the way in which you handle situations can go a long way in finding what you need to improve about yourself, how you approach others and how you justify your actions. It is important to have an understanding about yourself for peace of mind and to enable you to find your life purpose or life path. (MB3)*

During the third iteration, a more focused approach was followed to make the learners aware of their social imprint, and the choice of industry partners further facilitated the process. Time was also devoted during lecture hours to give instruction on the importance of listening and empathising, as highlighted by students in their blogs.

*I learned or acquired interpersonal skills in the sense that in class for example we have different people of all races and ethnicity. In order to have a comfortable learning environment, I had to understand, view and feel how the next person was thinking, and how to handle conflict especially. That is in new skill I can say is a game changer for me. (SZ3)*

*I acquired the skill to listen to what the next person has to say and actually view things from someone’s perspective and ideology. This has improved my life drastically as I now am able to actually take in criticism without taking offence to what was said. (MM3)*

As described above, the analysis of data during the third phase of this DBR study resulted in a process of testing and refining the design principles. After the third iteration, the draft design principles were updated according to the results. The results show the positive impact on student learning and the growth of an innovative culture amongst the students who participated in the courses during the three iterations.

6. **Phase 4: Updated Design Principles**

Once the learning design had been implemented and refined within iterative cycles, the final phase of the DBR study was to reflect on the process and to produce principles that can be applied for future development and implementation decisions (Herrington, et al., 2010).

The design principles need to contribute to the existing knowledge base to provide other practitioners with practical guidelines for implementation in similar interventions. The principles need to further assist future research to address complex educational problems. The draft design principles created in the second phase, as depicted in Table 1, were refined and updated during the three iterations, resulting in the updated design principles depicted in the Table 4.

<table>
<thead>
<tr>
<th>Table 4: Updated design principles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Principle 1</strong></td>
</tr>
</tbody>
</table>
| Requirements | Student teams should be selected prior to the commencement of the course, and selection from different disciplines per group is recommended.  
Facilitation by the lecturer during lectures to review and encourage participation by individual members, and to monitor potential conflict in teams. Allow teams to resolve their own conflicts and provide some scaffolding where required. Only intervene and mediate when the situation becomes untenable.  
Use a blended learning environment to encourage online collaboration, as well as face-to-face collaboration.  
Assessments need to include the monitoring of collaboration by team members, along with their overall work ethic. |
| Update | The requirements were refined from those described for the initial draft design principle. |
| **Principle 2** | **Create a learning environment that encourages adaptability and flexibility by encouraging experimentation** |
### Requirements

Innovation requires the participants to be willing to fail and to try other options. Encourage this via formative assessment of the tasks that culminate in the capstone project.

Focus on the process followed and not on the initial outcomes, to allow students to learn from mistakes and refine the final product.

Apply design thinking to encourage ideation, and brainstorming to allow learners to become more accustomed to experiment and change course if required.

Assessments should actively involve feedback mechanisms in the rubrics to increase student motivation and active involvement.

Apply multi-modal pedagogies to allow for free design to take place.

Both the lecturer and the students need to learn to embrace the uncertainties and open-ended nature of design problems, and to learn to accept failure. The lecturer should stress the importance of productive failure and assist students to correct prototypes and encourage them to try new things and new ways of doing.

### Update

The principle was moved from the fifth principle in the draft design to the second principle.

The initial draft principle was, “Allow for mistakes to happen”. This was updated to better describe the principle and to replace “mistake” with “experimentation”.

The requirements were also refined to better describe the learning interventions.

### Principle 3

**Implement a formal process of reflection**

#### Requirements

Students should be given the option to do this via a blog or via a website or vlog.

Provide guidelines via rubrics on content to be included in the reflections, such as weekly discussions on what has been learned, and what was good, bad and ugly. Include exercises to make students more comfortable with innovation and experimentation via creative expression. For example, allow them to reflect on futurist scenarios and find solutions for issues focused on equality, sustainability, social justice and ethics.

Include tasks in which students need to reflect on the challenges that technological and environmental transformations are posing for their own future.

Lecturer and peers must provide formative feedback to the students on their reflections during the semester, and the formal assessment of all reflections (blogs) should occur at the end of the semester.

#### Update

The principle was changed from “Implement exercises that encourage reflection” to “Implement a formal process of reflection”. This made the principle more tangible and ingrained it in the course design.

The requirements were also updated to reflect this change and to provide better guidance in terms of the implementation thereof.

### Principle 4

**Enable the development of ethical awareness**

#### Requirements

Make students aware of their effect on society and take them through the process of design thinking, where they start with user needs and combine user stories with empathy maps and/or personas. They need to become aware of the wider imprint that they have on society, as well as that the user can be human or nonhuman, along with the systemic implications thereof.

They then have to follow the processes of prototyping and testing, and repeating the process where required.

Students need exposure to their overall impact on the design process with industry partners, so as to consider ethical implications such as justice, equity, privacy, autonomy, safety and security, sustainability and wellbeing, amongst others.

#### Update

This principle was added when it became evident that humanistic knowledge was not adequately developed within the course design. The third iteration included more exercises on EQ and ethics, and it was after this iteration that the principle was added to the final design.

### Principle 5

**Implement integrated, authentic assessments**

#### Requirements

Teams should be involved in a capstone project that is rolled out over the course of a semester. The project should consist of multiple tasks that build onto one another.
Student teams must present their progress with their projects on a regular basis during class. Feedback must be provided per presentation to point out possible pitfalls and to afford students the opportunity to update accordingly. Peers should also be involved in the feedback process to open up the conversation and to allow an environment of mutual learning and sharing.

Feedback that is substantive and informative should be provided, rather than feedback that is comparative or competitive.

Feedback should be provided that models how to incorporate evaluation, including identifying patterns of errors and wrong answers, into positive strategies for future success.

**Update**

This principle was added to combine the second and third draft design principles in Table 1. These principles were too vague and did not contain stringent requirements for the design of the learning environment.

**Principle 6**

**Apply project-based learning to combine inquiry with accountability**

**Requirements**

- Require learners to do a team-based project with organisations within their community during which they are required to implement a real solution/polished product.
- The project ought to be broken down into a number of tasks that culminate in the finished project. Learners get formative feedback during this process to enable them to rework solutions and create a more polished product.
- Encourage a focus on social awareness.
- Have a strong emphasis on ethical business practices.
- Partner with entrepreneurs, preferably with start-ups, to encourage mutual, collaborative problem-solving and learning.

**Update**

The requirements were updated to provide more guidance and direction for the design of a learning environment that will facilitate knowledge creation.

7. **Conclusion**

This paper explored the complexities that a digital world of work poses to knowledge workers. The need to anticipate trends and prepare for future skills requirements to prepare university learners for this uncertain future was emphasised.

To address the misalignment between what is taught in formal education versus what is required in an innovative, digital world, the paper reviewed the evolution of employment. Thereafter, the potential knowledge frameworks to achieve 21st-century learning were analysed. The skills sets that were explored include core content knowledge, digital skills, cross-disciplinary skills, communication, collaboration, problem-solving, critical thinking, innovation, creativity, life and job skills, emotional intelligence and cultural competence.

The teaching and learning environment needed to enable digital innovation skills to support knowledge creation was explored, and the application of an authentic learning environment was foregrounded. The study developed draft design principles that were tested and refined over a period of two years in three iterations.

The paper concludes with recommended design principles for a teaching and learning environment that will enable the cultivation of innovation skills to strengthen knowledge creation in a digital world.

**References**


Abstract: A majority of the activities performed in higher education institutions are routines that need to be learned, remembered and refined for improvement. These include academic and administrative tasks that are central to the proper functioning of the institution. In addition to this, as any business, higher education institutions need to compete and innovate at a time when their performances are measured in detail by their management, students, governments and other external bodies. Staff members in various roles often become familiar with certain routine tasks. Although an institution may rely on these members and others who master a particular activity whenever needed, there is no guarantee that staff members or even teams will stay with the institution. Therefore, it would be necessary to ensure that institutional knowledge does not become synonymous with individual staff members and, therefore, the knowledge is available only when these individuals are present and absent when they are away. This paper looks into how higher education institutions can enhance their knowledge sharing practices by cultivating social capital among its employees. It employs a set of semi-structured interviews to gauge the attitudes of employees of two institutions in Saudi Arabia. This is complemented by a literature survey looking into how social capital theory is adapted by earlier researchers in the area of knowledge sharing. The findings indicate that trust, social interactions, participation and rewards have strong influence in knowledge sharing.

Keywords: social capital, higher education, knowledge sharing, Saudi Arabia, socialization, trust, participation, rewards

1. Introduction

The purpose of this paper is to investigate the relationship between knowledge sharing in Higher Education Institutions (HEIs) and the social capital within these institutions. It adopts a case study approach and its data is collected from two governmental colleges in the eastern province of Saudi Arabia. The two colleges offer various degree programs and have staff members of diverse countries of origin, academic disciplines and religious backgrounds. They come under the same administrative umbrella and share some services and resources but are managed differently. The colleges will be identified as College A and College B in this paper.

The research does not aim to compare the two institutions therefore the data collected will not be identified separately.

Although previous literature elaborated on the relationship between knowledge sharing and social capital, the link of these two to the higher education has not attracted much attention from researchers. Therefore, this paper focuses primarily on two main questions: does strengthening the social capital in HEIs affect how employees share knowledge? And, is it possible to measure social capital in organizations? It adopts a qualitative approach and employs a set of semi-structured interview as its data gathering technique and the results are analysed using simple thematic analysis. Qualitative research best serves when studying cultural and social aspects of organizations (Myers 2013).

Organizations create knowledge by absorbing information from their working environment or from external sources and transforming it to knowledge. Whatever the source of knowledge, it needs to be stored, codified and applied to make it useful to the organization. In addition to that, it is necessary to make this knowledge available to the relevant users. It is here that the organization needs to have clear knowledge sharing policies that can be put into operation. Globalized organizations and those with geographically distributed teams and processes may further need to streamline their knowledge across their various locations.

Knowledge sharing can be described as the most central of all activities through which employees can contribute to knowledge application, innovation and, ultimately enable their organization to be more competitive in its field (Wang & Noe 2010). It would be relatively meaningless to an organization if every employee has to create, codify and store his/her knowledge for his/her future use. Similarly, if every team
managed their knowledge for the sole use of their own members, it would be insignificant for the overall success of the organization.

A vital prerequisite before any knowledge sharing activity can take place is the existence of a group of people with knowledge to share. Therefore, knowledge sharing is primarily a social activity. The theory of social capital emphasizes the importance of social networks as capital.

This research looks into the relationship between social capital and knowledge sharing in higher education institutions (HEIs).

2. Literature Review

Several studies have attempted to conceptualize social capital theory into measurable dimensions. Nahapiet and Ghoshal, (1998) suggest three clusters of social capital: the structural, relational and cognitive dimensions.

The structural refers to the properties or the patterns of the social network. It includes identifying who communicates to who and how, the easiness of joining a network, and the configuration of the network, (Narayan & Cassidy 2001). On the other hand, the relational dimension includes the type of relations members have developed through their history of interactions. Examples of these include the respect and friendship that develops among staff members through their use of a knowledge sharing network. The last cluster, the cognitive dimension, points to the resources that provide interpretations and meanings among members of a network like shared language and shared narratives.

Previous literature indicates that when members of a community facilitate knowledge sharing, their mutual aid creates new knowledge. This leads more members to engage in mutual aid. However, since the knowledge created by the mutual aid is available to all members, this gradually erodes the need for mutual aid (Araujo & Minetti 2011). Through the structural dimension of the social capital, which entails social interaction, members can share tacit knowledge. Individual or group interactions would enable members to engage in a conversation that leads to the less knowledgeable member gain knowledge and skills. During the first periods of the group formation, individuals may not know each other’s potential and hence the level of ‘trust’ among members may be low. However, over time, frequent interaction among members will strengthen the social bonds among members and the relational dimension of social capital will develop and employees will be more willing to share or seek knowledge from other members that they deem trustworthy (Tsai and Ghoshal, 1998; Chang et al., 2012). This prolonged interaction will also result in the development of trust, where actors behave trustworthy as the expectation of incentives and prospects for opportunism diminish, (Jong and Klein-Woolthuis, 2004). It also increases the norms of reciprocity, and the shared identity among members, (Filieri et al., 2014).

The cognitive dimension indicates the existence of a shared cognition among members. This shared understanding will enable employees to exchange knowledge with relative ease. The cognitive social capital minimizes the potential for misunderstanding among members during knowledge sharing interactions (Hu & Randel 2014). Departments, teams or even individual employees of an organization possess knowledge that is necessary for their work. That same knowledge is also required by others who perform similar activities in the organization. When organizations encourage and facilitate bridging the gaps in the network structure, the privately held knowledge will become accessible to all, and hence, the overall organizational performance, value creation and its competitive prowess will improve. As members develop their social bonds, they voluntarily manage organizational knowledge with limited or no incentives or monitoring mechanisms. Social capital therefore replaces the formal contracts that are otherwise required to foster knowledge management (Hoffman et al. 2005).

In research focusing on European social capital, Oorschot and Arts, (2005) identify three measurable dimensions of social capital: networks, trust and norms. As these researchers were targeting ‘societies’ rather than business ‘organizations’, some of the terms they use as yardsticks for measuring social capital may not be applicable to organizations.
2.1 Measuring Social Capital

An apparent problem with social theories is the difficulty in devising a mechanism to measure them. This is more evident in the way researchers of the theory of social capital struggle to develop a stable list of measurable indicators for the theory (Enfield and Nathaniel, 2013). These theories include abstract concepts that are difficult to translate into operational measures, (Narayan & Cassidy 2001). However, several researches have tried to find a way to propose a measurable framework of constructs to social capital, (Grootaert, 2003; Gaag and Snijders, 2005; Siegler, 2015; Engbers, Thompson and Slaper, 2017). Table 1 below shows these proposed constructs.

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Constructs</th>
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<tbody>
<tr>
<td>Siegler, 2015</td>
<td>Personal Relationships</td>
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<tr>
<td></td>
<td>Social Network Support</td>
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<tr>
<td></td>
<td>Civic Engagement</td>
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<tr>
<td></td>
<td>Trust and Cooperative Norms</td>
</tr>
<tr>
<td>Narayan and Cassidy, 2001</td>
<td>Group Characteristics</td>
</tr>
<tr>
<td></td>
<td>Generalized Norms</td>
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<tr>
<td></td>
<td>Togetherness</td>
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<tr>
<td></td>
<td>Everyday Sociability</td>
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<tr>
<td></td>
<td>Neighborhood Connections</td>
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<tr>
<td></td>
<td>Volunteerism</td>
</tr>
<tr>
<td></td>
<td>Trust</td>
</tr>
<tr>
<td>Grootaert et al., 2003</td>
<td>Groups and Networks</td>
</tr>
<tr>
<td></td>
<td>Trust and Solidarity</td>
</tr>
<tr>
<td></td>
<td>Collective Action and Cooperation</td>
</tr>
<tr>
<td></td>
<td>Information and Communication</td>
</tr>
<tr>
<td></td>
<td>Social Cohesion and Inclusion</td>
</tr>
<tr>
<td></td>
<td>Empowerment and Political Action</td>
</tr>
<tr>
<td>Engbers et al., 2017</td>
<td>Social trust;</td>
</tr>
<tr>
<td></td>
<td>Formal membership and participation in groups</td>
</tr>
<tr>
<td></td>
<td>Altruism</td>
</tr>
<tr>
<td></td>
<td>Informal interaction among individuals</td>
</tr>
<tr>
<td></td>
<td>Shared norms</td>
</tr>
</tbody>
</table>

The above elements can be grouped into three main items of social capital: **socialization** (personal relationships, social network support, group characteristics, togetherness, everyday sociability, neighborhood connections, groups and networks, social cohesion and inclusion, Informal interaction among individuals) **trust** (Trust and Cooperative Norms, trust, Trust and Solidarity, Social Trust) and **participation** (Civic Engagement, Volunteerism, Collective Action and Cooperation, Empowerment and Political Action, Formal membership and participation in groups).

This research also adds two more elements in the measurement: the expectation of rewards (Flap and Boxman, 2001; Giudici, Guerini and Rossi-Lamastra, 2018) and the attitude to knowledge sharing (Esmaeiltadheh et al., 2015; Tangaraja et al., 2015).

2.2 Social Capital in Organizations

Organizations, including academic institutions, require its members to share knowledge with other members in the wider organization or within a close team. In such an environment, the theory posits that the members of a group will promote collective goals over individual interests. This assumes every individual understands that improving the overall group performance will also improve his/her individual status. Researchers like Ju, Chen and Ju, 2006; Lin, (2006) found that people are more likely to share their knowledge when knowledge sharing enhances their social network. According to Lesser (2000a), one of the drivers of the interest in social capital is the rise of knowledge-based organizations. He argued that as knowledge moves to replace the traditional production factors; land, labor and capital as the primary source of competitive advantage, organizations realize the importance of creating new knowledge, share the existing knowledge and apply the organizational knowledge. As such, strengthening social bonds within the members of staff becomes of paramount importance. The management style of the organization and the culture within the team may shape...
how individual members of staff perceive their position in the group and how they react to other members’ actions.

Furthermore, the literature indicates that one of the embedded values of social capital is that it facilitates the flow of information (Lin, 1999).

The theory of social capital attempts to explain how the relationships between the members of a group exerts influence in how they behave in organizations, including academic institutions.

Although academic environments are thought to be the hub where knowledge is created, aggregated, and shared, ensuring that the culture within the institution is conducive to knowledge seeking and sharing is vital. Moreover, setting effective knowledge sharing policy and procedures is also necessary for the smooth flow of institutional activities.

Social capital is also found to give researchers at academic institutions access to the resources they require for success (Angervall, Gustafsson and Silfver, 2018). Novice academics, therefore require to actively build ‘academic capital’ by joining networks to become familiar with the ‘trade secrets’ and start gaining symbolic or material capital (Maritz and Prinsloo, 2015). These networks allow academics to share knowledge and other valuable resources and it is possible for HEI management to tap into the various group connections and use them as a knowledge sharing vehicle.

2.3 Knowledge sharing

The routine work activities in higher education enable employees to extend their knowledge. In other words, they learn from their actions. Although such knowledge forms in the minds of employees (Nonaka, 1994), their interaction with their colleagues strengthens their knowledge and often transfers the knowledge from the personal domain to the organizational domain.

Nonaka proposed a model showing how different types of knowledge could be transferred from source to destination. The premise of this model is that knowledge is either explicit or tacit. Explicit knowledge is the knowledge that can be codified (Smith, 2001; Mathiassen, 2003), uttered and captured in drawings and writing (Nonaka and Krogh, 2009) documented and transmitted (Sajjad Jasimuddin, JH Klein, 2005), can be expressed directly in terms of rules, data or knowledge representations (Moss and Kubacki, 2007). On the other hand, tacit knowledge is defined as the knowledge that is unstructured, implicit, not self-evident and cannot be expressed, difficult to transfer (Sharon Ryan and O’Connor, 2013), and attached to person’s mind (Panahi, Watson and Partridge, 2013).

The four modes of transfer or conversion proposed by Nonaka are as follows: knowledge can be converted from tacit to another tacit through socialization. This is where the two individuals interact so that the less knowledgeable learns skills and experience from the more knowledgeable one. Coaching and mentoring are examples of the methods through which socialization can take place.

The second mode is when tacit knowledge is converted into explicit knowledge through externalization. This requires the individual that owns the tacit knowledge to articulate their views, ideas and mental images to make them understandable to others. When knowledge is transferred from manuals, documents and any explicit form to a new person, this is called internalization. This mode is where information technology is most helpful.

The last part of Nonaka’s model of knowledge conversion is combination whereby explicit knowledge is converted into a different form of explicit knowledge by expanding or reconstructing it.

If knowledge is constructed meaning, what is it that is transferred from a person to person? Matthews and Shulman (2001) argue that the notion of transfer is more relevant to information than knowledge. If knowledge is constructed by the individual based on the information they receive, it would then be difficult to share knowledge, rather, what is transferred from individual to individual is actually the information and not the knowledge. It is, however, hard to differentiate between knowledge and information in the sharing context (Alavi and Leidner, 2001; Zins, 2007).
3. Methodology

This research employs qualitative data collection and analysis techniques. It attempts to study the higher education employees and their attitudes about knowledge sharing. As employees interpret their organizational environment to form their attitudes, qualitative research was thought to be the most relevant approach to study human behaviour (Jovanović, 2011; Hammarberg, Kirkman and de Lacey, 2016; Flick, 2018). Semi-structured interviews were used to collect data for this study. Interviews are defined as planned, structured conversation between a researcher and a participant(s). In general, this method may be used in both qualitative and quantitative researches and it is useful when the interviewer wants to gather data about the background, experience and attitudes of the interviewee/s or when searching for sensitive information (Oates, 2005).

The purpose of the interview was to investigate the views of managers regarding knowledge sharing and the organizational culture. Managers are the decision makers in the organization and are therefore, a principal factor in any knowledge sharing initiative. Moreover, it is found that there is a link between the culture in the organization and attitudes of managers (Wang and Noe, 2010; Tangaraja et al., 2015). The interviewees were selected based on their job titles. The targeted managers were in a position to comment on the knowledge sharing activities of the teams they manage and how these activities are related the culture within the team or with the general organizational culture. Table 2 shows the targeted job titles and their responsibilities.

Table 2: Job titles and their responsibilities

<table>
<thead>
<tr>
<th>Job title</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department Chairperson (5)</td>
<td>Chairs department meetings, assigns tasks to staff members, monitors teaching/learning activities, resolves conflicts, sets staff development targets.</td>
</tr>
<tr>
<td>Chairperson of the Quality Committee (1)</td>
<td>Chairs committee meetings, sets policies and procedures for all college activities, ensures all programs and courses meet the criteria set by accreditation bodies, seeks accreditation for programs, ensures all activities comply with internal policies and procedures, and reminds staff about the quality cycle deadlines.</td>
</tr>
<tr>
<td>Course Director (8)</td>
<td>Sets and reviews course descriptions, ensures that courses are delivered according to the course description, writes course reports. Reviews the course material.</td>
</tr>
<tr>
<td>Program Director (3)</td>
<td>Designs and reviews degree plans, writes annual program reports.</td>
</tr>
</tbody>
</table>

Although the participants were interviewed under their current job titles, many of them held various managerial positions during their time as employees of this organization. This gives them a broad background knowledge to bring to the interview as they see events from different perspectives.

3.1 The interview structure

The interview contained 12 questions focusing on trust, socialization, organizational participation, rewards and knowledge sharing activities. The majority of the questions in the interview were open ended to allow interviewees to give the fullest possible answers to the questions. There were few questions that were worded in a manner that required a simple yes/no response, but they were often supported with follow-up questions if further clarification was needed. It was important to gain the confidence and the full consent of the interviewees before the interview started. The researcher therefore gave them the necessary information about the research and the reasons behind the interview. In addition to this, the interviewees received full assurances regarding their privacy and the confidentiality of their contributions. The interview questions were developed to address the five constructs outlined in the literature review. The questions were also tailored to the broad research question stated above.

Qualitative interviews can take various forms all of them allowing the interviewee to tell their narrative uninterrupted as postulated by Edwards & Holland (2013) who also propose the possibility of the researcher taking part in the discussion by sharing their own narrative especially when the interview is about a narrative shared by both sides. In this type of interview, the researcher is aiming to encourage the interviewee to discuss their narrative. The researcher and the participant are seen as co-producers of the narrative in such a situation. In the current research, although the interviewees and the researcher shared the same narrative as
they worked in the same organisation the researcher decided to avoid interrupting the flow of the interview by not sharing anything other than questions or necessary clarifications.

As found by Alawi, Al-Marzoqi and Mohammed (2007), trust, communication, rewards and organization structure positively influence knowledge sharing in organizations. The theory of social capital is also an important component in this investigation as we need to shape our enquiry under a theoretical foundation. As mentioned above, three main themes of social capital were identified: trust, social connection and active participation. Furthermore, the interview also looked into attitudes of staff towards knowledge sharing in general, rewards and their relationship with knowledge sharing attitudes.

A simple thematic analysis (Braun and Clarke, 2006) was used to categorize the interview responses. Statements recurring in the responses were grouped together to extract meanings conveyed by respondents. The original ideas expressed by respondents were used in this research instead of the implicit meanings usually discovered in in-depth thematic analysis (Vaismoradi, Turunen and Bondas, 2013). Table 3 below shows the list of questions contained in the interview:

**Table 3**: interview themes and questions

<table>
<thead>
<tr>
<th>Theme</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trust</td>
<td>To what degree you think staff members are willing to share their knowledge?</td>
</tr>
<tr>
<td></td>
<td>Do you have any programs that enhance intra/interdepartmental bonds?</td>
</tr>
<tr>
<td>Participation</td>
<td>How far do you consult the staff members you manage when developing policies or involve them in the policy making process?</td>
</tr>
<tr>
<td></td>
<td>Are there any mechanisms to encourage employees to voice their views in improving their work system?</td>
</tr>
<tr>
<td>Rewards</td>
<td>How far do individual performances contribute to staff rewards?</td>
</tr>
<tr>
<td>Knowledge Sharing</td>
<td>How do you connect your staff to other more knowledgeable people to solve problems?</td>
</tr>
<tr>
<td></td>
<td>How do you ensure that you do not lose your knowledge anytime a member of your staff leaves your organization?</td>
</tr>
<tr>
<td></td>
<td>How do you encourage your staff to refer to the available information when making decisions?</td>
</tr>
<tr>
<td></td>
<td>Do you have any policy or procedures to encourage staff to share the knowledge they create with other members of staff?</td>
</tr>
<tr>
<td>Socialization</td>
<td>Do you encourage or facilitate staff meetings outside working hours? Please explain further.</td>
</tr>
<tr>
<td></td>
<td>To what degree do you value social interaction among employees and its importance in organizational effectiveness?</td>
</tr>
</tbody>
</table>

4. **Findings and Discussion**

4.1 **Trust**

Trust has been found to have positive influence on knowledge sharing (du Plessis, 2006; Darmasetiawan *et al.*, 2013; Tong, Tak and Wong, 2015). The majority of respondents indicated the existence of ‘willingness to share knowledge’ among staff members they managed or worked with in this organization. Examples were cited where many new employees gained organizational knowledge without getting formal training or even initial orientation. Training and development do not only improve employees’ knowledge related to their routine work processes, but it can also be used to cultivate a culture of knowledge seeking and sharing. The lack of training and orientation may hamper the ability of the organization to learn and innovate (Babaahmadi, Hemmat and Poor, 2014), however, as the results of the interview show, the two organizations sampled for this research display a level of trust that motivates existing employees to continuously share their knowledge with their new colleagues as stated by the following respondent.

“In fact, I can’t remember any formal induction given to new staff members for the last three years, but they are doing fine. They teach, take assessments and follow procedures as anyone else. This is because we fully welcome everyone into the department and, without any formal procedures, ensure that new colleagues can do all their daily tasks with minimum errors.” Chairperson.
Reciprocal trust can be seen from the above description as the two sides need to believe in the benevolence and/or competence of the other before they engage in the knowledge sharing process (Wasko and Faraj, 2005; Moss and Kubacki, 2007; Evans and Evans, 2012). Trust nurtures an environment of cooperation and smoother interaction among the knowledge contributor and knowledge seeker (Hashim and Tan, 2015). One of the two institutions sampled for this study, College A is relatively new and is actively seeking national and international accreditation. This requires its different academic and administrative departments to collaborate and share information in support of its accreditation process. When one of the programs succeeds to receive accreditation, the same process can be applied to other programs. The reciprocal or mutual aid that develops among individual members, teams or departments is found to help the creation new knowledge (Araujo & Minetti 2011).

The majority of respondents indicate the lack of formal policy or procedures that is aimed at strengthening intra/inter departmental bonds. The interaction between members of staff within or outside the department/team stimulates knowledge sharing especially the type of knowledge that cannot be readily articulated or documented in manuals (Ryan & O’Connor 2013). Below is a response from one of the participants when asked whether they knew of any programs that encouraged inter/intradenartmental bonds:

“I don’t know any such program. But if you see how we work in the department, we are open to each other and I think the bonds are somewhat strong among colleagues. Again, we don’t have any formal thing to encourage us to interact with other departments, but some of my departmental colleagues are members of college committees and that is the closest we get to interacting with other departments. Obviously, in addition to proctoring examinations where all college staff come together in the exam hall and see each other or sometimes communicate.” Program Director/Chairperson

This again emphasizes the above mentioned culture where staff members voluntarily assist each other in acquiring knowledge. Although this culture of altruism shows to be effective in this organization, a weakness of such grassroots initiatives that are not supported by formal procedures is that it may take longer to bear fruits than when supported by top management (O’Dell & Leavitt 2004).

4.2 Participation

Enabling employees to participate and freely share their views and concerns is found to foster readiness to knowledge sharing in organizations (Rusly, Yih-Tong Sun and L. Corner, 2014). Respondents had varying views on the existence or the level of participation in their work environment. When asked whether employees are consulted on the decisions concerning their work environment, the following respondent who worked as departmental chair and was a long standing member of both Curriculum Development Committee (CDC) and Quality Assurance Committee (QAC) had the view that employees are fairly given the chance to shape their work processes:

“Yes, during meetings all of us discuss matters that are related to our work. In addition, the CDC and QAC are the ones that formulate all policies and almost every department has a member in these committees, whether the members consult their departmental colleagues before they come to meetings, is something I don’t know. But they should.” Chairperson

The varying responses may be rooted on how respondents view their role and the information they had on how decisions are made in the college. The following respondent (a Course Director) portrays and that may hamper the effectiveness of such mechanisms.

“During meetings people are allowed to air their opinions, yet, as said before, some do not want to listen and follow new ways. Opinions are often seen as criticism and therefore staff members are reluctant to say anything. Some staff members are also afraid of airing their views and just follow instructions - irrespective whether they agree or not. No other method of feedback or raising concerns and issues” Course Director

Two team characteristics are displayed in the above quote. The first one is the team leaders who are reluctant to accept change. This behaviour probably leads to the second one which is team members who do not speak up their views. If staff members know that their leaders do not embrace change or accept dissenting views,
they may prefer not to voice their views and simply follow ‘instructions’ as in the above description. Nonaka, (1994) points out that organizations can enhance their innovative abilities when they empower their employees to express their opinions freely. Even when the discussions pertaining policy making are confined only among few committee members and the rest of employees simply receive instructions to implement those policies, the few may feel included but the rest will be reduced as mere followers. The following two course directors portray a slightly different picture on the flow of decision making process in College B:

“The need for new policies is usually discussed with subordinates. The main features of the policies are discussed. But policy details and guidelines are prepared jointly with managers only. Procedures, forms and work instructions are developed in complete consultation with staff.” Course Director

“Well, not all the time. Especially anything to do with policy making, this is done by committees and top management. We also have some other decisions that come from the top and we only follow what it says. But anything that is within the department and is not against general college policies, all members share their views in the regular meetings.” Course Director

A head of department in College B states the following in response to how far he consults department staff before he takes a decision:

“Very much. We have highly structured hierarchy; every task is discussed thoroughly at the department level before it is finalized or sent to the higher levels” Chairperson

It seems that a majority of respondents agree on the existence of such a hierarchical level of decision making and the availability of some sort of ‘consultation’ with all members. Whether the members who hold no managerial or supervisory roles feel fully empowered to exercise these powers is where the respondents’ views are in disagreement. When the same above respondent was asked whether the college has mechanisms to encourage staff members to participate in the decision making process, he said:

“Yes, we have suggestion boxes, anonymous surveys that are dropped in the boxes and these tell us about the performance of the department leaders.” Chairperson

Another respondent however, states that these surveys are not anonymous. When the surveys are accessed through the college network, or require usernames and passwords to start, employees may not consider them as anonymous. However, only one respondent mentioned physical drop-in surveys and suggestion boxes.

4.3 Socialization

Socialization is necessary for transferring social capital. It reduces free loading because only those members who socialize will gain more social capital from each other (Chakraborti et al. 2016). Although employees can interact through social media, it is not as effective and reliable as face-to-face interactions (Davenport & Prusak 1998).

Interview responses have shown that employees differ in their understanding of what constitutes socialization. They all state the existence of departmental meetings where pre-set agendas are discussed. One respondent described these meetings as very formal events where chairpersons have full control of the discussion and many members simply show their presence without taking part in the discussions. Whatever the case, it is clear that staff members share knowledge through their interactions in the workplace rather than their socializations outside workplace. The majority of respondents describe an environment where very limited face-to-face interaction of employees exists outside the workplace. With that said, some respondents consider communicating through social media as effective as face-to-face meetings. When asked whether he encouraged staff to socialize outside workplace, the following respond said:

“That [encouragement] is very hard. Well, we only have some occasional events that take place outside the college like closing ceremonies, but they most likely take place in RC [Royal Commission] owned facilities. Some departments may also arrange their own events, like farewell events when one of them is leaving, where they lunch outside in a restaurant. These are not planned far in advance, they are usually announced few days before the event. There are also some employees who live in the same compound and they may have chances to meet outside.” Chairperson of Quality Assurance Committee
None of the respondents stated any form of formal induction that uses mediums like lectures, videos or documents taking place. However, as mentioned earlier, many respondents agree that new employees get quickly accustomed to the routine tasks they are expected to perform within a short period of time. If the purpose of socialization is to ensure that employees share knowledge, especially the type of knowledge that is hard to formalize, then a practice of socialization has to be cultivated among the employees either as a spontaneous culture which needs no backing from top management or as a planned policy initiated and supported by the management.

One of the reasons for the lack of meetings outside the workplace may be because evenings are the only times members have to rest after a long day’s work. In response to whether he encourages staff members to meet outside workplace, the following respondent says:

“I cannot claim that we actively encourage this but we do facilitate if required. The work here is very tough and we all need to relax in the evenings but there are times in the semester that some members feel that we should meet outside in a restaurant or at the beach. As chairperson I try to facilitate that by sending emails to all members, perhaps calling them in the afternoons and so on. We usually contribute the costs if there is no petty cash from the department purse.” Chairperson

This view is also held by the following respondent (answering if he encourages or facilitates meetings outside working hours):

“No. We work 8 hours a day five days a week and it is extremely difficult to organize meetings outside work. Again, we have members from different backgrounds, cultures, interests and it is not easy to make benefit of meetings that are not related to their work and I think that we can achieve almost anything during working hours.” Chairperson.

Informal interactions could enable employees share or gain more knowledge than formal meetings (Becerra-Fernandez & Rajiv Sabherwal 2010).

Almost all respondents agree on the importance of informal interaction and its role in organizational effectiveness.

“Well I think this is important in all organizations. In our department this happens every day in our office when members are not teaching or are not busy with administrative duties, they often gather around and talk about their work, their general life, or even discuss current events. There is no much contact among staff outside workplace though.” Course Director

4.4 Rewards

Tracey and Tews, (1995) argue that, when employees cannot link the knowledge they acquire on the job with rewards, this may lead to lack of training transfer. The results showed that a majority of the employees would like to participate more in the knowledge sharing process if they knew they would be rewarded.

The interview also aimed to measure the relationship between staff performances and rewards. With the assumption that, knowledge sharing is part of the general performance measured in the organization.

There were opposing responses on whether individual performances are counted in the promotions and rewards. Some interviewees believed that performances are taken into consideration during the annual appraisals while others said that the criteria for promotions is not pronounced and it would be, therefore, difficult to know the factors that are counted in the promotions and those that are not.

Table 4 shows how participants responded when asked how far staff performance contributes to rewards.
Table 4: Relationship between performance and rewards

<table>
<thead>
<tr>
<th>Response</th>
<th>Sample quote</th>
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<tbody>
<tr>
<td>Rewards are mostly tied with performances</td>
<td>&quot;A lot. The annual evaluation is based on how that member of staff performed during that year. There are also performance appraisals, research rewards that take into account individual performance.&quot; Chairperson.</td>
</tr>
<tr>
<td>Rewards are, to some extent, tied to performances.</td>
<td>&quot;All the time. Emphasis has always been on teamwork, team collaboration and joint success.&quot; Program Director.</td>
</tr>
<tr>
<td>Not known or very limited relationship between performances are rewards.</td>
<td>&quot;To some extent, performances contribute to staff rewards but the rewards are not substantial. The yearly evaluations are often confidential although staff members see and sign the final form, they have very little input into it.&quot; Course Director.</td>
</tr>
<tr>
<td></td>
<td>&quot;To some extent, performances contribute to staff rewards but the rewards are not substantial.&quot; Course Director (new)</td>
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<td></td>
<td>&quot;Very limited. The HR rules apply to all regardless of their roles as academics or otherwise. There are however, certain times when individuals that are noticed to have made continuous contributions are rewarded.&quot; Program director.</td>
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<td></td>
<td>&quot;The problem with this is that the reasons for promotions are not necessarily pronounced. Therefore, the link between performance and promotion is not officialized.&quot; Course Director.</td>
</tr>
</tbody>
</table>

5. Conclusion

The difficulty in converting the social capital theory into measurable constructs may cause some frustration for researchers. However, this research has combined a number of models from earlier researchers to propose a model to measure social capital in an organization. This research found that knowledge sharing in higher education institutions could be enhanced by building social capital bonds among staff. Trust, participation, socialization and rewards have been found to influence staff attitudes towards knowledge sharing in higher education. Even when employees practice social capital without any particular written policies or procedures obliging them to share and seek knowledge, it is found that new staff members quickly grasp the tasks they are supposed to perform. Socializing outside work place was not strong in the two colleges, however, the importance of such activity to knowledge sharing was acknowledged. Although respondents were not in agreement on whether rewards were tied with performance measurement in the two colleges, they indicated that they would be encouraged to share their knowledge if they knew that they will be rewarded.

There are two practical problems that may arise in some organizations: the first one is that knowledge is not always properly documented especially in a changing business environment where new work processes are continuously emerging. In such a situation, knowledge workers may not be able to keep up with the new developments and it may be extremely difficulty to document the newly created knowledge. The second problem is that even when the knowledge is documented, there may not be adequate dissemination and these knowledge manuals, whether in print or online, stay unused or often unheard of by knowledge users (Bock et al. 2005). This research has shown that social connections can solve these two problems because as the knowledge seeker builds his/her network of friends and colleagues it enables him/her to gain access to information and knowledge by communicating directly to a knowledgeable colleague. This is particularity vital in organizations where there is no formal induction training. A key finding of this research is that when employees voluntarily share information and knowledge, new staff members will face less difficulty in getting accustomed to their work environments. If knowledge is considered a capital (Lesser, 2000b), or a resource (Chatzkel, 2003), then it can be accessed as any other resource through social ties. In an academic environment where there is a strong social capital among employees, knowledge sharing will no longer be an activity where individuals simply seek to increase their personal knowledge, rather, the emphasis on social capital shifts the knowledge sharing initiative from the employee level to the organizational level.

This research uniquely contributes to the body of knowledge in its topic. No literature was found, by the author, in which the relationship between social capital and knowledge sharing in higher education was studied in Saudi Arabia. Nonetheless, generalizing the findings of this research may be constrained by its sample size and the lack of comparative data which could have given a more comprehensive understanding of the issues researched. With that said, it is arguable that the same organizational practices shaping the
attitudes of employees could be prevalent in different academic environments. Although harnessing employees’ social capital is found to affect their knowledge sharing attitudes and practice, replicating this study in different social and managerial settings may shed more light on the effects of social capital in academic environments.

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