This issue of the Electronic Journal of Knowledge Management (EJKM) presents a selection of the best articles from two API conferences (ECKM 2014 and ICICKM 2014). The Editors have based the selection of articles on evaluations and recommendations received from colleagues who acted as conference track chairs. Special issues from conferences are important because they highlight how the process of presenting research at conferences and peer review continues to be an important process for developing and disseminating research (Guthrie et al., 2015). Together, the eight articles that comprise this special issue represent research in the fields of knowledge management (KM) and intellectual capital (IC) that is internationally current and significant. The articles include empirical and conceptual articles addressing a variety of topics. With respect to empirical articles, they address core issues such as knowledge enabling roles of networks (Still et al., 2015; Tkachenko et al., 2015) and communities (Bedford et al., 2015). Others go beyond core concepts and extend the research to impacts of KM practices (Stankevice, 2015) and IC on performance (Wee and Chua, 2015). All selected conceptual articles move the field forward by suggesting novel models of KM on which to base future research (Castaneda et al., 2015; Handzic and Durmic, 2015) and guide better practice (Kohl et al., 2015).

Three empirical articles that examine core KM issues all focus on networks and communities. These people-orientated enablers of knowledge rightly continue to occupy the attention of researchers worldwide and is reflective of the need to develop further research that applies KM in practice (Serenko and Dumay, 2015). First, the article by Still et al. (2015) reminds us of the fundamental importance of relationships in this networked world we live. Furthermore, the authors highlight a need to look at the totality of relationships (e.g. social, individual, and organizational). Accordingly, they introduce the idea of the ecosystem as a framework for measuring relational capital and present concrete examples of this framework. The ecosystem approach is important because it helps develop research that is not just about managing the organization, but looks at the wider impact on the organization (Gray, 2006; Dumay and Garanina, 2013).

Another article looking at networks across sectors by Tkachenko et al. (2015), investigates the evolutionary transformation of cooperation and integration of Russian enterprises. From the interviews with top managers of companies in industrial and construction companies, a clear trend emerges of KM growing and maturing from the amorphous type of network cooperation to the integrated one. The need for KM research to mature so that there are more examples of research moving from theory into practice (Serenko and Dumay, 2015).

In the context of cities, Bedford et al. (2015) point out the need to build relationships with academic and business communities, labor and workforce, civil society, and the technology sector, to create knowledge cities. Their article considers how a Knowledge Sciences Center might fulfill the transformational role from an industrial city to a knowledge city. This proposal outlines the views of over 200 knowledge scientists from the United States. The article is interesting because the research is in parallel with similar research investigating the IC of regions (Pöyhönen and Smedlund, 2004; Smedlund and Toivonen, 2007). More research is needed from this perspective, especially with regards to policy (Dumay et al., 2015).

Given the recognition that IC or KM is used to create value and improve performance, two articles in this special issue look at the outcomes of IC and KM in business contexts. First, the importance of IC for organizational performance attracts the attention of Wee and Chua (2015) as they address the prevalence of communication of IC and its link to organizational performance in the banking sector. Their article reports on the widespread communication of IC, particularly human capital. The article highlights the relevance of communicating IC from the perspective of IC components and its correlation to organizational performance. This article is a good example of performative research that answers calls for examining IC in action rather than viewing IC from a distance (Mouritsen, 2006; Guthrie et al., 2012).

Similarly, Stankevice (2015) views KM practices as antecedents of innovation strategies resulting in variations in organizational performance. Her article identifies the KM practices that contribute to the emergence of the most and least sophisticated innovation strategies, and how KM is related to performance via innovation strategies at organizational and national levels of selected European economies. Again, this is a good example of taking research beyond the boundaries of organizations to understand KM’s impact on the wider society (Lin and Edvinsson, 2008).

In addition to five empirical articles, this special issue includes three conceptual articles that address descriptive (Handzic and Durmic, 2015), measurement (Castaneda et al., 2015), and prescriptive (Kohl et al., 2015) KM models. First, responding to recent calls for a need to merge KM with other disciplines to ensure its advancement and/or survival, Handzic and Durmic (2015)
propose a descriptive research model that connects the dynamic (KM), static (IC) and performance (PM) aspects of project-based organizations. The authors argue that the model provides a valuable theoretical basis for broader empirical research and enhances its relevance to practice (see Serenko and Dumay, 2015).

Rigour is an as important aspect of published scientific research as is its relevance (de Villiers and Dumay, 2014). In their article, Castaneda et al. (2015), address research rigor by designing, constructing and validating a novel instrument for measuring knowledge sharing. Their instrument is more comprehensive than other existing instruments and measures different types of knowledge, techniques, and tools for knowledge sharing. The peculiar characteristic of this instrument is that it enables the measurement of this construct in Spanish which exemplifies how we need to expand KM research beyond the Anglo American boundaries commonly found in much research of the past (Guthrie et al., 2015), especially in the KM domain (Serenko and Dumay, 2015, p. 414).

Finally, the ultimate role of research is to guide practice (Guthrie et al., 2012). With practice in mind, researchers Kohl et al. (2015) design the ProWis tool to meet the specific needs of SMEs and allows the implementation of process-oriented knowledge management. In their article, the authors illustrate step-wise process-oriented KM according to the ProWis approach. This article is another good example of how innovative KM researchers can and do develop tools designed for specific contexts, rather than try to create all encompassing KM models (Dumay and Garanina, 2013).

The Editors commend these articles to you and we are sure that these articles will be enjoyable to read and will inform and inspire future IC and KM research.

References
A Spanish Knowledge Sharing Instrument Validation

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Abstract: Knowledge sharing research is growing in Latin America. Most instruments used to measure employees’ knowledge sharing activities have been developed in the Anglo-American language (English). Currently there is no instrument available to measure the knowledge-sharing construct in Spanish. The purpose of this paper is to present the results of the research process adopted to design, construct and validate such an instrument in the Spanish language. The validation process was conducted with 228 knowledge workers in Colombia. The instrument has two components. The first part (32 items) evaluates the different ways in which knowledge is shared in an organization. The second part (24 items) evaluates the different tools used in an organization to share knowledge. The validation process is structured in three steps: the construction of the items following a review of the literature, psychometric validation, and the statistical verification of the instrument’s sub-scales. Four categories of types of knowledge and four categories of knowledge sharing techniques are identified. The results of this research contribute to the understanding of a broader perspective of the measurement of knowledge sharing behaviour and enable the measurement of this construct in Spanish. Many of the current instruments are very short and do not consider categories of knowledge sharing, neither tools people use to share knowledge. It is expected that the instrument will become a referent to the measurement of knowledge sharing in Spanish speaking countries. It is recommended the translation into English and the validation process of the instrument with an English speaking sample.

Keywords: knowledge sharing, instrument validation, knowledge management

1. Introduction

In the current era of knowledge, the achievement of strategic objectives of an organization is linked to the creation, organization and distribution of knowledge (Lin, 2014). Knowledge sharing is a key behaviour in these processes, therefore, knowledge sharing activities are a fundamental element in organizational learning and knowledge management processes (Castaneda, 2002a; Castaneda & Toulson, 2013; Delgado y Castaneda, 2011; Castaneda & Fernandez, 2007; Hendriks, 2004; Huysman & De Wit, 2002). Knowledge sharing is associated with organizational competitiveness (Liao, 2008). In order to create and apply knowledge, it is not enough for an organization just to have large information repositories. There is a need for their employees to be able to take this knowledge from the repositories and share with each other to create and modify their outputs in the achievement of the organization’s strategy. It is only through the behaviour of employees that such inputs are converted into new outputs.

Helmstadter (2003) defines knowledge sharing as voluntary interactions between people based on knowledge. The study of knowledge sharing is part of the behavioural perspective of knowledge management (Castaneda, 2002; Dingsoor, Bjornson & Shull, 2009; Earl, 2001). Knowledge sharing is an activity that contributes to the collective knowledge of the organization (Castaneda & Toulson, 2013a; Cabrera & Cabrera, 2002; Villamizar & Castaneda, 2014). People share ideas, experience, expertise, beliefs, expectations, technical specifications, and other documents (Cummings, 2001; Lin & Lee, 2004). This activity is not automatic, but is highly dependant on human will and motivation (Dougherty, 1999; Helmstadter, 2003; Lagerstrom & Andersson, 2003; Scarbrough & Carter, 2000). Some of the reasons why employees share knowledge are: to gain and improve their reputations; to obtain reciprocal actions from those with whom they share their knowledge in the future; and, in some cases, to demonstrate themselves as exemplars of organizational commitment (Taylor & Murthy, 2009). When an individual has the option to share or not to share knowledge, the most common reason above is the second that is associated with anticipated reciprocity from their colleagues (Müller, Spiliopoulou & Lenz, 2005).

There are many instruments designed to measure knowledge sharing in English. Some are popular, like the one developed and tested by Bock & Kim (2002). However, so far none have been developed in Spanish. This has been a limitation in conducting research in this topic in Latin America, where Spanish is the predominant language, with the exception of Brazil, where the language spoken there is Portuguese. The objective of this paper is to present results of a research process conducted in Colombia that consists of the design and validation of a knowledge sharing instrument in Spanish.
Evaluation is as old as civilization itself (Buyske, 2005); however, the design and construction of standardized tests has a century of history, starting with the work of Binet & Simon in 1905 (Pardo, 1999). Today, there are some models about how to process data and obtain information from such standardized test instruments. In the construction of instruments there are two predominant psychometric approaches: classic test theory and item response theory.

Classic test theory proposes a linear model that describes the influence of the measurement error in observed scores. While this model has well developed and robust psychometric properties it has some limitations. The most important of these is that it is not possible to separate characteristics of those who respond to the test from the characteristics of the test items based on the assumptions and prejudices of the designers themselves. Additionally, the metric characteristics of the test, like reliability and validity indices, are defined based on a determined group or sample of respondents, which makes it difficult to compare individuals who take different tests. Finally, with this method it is not possible to have precise information on the performance of each participant, because the error variance is the same for all respondents who are evaluated on the test.

Item response theory, as an alternative to the classic approach, gives a probabilistic approach to the problem of unobservable constructs, and considers an item as the basic unit of measurement. The classic theory of test estimation of an attribute is measured by the simple arithmetical or some weighted sum of answers to individual items according to a predetermined factor or dimension. Item response theory estimates the level of an attribute (or construct) by measuring the answer pattern of the evaluated respondent.

So there are some variations in the design of knowledge sharing instruments. Hambleton (cited by Buyske, 2005) suggests that the design of such instruments should be considered as a collection of short experiments (items), where data comes from the answers given by the individual respondents to each item. Buyske (2005) recommends building instruments from the perspective of optimal design, which is based in the use of statistical information in response to particular needs.

To develop the instrument previous studies cited in the literature like those of Bock & Kim (2002) and Rahman (2011) were considered. Bock & Kim (2002) identified some types of knowledge to be shared and tools that employees use in the knowledge sharing process. The types of knowledge shared included: reports, official documents, methodologies, models, experience and expert knowledge. The tools used included: electronic repositories and mails. Rahman (2011) identified tools used to share knowledge in the sharing process like: storytelling, knowledge sites, chats and knowledge cafes.

So the purpose of this study is twofold, and that is to develop a knowledge sharing instrument that is based on Spanish speaking employees, and an instrument that is based on measuring knowledge sharing behaviours of individual respondents, rather than simply asking them for their perceptions relating to knowledge sharing activity.

2. Method

This research is a psychometric study with the analysis of descriptive data (Chow, 2002). The sample consists of 228 knowledge workers in Colombia. All of them are employed at a professional level, for example: university professors, administrators, consultants and engineers.

2.1 Instrument

The instrument is designed and validated by the authors of this paper, following the guidelines of DeMartino (2010). According to this author, the design of an instrument should include: an objective, the writing of items, the administration of the instrument, the analysis of items and instrument and the reporting of results.

The design of instruments of psychological evaluation is framed within the psychometric discipline, which is linked to central concepts like validity and reliability. In the first instance it is to establish the framework that guides the design of instruments and the interpretation of the results from an administration of the instrument. This is the moment where the cognitive and disciplinary domains of the evaluation are expressed, which is directly related to the validity of the instrument itself (Pardo, 2006).

In the second instance, there is the process of instrument requirements that are of two kinds. These are: structure and psychometric specifications (Pardo, 2010). The instrument’s structure is about information related to the purpose of...
measurement. The psychometric specifications refer to characteristics like the number of items, their format, and time requirements to complete the instrument. The elaboration of its items is the main aspect of the design of an instrument. After this process, the items are consolidated as an instrument in the established format for its application.

The present instrument is designed in two components. The first component asks questions about different kinds of knowledge that are shared in organizations. The final version of this component has 32 items. The second component explores the different tools used in organizations to share knowledge. The final version of this component has 24 items (Exhibit 1).

2.2 Procedure

The procedure followed for the validation of the instrument is structured in three central elements: the construction of items (Mislevy, 2010), the psychometric validation using the model of Rasch (1980) and the verification of subscales of the construct through the identification of the dimensions of the instrument.

3. Results

The two components of the instrument: kinds of shared knowledge and tools used to share knowledge were analyzed technically using the model of Rasch and the item response theory, using Winsteps version 3.75 (Linacre, 2012).

According to Aiken (1996), such instruments are ways through which a participant assesses the information of each item using a prestructured criterion. The first component called type of shared knowledge used the levels (response categories) of answer: not at all; very little; sufficient; and, very much. The second component called tools used to share knowledge utilized the levels (response categories) of answer: applicable, but I don’t use it at all; I rarely use it; I use it fairly often; and, I use it a lot. In both cases a further category included as an alternative is named “does not apply in my organization”. This is included to avoid a forced answer.

The scale of this instrument is ordinal (Serle, 1996), where the distance between each response category is not identical or equal interval. In this case the model of Rasch allows the obtaining of objective and additive measures from stochastic answers using the model for polytomous answers expressed: log (Pnij / Pni(j-1)) = Bn – Di – Fj

Where Pnij is the probability that the relationship evaluated n and item i belong to the category j. Bn is the evaluated construct. Di is the difficulty of an item i. Fj is the measure of calibration of category j in relation to the others.

This model produces results about participants and items in a scale named logit, characterized by having a mean score of zero (0) and standard deviation of one (1). Results range from minus infinity to plus infinity and are built based on Napierian logarithms.

Indicators for the technical analysis of the items and the instrument can be distributed in two categories: those of first order associated to the decision to maintain or not to maintain an item, and those of second order that relate to improving the quality of an item. The fundamental criterion of analysis of an item is the model of adjustment value. An item is adjusted when it is in a range between 0.5 and 1.5 (Linacre, 2012).

After looking at the responses of participants, it was found that the first component, types of shared knowledge were answered by 228 participants, and the second component, tools for sharing knowledge were answered by 221 people.

In table 1 the descriptive values of the test are given.

Table 1: Descriptive values of the instrument

<table>
<thead>
<tr>
<th>Test</th>
<th>Average</th>
<th>Standard deviation</th>
<th>Measurement error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinds of shared knowledge</td>
<td>1.0029</td>
<td>1.001</td>
<td>0.2721</td>
</tr>
<tr>
<td>Tools for sharing knowledge</td>
<td>0.0896</td>
<td>0.8646</td>
<td>0.3110</td>
</tr>
</tbody>
</table>

For the analysis of the instrument as a whole, the reliability value is used in three indices: Cronbach’s alpha, Rasch, and the separation index. Table 2 shows the three reliability values. The obtained values were higher than 0.80, which are considered suitable. The separation index was higher than 1.5, which is appropriate according to Linacre (2012).
Table 2: Reliability of the instrument

<table>
<thead>
<tr>
<th>Test</th>
<th>Alpha</th>
<th>Rasch</th>
<th>Separation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinds of shared knowledge</td>
<td>0.94</td>
<td>0.9</td>
<td>2.98</td>
</tr>
<tr>
<td>Tools for sharing knowledge</td>
<td>0.95</td>
<td>0.82</td>
<td>2.15</td>
</tr>
</tbody>
</table>

Table 3 presents the technical information of items relating to kinds of shared knowledge and in table 4 the technical information of items relating to tools for sharing knowledge.

Table 3: Technical information of kinds of shared knowledge items

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Difficulty</th>
<th>Error</th>
<th>Infit</th>
<th>Outfit</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.29</td>
<td>0.10</td>
<td>1.35</td>
<td>1.48</td>
<td>0.31</td>
</tr>
<tr>
<td>2</td>
<td>0.32</td>
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<tr>
<td>3</td>
<td>-1.13</td>
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<td>0.89</td>
<td>0.53</td>
</tr>
<tr>
<td>4</td>
<td>-0.62</td>
<td>0.11</td>
<td>1.02</td>
<td>1.31</td>
<td>0.46</td>
</tr>
<tr>
<td>5</td>
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<td>0.10</td>
<td>1.15</td>
<td>1.19</td>
<td>0.43</td>
</tr>
<tr>
<td>6</td>
<td>0.12</td>
<td>0.10</td>
<td>1.09</td>
<td>1.12</td>
<td>0.45</td>
</tr>
<tr>
<td>7</td>
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<td>0.11</td>
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<td>0.90</td>
<td>0.55</td>
</tr>
<tr>
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<tr>
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<td>13</td>
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<tr>
<td>14</td>
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<td>1.25</td>
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</tr>
</tbody>
</table>

According to the data presented in Tables 3 and 4, it is observed that they fulfil the established criteria for each indicator. From this it is possible to conclude that the quality of the instrument is adequate.
Table 4: Technical information of tools to share knowledge items

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Difficulty</th>
<th>Error</th>
<th>Infit</th>
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<td>0.09</td>
<td>1.07</td>
<td>1.09</td>
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<td>0.09</td>
<td>1.00</td>
<td>1.00</td>
<td>0.48</td>
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</table>

4. Discussion

Knowledge sharing is considered a fundamental behaviour in the creation and application of knowledge. Although there are some instruments in English designed to measure this behaviour, there is not a validated instrument to measure this construct in Spanish. The research on knowledge sharing in Latin America is growing and it is relevant for the building and validation of instruments in this direction. Besides, some of the instruments that are highly used in English have a limited number of items and do not identify the constituent dimensions. Also many English speaking versions of knowledge sharing are based on assumed equal interval scales, such as five point or seven point Likert scales. The instrument presented in this paper is built based on two dimensions: types of shared knowledge and tools to share knowledge, and the scales developed are ordinal, without assuming equal intervals between response categories.

The items of the knowledge sharing instrument were designed following from the directions identified in the review of the literature. In order to identify some dimensions in the instrument, factor analysis was undertaken using Winsteps statistical package. In relation to kinds of shared knowledge four dimensions were formed, having the criterion load greater than 0.20.

- Items of Dimension 1: 16, 17, 18, 19, 20 21 and 22 (explicit organizational knowledge)
- Items of Dimension 2: 6, 7, 8, 9, 10, 11, 12, 14 and 15 (tacit organizational knowledge)
- Items of Dimension 3: 1, 2, 3, 4 and 5 (experiential knowledge)
- Items of Dimension 4: 23, 24 and 29 (bibliographic knowledge)
Dimension 1 was formed by items related to organizational explicit knowledge (Nonaka & Takeuchi, 1999): work reports, norms, policies, manuals and documented technical concepts. Dimension 2 included items of tacit knowledge: intuitions applied to work, knowledge on why to do an action, ideas to improve the team work, beliefs and values applied to work. Dimension 3 was formed by items related to experiential knowledge: experience on dealing with conflictive situations, experience on the meaning of an action in a particular context, experience on the use of procedures and technical experiences. Dimension 4 included items of bibliographic documented knowledge: recent and novel bibliographic material, knowledge on sources of knowledge.

In relation to tools to share knowledge there a further four dimensions were found as follows:
- Items of Dimension 1: 15, 16, 17, 18, 19, 20 21, 22, 23 and 24 (technological tools)
- Items of Dimension 2: 4, 5, 6, 7 and 8 (structured dialogical tools)
- Items of Dimension 3: 1, 2, 3 and 10 (no structure dialogue)
- Items of Dimension 4: 11 and 13 (organizational tools)

Dimension 1 was formed by technological tools to share knowledge: internet, intranet, telephone, audio conference, video conference, electronic mail, text messages, chats, blogs, and data bases. Dimension 2 considered structured tools based of dialogue: communities of practice, focal groups, workshops, study groups. Dimension 3 comprised no structured dialogue: informal conversation face to face, storytelling, dialogue in work meetings, knowledge cafes. Dimension 4 was formed by tools used for assessment and training: peers review, induction.

Knowledge sharing is an indispensable behaviour in the creation and application of organizational knowledge. Therefore, knowledge sharing is the heart of knowledge management. Knowledge sharing has been one of the growing subjects of research in knowledge management in this millennium. However, there are not many instruments to measure the relevant behaviours associated with knowledge sharing. There are some instruments to measure knowledge sharing in the English language frequently used, like the one developed by Bock & Kim (2002). However, there is a lack of instruments that are designed and validated right from the beginning in the Spanish language. In this paper, then, the process of construction and validation of an instrument on knowledge sharing in Spanish has been presented.

The design and validation of this instrument has contributed to the understanding and the measurement of knowledge sharing among people at work, as reported through the perceptions of knowledge workers who actively engage in knowledge sharing behaviours. This will facilitate the study of this relevant behaviour in Latin American countries where the common language is Spanish. Secondly, the identification of dimensions of knowledge sharing from the validation of items may broaden the scope of research in international contexts where the language of measurement of the topic is English. This is the reason why the next step of this research will be the translation-back-translation process of the instrument from Spanish to English and its validation in an English speaking sample. Currently at the writing of this paper, an English translation of the questionnaire is being administered to a sample of knowledge workers employed in New Zealand. The results of a pilot study of 68 completed responses to the English version of the questionnaire are encouraging, and are indicative of a high degree of alignment on both the types of knowledge sharing items and the tools of knowledge sharing items between the Spanish speaking and English speaking versions. However it is too early to present any robust conclusions till the main English speaking survey is completed.

Looking to the immediate future, if alignment between translations of this questionnaire can be demonstrated, then the possibilities are that a knowledge sharing tool that has global reach has been developed. A tool that is not just dependent on particular languages is a very encouraging possibility. One of the practical applications of developing this knowledge sharing instrument that focuses on reported behaviours rather than perceptions of knowledge workers employed in global environments, is that we have developed a tool that may be used as a measure of knowledge-sharing behaviour as a key means to the leveraging of pools of human capital potential that is available in international organizations (Castaneda & Toulson, 2013).

This has consequences for the managing of human resources (HRM), and linked with this is another question proposed by Castaneda & Toulson (2013a), and that is to what extent is organizational culture a mediator between human resource (HR) practices and knowledge sharing behaviour? The argument here is that while certain HR practices may encourage knowledge sharing behaviour, others may actually inhibit such behaviour because of competitive pressures among knowledge workers. The conceptual model proposed by Castaneda and Toulson...
(2013a) suggests that it is the culture itself that mediates the success of knowledge sharing, not the HR practices themselves. There is general empirical support that certain HR practices do foster cultures that in turn foster knowledge sharing behaviours among employees. There is also evidence to suggest that the opposite may occur as a result of the predominant work cultures in particular organizations. So the relationship between HR practices and knowledge sharing is complex, and is concluded that the development of a multi-lingual knowledge sharing instrument will assist in increasing our understanding of this important relationship within 21\textsuperscript{st} Century business organizations.

References


**Exhibit 1**

**Knowledge sharing instrument**

<table>
<thead>
<tr>
<th>PREGUNTA</th>
<th>Nada</th>
<th>Poco</th>
<th>Bastante</th>
<th>Mucho</th>
<th>No aplica</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Experiencia sobre el manejo de situaciones conflictivas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2. Experiencia sobre la diferencia de significado de un concepto o acción según el contexto</td>
<td></td>
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<td></td>
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<tr>
<td>3. Experiencia sobre el uso de procedimientos</td>
<td></td>
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<tr>
<td>4. Experticia técnica</td>
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<td>5. Historias que tienen una enseñanza</td>
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<tr>
<td>6. Intuiciones aplicables al trabajo</td>
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<tr>
<td>7. Conocimiento sobre el por qué se debe realizar una acción</td>
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<tr>
<td>8. Conocimiento sobre cómo realizar una acción</td>
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<tr>
<td>9. Ideas para la organización del trabajo de otra persona</td>
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<tr>
<td>10. Ideas para mejorar el trabajo de su grupo</td>
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<tr>
<td>11. Ideas para mejorar el trabajo de otro grupo</td>
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<tr>
<td>12. Formas exitosas de hacer una tarea</td>
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<tr>
<td>13. Conocimiento para resolver problemas</td>
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<td>14. Creencias aplicables al trabajo</td>
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<td>15. Valores aplicables al trabajo</td>
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<td>16. Informes de trabajo</td>
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<td>17. Normas organizacionales</td>
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<td>18. Normas externas aplicables a la organización</td>
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<tr>
<td>19. Políticas institucionales</td>
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<td>20. Objetivos organizacionales</td>
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<tr>
<td>21. Conceptos técnicos documentados</td>
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<tr>
<td>22. Manuales laborales</td>
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<tr>
<td>23. Material bibliográfico novedoso</td>
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</tbody>
</table>
24. Material bibliográfico reciente
25. Metodologías de trabajo documentadas
26. Lecciones aprendidas documentadas
27. Prácticas exitosas en la organización
28. Prácticas exitosas de otras organizaciones
29. Conocimiento sobre fuentes de conocimiento
30. Información documentada de clientes o usuarios
31. Evaluaciones de proyectos o de iniciativas
32. Información sobre eventos académicos o profesionales futuros

¿Cuáles de las siguientes herramientas usted utiliza para compartir conocimiento en su organización o trabajo? Si alguna o algunas de ellas no se utilizan, marque una X en la casilla “no aplica en mi organización”.

<table>
<thead>
<tr>
<th>Herramienta</th>
<th>No aplica en mi organización</th>
<th>Aplica, pero no lo uso</th>
<th>La uso poco</th>
<th>La uso bastante</th>
<th>La uso mucho</th>
</tr>
</thead>
<tbody>
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<tr>
<td>3. Cafés del conocimiento</td>
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<td>4. Sesiones de lluvias de ideas</td>
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<td>5. Comunidades de práctica</td>
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<td>6. Grupos Focales</td>
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<td>7. Talleres (prácticos)</td>
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<td>8. Grupos de estudio</td>
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<tr>
<td>9. Ejercicios de simulación</td>
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<td>10. Reuniones grupales</td>
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<td>11. Revisión de pares</td>
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<td>12. Coaching o mentoring</td>
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<td>13. Inducción y re inducción</td>
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<tr>
<td>22.</td>
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<tr>
<td>23.</td>
<td>Blogs</td>
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<td>24.</td>
<td>Bases de datos</td>
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</table>
New Insights for Relational Capital

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Abstract: In this paper, we concentrate on relational capital, manifestation of the old adage “it is not what you know but who you know”. We propose that in this networked world, the importance of relationships between multiple stakeholders created by key personnel and financing becomes fundamental, and hence understanding and measuring those becomes fundamental, too. Accordingly, we highlight a need to go beyond social, individual or personal relationships and organizational context, as well as beyond the limitations of the dyadic (one actor to one actor) view on relationships. Hence, we are introducing the ecosystem as the context for measuring relational capital. This paper builds on a construct of ecosystemic relational capital, created for understanding and measuring the importance of relationships in the context of ecosystems. It looks at the totality of relationships both at organizational level and at individual level, measuring the structures and characteristics related to individuals, organizations as well as the ecosystem as a whole (Still et al. 2014a). We acknowledge that the initial framework emphasizes the “networking capabilities” element of relational capital, with less attention to the element of “customer loyalty and reputation”, which is the motivation for building on the construct. The processes of ecosystemic relational capital are built on the possibilities afforded by the volumes of digital data, mostly from social media, providing details on the relationships between various actors related to various regions, sectors, technologies and products. However, we propose enhancing the holistic integration for better understanding and measuring of relational capital with the application of methods of social network analysis (SNA), network visualizations and social media analytics. In this paper, we present concrete examples of the enhanced framework. At the same time, we acknowledge that there are many other avenues for obtaining novel insights for relational capital with these analytics, and we strongly encourage researchers and practitioners to do so.

Keywords: innovation ecosystems, relational capital, social capital, visual ecosystem analytics, social network analysis, social media analytics, innovation indicators

1. Introduction

Despite the fact that ideas and approaches of intellectual capital (Sveiby, 1997; Edvinsson and Malone, 1997) are more than 15 years old, the realities of addressing and measuring it still remain challenging: current company valuations cannot be explained only with conventional economic measures. For example, why was Instagram (with 12 employees) sold for a whopping 1 billion dollars? Why the Facebook valuation turned out to be partly speculative? Why is Google, and no longer Apple, the most valuable company in the world? The concepts of intellectual capital and intangible capital are provide some explanations to questions about the value of relationships in this networked world, in which value is seen to be co-created by multiple actors in interactions with the customer (Vargo and Lusch, 2004). Furthermore, the fundamental proposition of social capital theory is that network ties provide access to resources, contributing to organizational advantage (Nahapiet and Ghoshal, 1998).

The paper is structured as follows: we first explore the theoretical background of relational capital, which is at the core of this paper. The motivation for going beyond the organizational level approach as well as the approaches and indicators for measuring it will be addressed, coupled with the availability of novel data about relationships. We then review the construct for ecosystemic relational capital (Still et al., 2014a) and analyze how it can be enhanced to better capture the various elements related to relational capital, with concrete examples using digital data sources, especially from social media, with methods of social network analysis and social media analytics. Finally, we will conclude by discussing the findings, the insights from them, their applicability and limitations.

In this paper, the emphasis is on the fact that these ecosystemic relational capital indicators provide novel ways of understanding the importance of relationships. We propose that in the ecosystem, there are many types of relationships at many different levels; we already are fairly familiar with some of those—as they describe “business as usual”. By using novel data sources, we can get glimpses of the emerging actors and their relationships within the ecosystem.
2. Theoretical background

2.1 Relational capital in an organizational setting

Relational capital is most often seen as an organizational attribute, which has been framed as the totality of relations between a firm and its main stakeholders and is operationalized through image, customer loyalty, customer satisfaction, link with suppliers, commercial power, negotiating capacity with financial entities, environmental activities etc. (Bronzetti et al., 2011). It is generally explained with alliances, exchange, resource, social network processes, relationships, relations, customers, suppliers, employees, and co-operation (Still et al., 2013b). Oftentimes, the emphasis remains on the company’s external connections with a wide variety of economic agents, with the elements of networking capabilities, and customer loyalty and reputation (Molodchik et al., 2014).

Relational capital is usually complemented with concepts of human capital (addressing the individuals and “what is in their heads”) and structural capital (addressing the organizational, explicit knowledge that “is owned by the organization”), as well as social capital (Nahapiet and Ghoshal, 1998). These concepts are interrelated and linked (Still et al., 2013b); for example, human capital is not built in isolation, but in interactive relationships. Furthermore, the use of term social capital indicates that it is an asset; while the term social connotes that the particular asset is attained through involvement with a community (Feltman and Zoller, 2012).

There have been attempts to measure relational capital. Commonly used metrics of organizational relational capital have included, for example: (1) measuring contacts with investors, analysts and other stakeholders, as well as opportunities for networking with colleagues in academic and social events; (2) the level of collaboration with individuals and institutions; (3) measuring the exposure to media, notoriety and value perception, and (4) measuring customer satisfaction and loyalty (de Pablos, 2003). Among the indicators of relational capital, advertising expenditures have been described as the most often used (Molodchik et al., 2014), as have factors relating to the existence of satisfied customers (Chang and Tseng, 2005).

Recently, the measurement of relational capital has been defined with two elements: (1) networking capabilities, and (2) customer loyalty and reputation (Molodchik et al., 2014). These elements are appropriated with indicators, such as number of subsidiaries as a measure for networking capabilities, and advertising expenditure as an indicator for customer loyalty and reputation. The constructs, indicators, source of information, and the reasoning of such measurements are presented in Table 1.

At the individual level of relational capital, one recent attempt to measure relational value has been “Klout” (www.klout.com/home). Initially Klout examined at a person’s online presence (measuring your reach, how you engage in your network, how well your network is working for you, your influencers, your influences, about content you are influencing) but is now expanding to address the off-line activities of people, too (Stone 2012). The Klout score is a controversial measure, but it embodies the quest and importance of metrics for relational capital—and highlights the rapidly changing nature of this asset, as Klout scores are calculated every day.

For calculating the indicators of relational capital at the organizational level, data frequently comes from corporate financial data. In addition, online sources, web pages, are also mentioned as sources of data about organizational relationships (Table 1).

2.2 Relational capital in ecosystems

Though the emphasis in relational capital literature continues to be at the organizational level, the links to individuals have been noted. For example, the individual level relationships have been described as “personal networks” (Kujansivu and Lönnqvist, 2007) or as social relationships with both business purposes as well as non-business purposes (Agndal and Nilsson, 2006). Furthermore, the concept of “personal relational capital” has been introduced to address the value created by people in a business relationship, with qualities of credibility, integrity and authenticity, and considered by some to be the most important element in business relationship.

Increasingly, it is recognized that sustainable innovation activities—and other business activities—are rarely carried out by a single individual or within a single organization. These interdependencies of multiple actors are addressed with a concept of ecosystem, the business concept of which was introduced by Moore (1996), and which can be defined as networks of relationships for sustained value co-creation (Russell et al., 2011; Russell et al., 2015), including interdependent firms forming symbiotic relationships (Basole and Rouse, 2008) and human networks that generate
extraordinary creativity and output (Hwang and Horowitz, 2012). Hence, companies are not only connected through formal relationships, such as deals and alliances, but also interlocked through key individuals—information flow, norms, mental models (Davis, 1996),

The concept of ecosystemic relational capital is based on the consideration that companies are not isolated systems; on the contrary, they are active and permanently connected to multiple external entities (Dorrego et al., 2013). Relationships shape the behavior and outcome of all stakeholders as well as the system-level effects (Hwang and Horowitz, 2012), and it is through the relationships of individuals within and across organizations in an ecosystem that knowledge transfer, technology dissemination, and organizational change are accomplished.

Table 1: Constructs and indicators of relational capital elements (Molodchik et al., 2014)

<table>
<thead>
<tr>
<th>Construct</th>
<th>Indicator</th>
<th>Source of information</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Networking capabilities</td>
<td>Participation in associations</td>
<td>Company’s web site</td>
<td>It is important for a company to participate in professional associations and develop its branches and representatives close to the resources or the markets; reflecting the significant networks of large enterprises</td>
</tr>
<tr>
<td></td>
<td>Number of subsidiaries</td>
<td>Company’s annual report, section “Common information”</td>
<td>A company which attracts foreign capital is introduced to international markets and is relatively wealthier; the international network is reflected through the foreign capital employed</td>
</tr>
<tr>
<td></td>
<td>Foreign capital employed</td>
<td>Company’s annual report, section “Financial data”</td>
<td>Estimation of the financial resources available to company; reflects the optimum leverage and the autonomy of the company in taking decisions</td>
</tr>
<tr>
<td></td>
<td>Debt to equity ratio</td>
<td>Company’s annual report, section financial data</td>
<td></td>
</tr>
<tr>
<td>Customer loyalty and reputation</td>
<td>Ranking brand Finance Global 500</td>
<td>Ranking Brand Finance Global 500 (<a href="http://www.rankingthebrands.com">www.rankingthebrands.com</a>)</td>
<td>A well-known brand together with awards enhance customer commitment and establish corporate image</td>
</tr>
<tr>
<td></td>
<td>Number of awards for innovation</td>
<td>Company’s web site</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Citation in search engines</td>
<td>Search on company’s name and its score on the web site: <a href="http://www.prchecker.info/chcheck_page_rank.php">www.prchecker.info/chcheck_page_rank.php</a></td>
<td>Internet penetration reflects a company’s popularity; helps to form its reputation and allows the monitoring of company’s current position in the electronic world</td>
</tr>
<tr>
<td></td>
<td>Advertising expenditures</td>
<td>Company’s Annual Report, section “Financial data”</td>
<td>Advertising costs are considered as an investment in the promotion in the activities and product of the firms.</td>
</tr>
</tbody>
</table>

Based on elements associated with relational capital and social capital, the framework of ecosystemic relational capital introduces three elements (structural, relational and individual) that are interrelated and have meaning in understanding an ecosystem (Still et al., 2014a). The approach to measure the interrelated elements stems from recommendations to examine the relationships and interactions, so that the processes in innovation ecosystems that are enacted over time in nested network structures can be explored (Halinen et al., 2012).

Calculating the Klout score for an individual introduces the use of social media as data source. Social media is seen to contribute to innovation data, or relational data, as a natural by-product of activities by various actors, oftentimes in unstructured format. Individuals, such as company founders, entrepreneurs, knowledge and financial investors, journalists, policy makers, and customers share information, discuss and communicate about their needs, experiences and opinions using it (Still et al., 2014b). For example, a company writes and shares a press-release when it receives major funding or appoints a new board member; board members reveal their career paths; the same individual could
write a scientific article, which gets cited and could lead to patent filing; companies are written about in Wikipedia, in Twitter and in Facebook.

Social media provides access to volumes of global, multipurpose, real-time digital data related to various actors in a cost-efficient manner (Still et al., 2014b); data describes relationships of many types – individuals-to-individuals, individuals-to-organizations, and organizations-to-organizations, at the same time going beyond single organizations by including universities, research organizations, financing organizations (Table 2). It should be noted that the available data is not dyadic but it can link, for example, multiple financing organizations to one company, a research organization to multiple projects, an individual to multiple companies etc.

2.3 Tapping into network analysis and visualizations

Social network analysis (SNA) is generally used for bringing visibility to the networked aspects of human collaboration and communication, with terminology of networks (referring to the system), nodes (actors, or agents, referring to individual parts of the system), and edges (also called relations or connections between the nodes). The basic mathematical algorithms of SNA provide quantitative approaches for the network as a whole (with metrics such as size, density) and for the individual nodes (with metrics such as degree, betweenness centrality); this differentiation is important because network dynamics at each level, although related, are also distinct (Zaheer et al., 2010).

The inherent emphasis of relationships and their resulting networks provides a list of possible measures based on network metrics. SNA is increasingly used for exploring social media (Welser et al., 2007), as social media is digital, reveals social relationships and is relatively easy to gather and store, making it readily amenable to SNA (Huhtamäki and Parviainen, 2013).

Traditional SNA (Wasserman and Faust, 1994) introduces a set of node and network level metrics that can be used to describe the structural properties of networks and to quantify the various social roles of network actors (Huhtamäki et al., 2015). Existing research on networks shows that network analysis has a good fit for explorative analysis of systems. For example, network structure-density, connectivity, and hierarchy are all features associated with flexibility and ease of information exchange through their impact on the level of contact or the accessibility they pro vide to network members (Nahapiet and Ghoshal, 1998). Much is already known about structure in networks (Granovetter, 1973; Barabási and Bonabeau, 2003), the roles of individual actors in the network (Hansen et al., 2011), the drivers of network evolution (Giuliani and Bell, 2008) as well as the latent structures and dynamics behind the diffusion of information through networks (Leskovec et al., 2009), network control (Liu et al. 2011) and virality (Shakarian et al. ,2013; Weng et al., 2013).

Already in 2005, visual network analysis was used to analyse how Friendster (a social media service) was used (Heer and boyd, 2005). Also, one of the first and formative papers of studying how and why people use Twitter used social network analysis to understand user intentions and community structure (Java et al., 2007). While network analysis has been available for decades as an analytical method, the realization that networks indeed have a role in the opportunities for value creation and appropriation for a business is only beginning to emerge. Recently, Feltman and Zoller (2012) addressed the role of dealmakers in regional entrepreneurial economies with network metrics, and suggest that strong entrepreneurial and investor networks are associated with successful entrepreneurial economies. Also, Afuah (2013) composed a set of propositions on ways a company’s role in network, as well as its conduct, impact its success, and he claims that network effects concern more than the size of company’s clientele. Hence, the revelation of relationship-based structures as patterns of connections and interactions within an ecosystem can be captured (Green and Sadedin, 2005), as a sum of organizational level and individual level elements, using SNA metrics and related dynamics (Ahuja et al., 2012).

Showing the relationships with visualizations can be achieved with drawings-by-hand on smaller scale; however, with the advances in computation as well as responding to the larger volumes of data, novel visualization methods can be used. This implementation of the computation, analysis and visualization step is a combination of interactive computing (Goldin et al., 2010), knowledge discovery (Fayyad and Stolorz, 1997), information visualization (Card, Mackinlay and Shneiderman, 1999) and visual analytics (Wong and Thomas, 1994; Heer and Shneiderman, 2012). For example, the ability to visualize one’s professional network, using one’s network information from LinkedIn, allowed seeing the communities, the friends-of-friends and the influencers in one’s own network. This, combined with visualizations provided by other social networking sites, such as Facebook, brought the understanding of network concepts to a new level.
Table 2: Availability of relational data (Still et al., 2014b)

<table>
<thead>
<tr>
<th>Data source</th>
<th>Description</th>
<th>Type of relational data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open data</td>
<td>About public and private financing</td>
<td>financial organizations to companies</td>
</tr>
<tr>
<td></td>
<td>About projects and technology</td>
<td>companies to companies, companies to universities and research organizations, individuals to organizations</td>
</tr>
<tr>
<td>Patent data</td>
<td>About patenting activity and their technology</td>
<td>individuals to other individuals, individuals to companies, individuals to technologies</td>
</tr>
<tr>
<td>Scientific publication data</td>
<td>About scientific writing activity and the technology</td>
<td>individuals to other individuals, individuals to companies, individuals to technologies</td>
</tr>
<tr>
<td>Web pages</td>
<td>About company and its connections to products and technologies, people and organizations</td>
<td>companies to companies, individuals to companies, financing to companies, companies to products and technologies</td>
</tr>
<tr>
<td>Socially constructed datasets</td>
<td>crowd-sourced datasets (such as TechCrunch Crunchbase, Arctic Startup, AngelList)</td>
<td>individuals to companies, companies to companies, companies to technologies, companies to financing</td>
</tr>
<tr>
<td>Wikipedia</td>
<td>About the company, its technology, products, individuals, financing, partners</td>
<td>individuals to companies, companies to companies, companies to technologies and products, companies to financing, companies to research</td>
</tr>
<tr>
<td>Twitter</td>
<td>About the company, its technology, products, individuals, financing, partners</td>
<td>individuals to individuals, individuals to companies</td>
</tr>
<tr>
<td>Facebook</td>
<td>About the company, its technology, products, individuals, financing, partners</td>
<td>individuals to individuals, individuals to companies</td>
</tr>
</tbody>
</table>

3. Methodology

With the goal of presenting measurements, or indicators, of relational capital in the context of ecosystems, this paper draws heavily on in-depth literature searches. The subsequent understanding, also about the influential and seminal sources related to the research context (especially those of disciplines of knowledge management and intellectual capital), enables a synthesis. Accordingly, an understanding is developed, described and discussed with constructs, which are conceptual frameworks to organize the ideas related to question (Shields et al., 2013).

The constructs for relational capital are approached with a case study research, attempting to understand the nature of the research problem, reflecting, forming and revising meanings and structures of the phenomena being studied. Furthermore, in accordance with the exploratory nature of the study (Yin, 2014), we are relying on “the inductive multiple case study” (Almpanopoulou and Järvi 2015).

The cases used in this paper are described with boundary specifications of an ecosystem for presenting the composition of an ecosystem and the presence of relational capital in it. In all of the cases, the relationships and interactions are studied using non-traditional relational data:

- **Case Finland** (Still et al., 2013) looked at the national ecosystem of Finland, with three different country-specific data sources about people and money flows.
- More detail about the Finnish ecosystem was explored with one specific financing instrument used to support startups, and the social media presence of these startups (Huhtamäki et al).
- Furthermore, by tuning the lens to address company specific ecosystems, one case looked at formal as well as informal connections between Nokia—a Finnish giant—and Microsoft (Rahul et al., 2015).
A case for comparing three ecosystems—namely Austin, TX, Minneapolis-St. Paul, MN; and Paris, France—looked at three metropolitan ecosystems, with data about these cities and their connections Russell et al., 2015).

To highlight the networked and interrelated nature of organizations in the cases, we tap into the potential provided by network approaches. In doing so, we are drawing from the approaches and processes of social network analytics, visual analytics and social media analytics.

![Figure 1](https://www.bethkanter.org/network-mapping/)
LinkedIn network visualizations, in the middle using Inmaps (2014), in right using socilab.com (2015); (lower row) visualization of 500+ million Facebook users and their connections pasted on the world map (https://www.facebook.com/notes/facebook-engineering/visualizing-friendships/469716398919)

4. Findings

As Nahapiet and Ghoshal (1998) so eloquently put it in their groundbreaking paper, this paper also is fundamentally concerned with resources within the structures and processes of social exchange, seeing that the development of social capital is significantly affected by those factors shaping the evolution of social relationships. Due to the ecosystemic rationality of business and innovation activities, the concept of relational capital is seen to evolve from primarily an organizational characteristic into a concept that includes multiple relationships between multiple actors (Still et al., 2014a). The framework (Table 3) for exploring relational capital responds to this by introducing three interrelated entities of the whole ecosystem (structural)—concerning the properties of the social system and of the network of relations as a whole (Nahapiet and Ghoshal, 1998) —as well as its organizational and individual elements as assets created and leveraged through relationships or “actor bonds” (Nahapiet and Ghoshal, 1998: 244).
In the context of ecosystems, the SNA metrics, such as centrality, density, connectivity and clustering within the network, allow for quantitative analysis of the ecosystem and the roles of its individual nodes (organizations and individuals). Those metrics can be seen as a means for describing the structure and character of whole ecosystem as well as those of its elements, as these metrics describe the business context in which new companies are growing. It should be noted that, initially, clustering co-efficiency was considered a characteristic of an individual actor as it describes the “how my friends are connected to each other”. However, it can be also been seen to describe the connectivity of the structure, which is why it is now categorized as an indicator of ecosystemic structural capital.

The initial framework, which emphasized SNA metrics as means for describing the structure and character of whole ecosystem as well as those of its elements, can be seen to respond largely to the networking potential of relational capital. This initial framework contributes to understanding “customer loyalty and reputation”, for example by revealing the most connected individuals and organizations— and making it possible to add the attribute of connectedness to reputation. Network metrics add an additional perspective into measuring relational capital, essential to understand the network effects of customer loyalty and reputation (Molodchik et al., 2014).

Table 3: Measuring ecosystemic relational capital (Still et al., 2014a; Russell et al., 2015)

<table>
<thead>
<tr>
<th>Table 3: Measuring ecosystemic relational capital (Still et al., 2014a; Russell et al., 2015)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Table 3: Measuring ecosystemic relational capital (Still et al., 2014a; Russell et al., 2015)</strong></td>
</tr>
<tr>
<td><strong>STRUCTURAL</strong></td>
</tr>
<tr>
<td><strong>Type of actors present</strong></td>
</tr>
<tr>
<td><strong>Quantity of actors and ties</strong></td>
</tr>
<tr>
<td><strong>Density</strong></td>
</tr>
<tr>
<td><strong>Clustering co-efficient</strong></td>
</tr>
<tr>
<td><strong>Major component</strong></td>
</tr>
<tr>
<td><strong>Degree</strong></td>
</tr>
<tr>
<td><strong>Betweenness centrality</strong></td>
</tr>
</tbody>
</table>

4.1 Understanding networks of relational capital with the Ostinato Model

A data-driven approach toward understanding and measuring relational capital and its elements described in this paper is largely dependent on the data as well as on the methods of “making the data speak”. Although SNA typically visualizes networks in two-dimensions, real world social networks are multi-dimensional and have multiple foreground-background alternatives. The choice of boundary conditions, data, metrics, and sense-making perspectives
depends on the objectives of the analysis – canonized through the Ostinato process which uses an exploration-automation cycle for a user-centric, process-automated data-driven visual network analytics (Huhtamäki et al., 2015).

As much of the data (from websites, social media sites) is socially constructed, rather than officially curated, its provenance and quality must be understood (Still et al., 2014b). Raw data that is harvested across various sources, online and proprietary, as required by the case context, is refined and curated to create a coherent and consistent dataset about relationships in the ecosystem that provides a solid base for the analysis. Boundary conditions are used to sample from this data, metrics are selected, network representations of the underlying structure of an ecosystem are created, and the sense-making process is inacted (Huhtamäki et al., 2015).

To present the data as a network and its metrics in a visual form, a set of tailored batch-processing tools in Python is used. These tools compile the source data according to the boundary specification, create the network and calculate metrics. To explore and visualize the networks, we used Gephi, an interactive network analysis platform that implements a core set of key functionalities for visual network analytics (Bastian, Heymann and Jacomy, 2009). These network layouts were created using a force-driven algorithm in which nodes repel each other and edges pull the connected nodes together (Noack, 2009), revealing the spatial structure of relationships. Color-coding has been added to differentiate node type: red shows companies; green shows finance organizations; and blue shows key individuals (founders, C-suite, board members.) In a graph theoretical perspective, force-driven layout reveals the macro-level structure of the network including the key clusters, the key brokers in the network as well as possible structural holes (Burt, 1992).

Both actor (node) and network (ecosystem) level metrics can be calculated, and the data is analysed in service to the analytical objective, followed by facilitated sense making and storytelling through visualizations of the networks structure. As fluency with network metrics is just emerging for policy makers and program managers, sensemaking through storytelling is essential to engage the analytical thinking for practical applications. Without context, SNA metrics as stand-alone numbers can be difficult for the lay person to understand. Discussions with stakeholders about the meaning of the metrics has provided the additional benefit of eliciting additional considerations from practitioners, considerations which can refine the analytical boundaries and selection of metrics, catalyzing a user-oriented iteration cycle in the Ostinato process.

4.1.1 SNA metrics

Metrics provide quantitative measures for comparison and analysis. In one use case, showing some SNA metrics for case Finnish ecosystem based on multiple data sources led to engaged discussions with analysis about insights related to the ecosystem. However, when multiple datasets are used (Dataset 1 concentrates on startups, their key individuals and angel investments; dataset 2 on growth companies, their key individuals and investments; and Dataset 3 on deals and alliances), sense-making discussions must include detailed understanding of the source and quality of the data, in order to avoid misleading deductions and guide defensible insights (Table 4).

<table>
<thead>
<tr>
<th>Network metrics</th>
<th>Dataset 1</th>
<th>Dataset 2</th>
<th>Dataset 3</th>
<th>Aggregate dataset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>0.002</td>
<td>0.002</td>
<td>0.007</td>
<td>0.001</td>
</tr>
<tr>
<td>Diameter</td>
<td>15</td>
<td>18</td>
<td>4</td>
<td>16</td>
</tr>
</tbody>
</table>

Context can be added to the metrics, for example showing the top ten lists of actors—individuals (such as Ind-PK) and companies (such as Mendor) within the Finnish ecosystem case. The actors who have the highest betweenness centrality can be seen to have key connecting roles within that ecosystem, highlighting the significance of certain specific actors within the various levels of Finnish ecosystem as well as in the aggregate, composite ecosystem (Figure 1). Hence, this example revealed that the same actors play significant roles in the various levels of the ecosystem.
When the SNA metrics are based on the same dataset and similar analytical procedures are used, comparisons are justified. In the use case comparing three metropolitan ecosystems of Austin, Twin Cities and Paris—concentrating on data about growth companies, their key personnel and their financing, in those areas—the metrics contribute to insights about ecosystemic relational capital (table 5). Furthermore, as the analysis was designed for supporting regional decision making and regional policies, the traditional SNA metrics were explained with terms more familiar and relevant for that specific context. Hence, the measurement of degree was called “relational potential”, referring to the number of available connections that could be leveraged (Russell et al., 2015).

Table 5: Allowing for comparisons between cities (Russell et al., 2015)

<table>
<thead>
<tr>
<th>Relational Indicators</th>
<th>Network Metric</th>
<th>Austin</th>
<th>Twin Cities</th>
<th>Paris</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Nodes</td>
<td>2501</td>
<td>1358</td>
<td>1405</td>
</tr>
<tr>
<td></td>
<td>Number of Edges</td>
<td>2193</td>
<td>978</td>
<td>1102</td>
</tr>
<tr>
<td>Profile</td>
<td>Ratio of Edge to Node</td>
<td>0.88</td>
<td>0.72</td>
<td>0.78</td>
</tr>
<tr>
<td>Engagement</td>
<td>Company Avg Degree</td>
<td>2.89</td>
<td>1.94</td>
<td>1.88</td>
</tr>
<tr>
<td></td>
<td>Finance Org Avg Degree</td>
<td>1.76</td>
<td>1.35</td>
<td>3.12</td>
</tr>
<tr>
<td></td>
<td>Individual Avg Degree</td>
<td>1.03</td>
<td>1.05</td>
<td>1.07</td>
</tr>
<tr>
<td>Relational Potential</td>
<td>Density</td>
<td>0.0007</td>
<td>0.0011</td>
<td>0.0011</td>
</tr>
<tr>
<td>Vitality</td>
<td>Average Betweenness Centrality</td>
<td>0.0022</td>
<td>0.0018</td>
<td>0.0002</td>
</tr>
<tr>
<td>Linking Factor</td>
<td>Main Component # nodes</td>
<td>1132</td>
<td>190</td>
<td>428</td>
</tr>
<tr>
<td></td>
<td>% nodes</td>
<td>45</td>
<td>14</td>
<td>30</td>
</tr>
</tbody>
</table>

Furthermore, with the developments of network metrics over time, the ecosystem dynamics related to the metrics can be presented. For example, the evolution of degree and betweenness centrality over time for two companies (Nokia and Microsoft) using two different datasets between the years of 2000 and 2013 makes the dynamics visible (Figure 3). The visual representation highlights that as networks evolve, so do their metrics, providing insight about the relational capital of a single organization in its larger ecosystem.
4.1.2 SNA visualizations

Visualizations of social network can emphasize the context and draw attention to key metrics for explaining relational capital. Especially for large networks (generally the case for social media networks), the visual presentation of metrics resulting from large datasets becomes crucial. Through visualization techniques, SNA makes relationships visible, revealing the social structures of the relationship phenomena, but also facilitating communicating about it and sharing insights (Freeman, 2009). The visualization of complex data enables decision makers to see patterns, spot trends, identify outliers, and thereby improve comprehension, memory and decision-making (Tufte, 1983). Coupled with the development of tools and computational power, the possibilities of visual network analysis are vast.

For example, an analysis of socially constructed data telling the story about the start-up scene in Finland (figure 3) shows the connections between the actors—companies and press-worthy individuals and financing organizations — of the ecosystem (Still et al., 2013a). It is not surprising that Nokia is a key actor as people previously associated with it are now taking active roles in other companies, either through employment, financing or advising roles. What is notable, however, is the fact that Startup Sauna also has a prominent relational capital role: it is a student-lead initiative for business incubation and acceleration, which connects to a number of start-up companies. Both of these key actors can be found easily from the network visualizations, and their direct relationships can be identified.

Figure 3: Showing developments of metrics over time (Basole et al., 2015)

Figure 4: Network visualization insights for relational capital (Still et al. 2013a)
Another example explores the insight potential of comparing alternative visual representations of data drawn from the same data sources, using similar analysis and visualization approaches, but sampling the data at various levels of the ecosystem. In the case of three metropolitan areas, the visualizations highlight the cumulative relationships present in the ecosystem at the growth level (Figure 5). In addition, as the human eye excels in seeing patterns, we can see that the amount of green (presenting the financial organizations and relationships to and from them) is proportionately different in each of the metropolitan areas.

![Figure 5: Visualization of comparing three metropolitan ecosystems (Russell et al., 2015)](image)

4.2 Customer loyalty and reputation with social media analytics

With the possibilities awarded by the availability of social media data about relationships, the approaches of social media analytics enhance the inclusion of the “customer loyalty and reputation” component. The example of Klout (Stone, 2012), usually seen as a characteristic of an individual, can be seen as a prominent example of measuring the online reputation.

There is an increasing trend toward using monitoring tools to search, track and analyze conversations and interactions of the large volumes of social media. A well-known understanding of the functionalities of social media is the honeycomb-approach, which lists identity, presence, relationships, reputation, groups, conversations and sharing as the seven building blocks constructed to allow making sense of how different levels of social media functionality can be configured (Kietzmann et al., 2011). Though many of these functionalities contribute toward better understanding of relational capital, one of the most relevant functionalities is reputation, the extent to which users know the social standing of others and content (Kietzmann et al. 2011). Its implication is for monitoring the strength, passion, sentiment, and reach of users and brands.

Toward understanding the reputation of some Finnish companies (all participants in the Finnish program for supporting their growth), the number of their twitter followers was analyzed and presented with the distribution of the twitter follower count (see Figure 6). It showed that some Finnish companies (namely Microtask, dealdash, Web of Trust, and Sportstracking) have significant numbers of twitter followers: Microtask more than 30,000; dealdash more than 10,000 (Huhtamäki et al. 2012), hence highlighting reputation, the attractiveness of these companies from the public perspective.
5. Discussion

We have emphasized that in this networked world relationships are not just within the one organization or from/toward that organization—that many levels of types of relationships do exist in the ecosystem, that they need to be orchestrated upon for knowledge flow and value creation, and that they can be quantified using social capital measurements (Feltham and Zoller, 2012). In addition, we show that there exist volumes of data about these relationships, especially in the realm of social media, including a lot of interactions between individuals, companies, technologies and products, and that data can be used to create novel measurements or indicators for relational capital (Figure 7).

For understanding value in networking capabilities, we support using SNA metrics, according to the initial framework and process of ecosystemic relational capital (Still et al., 2014a), elaborated in this paper to better communicate and explain its applicability. For further improvements in SNA metrics, we propose using and presenting these metrics in their context as well as using network visualizations to make the ecosystem visible and concrete. For enhancing the initial framework to extract elements of customer loyalty and reputation, we propose the use of social media analytics, which have been demonstrated in measuring online activities and content.

In this paper, we emphasize that these ecosystemic relational capital indicators provide novel ways of understanding and presenting the value of relationships. Hence, though the concrete use cases described in this paper use large volumes of relational data available from social media type data sources, the illustrative metrics and their visualizations can also be applied to more traditional data sources (such as data about deals and alliances, or any other relational data). Our motivation for highlighting these new types of openly available data sources is our expectation that they may provide interesting insights into ecosystems or relational capital.
5.1 Implications

In this paper, we are proposing a new set of tools to be added to the toolbox for exploring value in the networked, ecosystemic world. Our examples of relational capital have focused on networking capabilities and their application to the ecosystem context. The metrics—whether standalone, metrics in context, comparative, or dynamic — and the network visualizations contribute insights to understanding and measuring relational capital in the context of ecosystems. Hence, our paper contributes to the continuum for research designed to identify the processes for capital creation, accumulation, dissipation, and consequence introduced by Nahapiet and Ghoshal (1998).

Increasingly, networks are intentionally “orchestrated” or “engineered” by an organizational actor who recruits network members and shapes their interactions, corresponding to phases of innovation ecosystem building and management (Ritala et al., 2013). Network orchestration, the ability to connect and manage competences across a broad network of relationships, has been recognized as one of the most important meta-capabilities for a networked world (Wind et al., 2008). Previously, some of the stakeholders identified to benefit from network orchestration and its enhanced regional intellectual capital formation include venture capitalists, policy makers and employers’ federations and citizens’ interest groups (Schebesch et al., 2014).

We see that relational capital insights can contribute to network orchestration by:

- Presenting the “big picture”: making visible the complexity of relationships, simultaneously noting that not all actors nor all relationships can be represented. Still, patterns in the big picture can provide a shared mental model (whether with metrics or their visualization), which can then be used for sensemaking, discussions and shared vision within an ecosystem.

- Presenting beyond the “business as usual” ecosystem: showing the emerging actors and their roles. Though data from openly available online sources may not be official, validated or complete, it can be very timely and hence powerful in highlighting emergent patterns in the existing ecosystem - newcomers and their relationships—or the lack of relationships.

- Presenting comparisons between ecosystems: providing new ways for describing, comparing and possibly benchmarking ecosystems. For example, network density has been acknowledged as an institutional variable for innovation (Zoller, 2010).

By making the relationships visible, we see that the relational capital insights support the third dimension of social, labelled “the cognitive dimension” by Nahapiet and Ghoshal (1998), referring to those resources that provide shared representations, interpretations, and systems of meaning among parties. Hence, we propose that like “a minimum viable product” in rapid iterations of product development, business success may be enabled (Ries, 2011) by having a “minimum cognitive dimension” within an ecosystem – to align expectations and drive transformation.

5.2 Limitations

We do not suggest that these novel measurements are stand-alone solutions but rather complimentary approaches for understanding relational capital, which remains a complex concept and therefore should be treated as such. Though we agree with Kohlihammer et al. (2012) that visualization and visual analytics are vital for informed decision-making and policy modeling in a highly complex information environment overloaded with data and information, we do not advocate using network visualizations as the only evidence for decision-making or policy setting. At the same time, we acknowledge the challenges of boundary specification and overall definition for the ecosystem: what is an ecosystem; are ecosystems regional; are they platform, sector or transaction based? This debate is ongoing as the concept of ecosystem keeps getting traction, and we are looking forward of its implications for defining the relational capital and the relationships that need to be accounted for it.

We recognize that data-driven approaches are always limited by the data itself, its quality and quantity. Some of the advantages of social media include availability, large coverage, timeliness, and community verification of data quality. Some of the disadvantages are potentially erroneous data and public bias—and certainly, some of the relevant data might not be included. We encourage the development of improved methods for managing the volume, velocity and variety of data (McAfee and Brynjolfsson, 2012).

We propose experimenting and widening the use of SNA metrics and especially social media analytics, following the promise of big data and its analysis (McAfee and Brynjolfsson, 2012). For example, we highly recommend expanding
the exploration to other social media data, going beyond the Twitter data of our example. Some further experiments about using Wikipedia data have shown us that a very limited number of companies have their own Wikipedia pages. Hence, for policy making—which is traditionally addressing averages when measuring innovation activities—Wikipedia might not be the best data source for getting inclusive data about companies. However, for policy making concentrating on “superstars” the Wikipedia data source shows promise.

6. Conclusions

In today’s global and interconnected world, relationships between multiple stakeholders—created by key personnel and financing — are fundamental. Relationships create value through social capital, which is exchanged as talent, information and financial resources pass between people in organizations (Russell et al., 2011). Understanding and measuring social capital becomes fundamental, and relationship networks in ecosystems provide one way of understanding the patterns of relationship. The ecosystem context permits measuring relational capital in a context that extends beyond social, individual or personal relationships and organizational context, as well as beyond the limitations of the dyadic (one actor to one actor) view on relationships. By proposing constructs and methods to examine the totality of relationships - both at the individual and organizational levels, measuring the structures and characteristics related to individuals, organizations as well as the ecosystem as a whole (Still et al., 2014a) – this paper presents a construct of ecosystemic relational capital, which can be used to measure and understand the importance of relationships in the context of ecosystems. This conceptual framework emphasizes the “networking capabilities” element of relational capital, with less attention to “customer loyalty and reputation. It presents a viable avenue for obtaining novel insights about relational capital, which can be used on consort with other methods.

Using data-driven social network analysis, the abstract concepts of relational capital in ecosystem contexts become visible, enabling discussion, the development of shared understanding and vision. In doing so, we believe significant contributions can be made to improving the quality of complex decisions which face leaders. We invite further elaboration of the concepts and analytical methods and look for enhanced judgment and leadership in addressing complex issues.

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The Evolution of the Models of Knowledge Management in the Dynamic Business Environment (Cases of the Industrial and Construction Networks in St Petersburg)

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Abstract: The paper investigates the process of evolutionary transformation of cooperation and integration modes of industrial and construction enterprises in St.-Petersburg. The period of research (1995-2015) covered three crises in the Russian economy: the crisis after the default of 1998-1999, the global financial crisis of 2008-2009, and the current crisis of 2014-2015. The results obtained enable us to analyze the evolution of the intellectual capital management system in networks, as well as the evolution of networks themselves during changes in the business environment. The network form of integration was chosen as the main objet of this research. The paper is aimed at identifying the path of knowledge management development in different types of networks. One of the peculiarities of the network form of integration is the high level of independence of the network participants that interact with each other. Key issues in this cooperation would be the following: How to organize an effective transfer of knowledge and technologies within a network? How to find a balance between open systems of innovation and the protection of the intellectual property of network participants? How to evaluate the intellectual capital of a network? Is it necessary to make an assessment for each participant separately? Should one take into account synergies that increase the value of the intellectual capital of the companies interacting within a network? How to measure the impact of open innovations on the intellectual capital of the companies? Thus, it is important to reveal how knowledge management model is growing and becoming mature from the amorphous type of network cooperation to the integrated type.

Keywords: networks, knowledge management, open innovation systems, innovation synergy, capacity for evolution

1. Introduction

Competitiveness of companies in a knowledge-based economic environment is determined by the efficiency of knowledge and intellectual capital management. The possibilities of network cooperation considerably broaden innovation potential of the companies. The Network consolidates intellectual assets, including knowledge, expertise, people resources. Synergy allows the innovation process to be significantly accelerated. The innovation cycle stages are reduced not only by augmentation of the quantitative potential, but by a corporate culture oriented to development and continuous education. The study of network cooperation modes between small, medium and large companies showed that integration can be accomplished in different ways. In these conditions the institutional aspect the management of knowledge and intellectual capital is of interest. We've analyzed different models of network interaction and revealed the main modes of knowledge management system in our article.

2. Study methodology

The main purpose of our article is to identify the influence of the network cooperation mode on the knowledge management system architecture. Accordingly we addressed the following problems: study of networks in industry and construction; revealing the mode and stage of integration of network companies; study of the methods and mechanisms of knowledge and intellectual capital management in networks; efficiency assessment of network cooperation in value enhancement of intellectual capital. The main methods of our study are observation, interview, information analysis and synthesis, and logical and mathematical simulation. The basic concept adopted in the study is the open innovation concept theoretically based by Chesbrough, Vanhaverbeke and West (2003). In the article “Open innovation: The next decade” presented by West, Salter, Vanhaverbeke and Chesbrough (2014) 10 years of this approach were summarized. The authors confirmed the efficiency of this business model in the current conditions. At
the same time the authors identified some problems. Open innovation presents the problem of interested parties’ relationship within the network and out of it. The open innovation problems in the context of the SME’s networks was developed by Lee, G. Park, Yoon and J. Park (2010), Drechsler and Natter (2012), Okatan (2012), Gnyawali and Srivastava (2013), Tomlinson and Fai (2013). As noted by Rogo et al. (2014), open innovation efficiency is defined by several factors, including the level of development of legislation and availability of highly qualified personnel. Those factors enable the interests of the network parties to be protected. The process of network formation has a heuristic nature. By its nature, a network is the structure formed on the basis of cooperation between companies in the process of creating a certain product. Having said that, it must be noted that the scales of network structures essentially depend on the specifics of the core process for the creation of the end product.

Networks intrinsically possess all the benefits provided by economic integration based on cooperation.

Let us analyze the cooperative interactions within a network. The basis for assessment of the impact of cooperation is the discovery of the primary mechanisms which implement cooperative interactions. A similar analysis of the mechanisms for the whole complex of small enterprises was carried out in the research paper by Yegorova and Marennyi (2002). We think expedient to extend and complement the list of mechanisms revealed, taking account of the specific nature of cooperation within a network.

These include the following:

- A cost and distribution mechanism ensuring optimum utilization of production capabilities for all companies taking part in the process of cooperation on the basis of subcontracting and outsourcing. At the same time, joint use of information and manufacturing resources may serve as a tool with a view to optimizing the costs of all participants of the cooperation process.
- A loan and cooperation mechanism with the utilization of network participants’ reciprocal loan facilities, as well as mutual guarantees and sureties in case of stable and long-term cooperation. A network may include production facilities, as well as financial and investment companies, investment banks and leasing companies.
- A tax optimization mechanism. It presupposes legitimate methods, as well as illegitimate ones, to be used as a basis for reducing taxes. Tax problems, as faced by financial management of the companies that make up the network, are partially solved by conducting operations that facilitate the use of schemes aimed at reducing the burden of taxation (Proskura, 2007).
- An innovation mechanism. It presupposes the use of technological transfer on preferential terms for the network participants (including franchising elements), as well as research and development cooperation.
- An information mechanism. It has two aspects. A marketing mechanism brings an opportunity for all cooperation process participants to use the advantages of a well-known brand. A communication mechanism presupposes the formation of a common information space to ensure efficient communications.
- Each major network can be a system of minor networks engaged in competition with each other on a limited regional market; however, they may combine efforts, when externally influenced, for instance to enter national and international markets.

3. Network model study: The cases of the industry and construction networks of St Petersburg, Russia

Our study of the networks in industry and construction of St Petersburg is being conducted from 1998 till nowadays. Market transformation of the Russian economy on the first stage led to disintegration of companies, primarily in industry. Long-term cooperation connections were destroyed. The process of segmentation of production associations occurred rapidly; for instance in 1991 there were more than 5,500 engineers and production workers at the Northern (Severny) plant, and the plant had its own development bureau. By 2002 there were less than 500 workers left on the plant. All production enterprises suffered this trend. The process of recovery and development of cooperation networks was slow. The general decline in industry hampered economic development of separate enterprises. Quasi-holdings became the main form of the network during this period. Quasi-holdings were formed in the process of restructuring of the large enterprises. The process of separation of small and medium enterprises from their structure led to a loss of control. Management endeavoured to save the remains of the industrial potential and formed holding ventures. The model of the quasi holding, JSC Stroymechanizatsia-1, is shown in fig. 1.
In these conditions, the knowledge-based SME sector grew rapidly. The employee development, innovation, customer satisfaction and organizational success were the areas where small and medium-sized businesses benefited from knowledge management activities (Edvardsson and Durst, 2013).

3.1 Case 1: The amorphous networks. Proto-cluster of SME in construction industry (St. Petersburg)

The process of rapid development of the networks began during the recovery period of the Russian economy. Moreover a lot of cooperation connections were informal, networks did not have a clearly defined architecture, and a great number of network participants did not have clearly defined boundaries. Accordingly, those networks were difficult to research. The only way to analyse network cooperation is an interview. Studies we conducted showed us that frequently those networks had the certain coordinate authorities, which defined the strategy of the network development. The main method of knowledge transfer in those networks is replication, legal as well as illegal. A knowledge management system is practically non-existent and intellectual capital essentially underestimated. This condition of the knowledge management system can be defined as amorphous (fig.2)

**Figure 2:** The amorphous network

From an interview (2010) of the director of the company participating in the divisionalisation of a cooperating network in the construction industry: “I don’t need qualified workers. They cost too much. To teach migrant worker to tighten a screw you only need one hour – and let him go and work. The engineers just have to design the projects; they were taught that in university, you don’t have to teach them”. However under the influence of the changed circumstances transformation of such networks occurs very quickly. The company described teamed up with a large network, which develops new technologies for construction assembling on the open innovation platform. From the interview with the same director (2013): “Everyone went to learn. I myself went abroad for training four times in the last year. We need
to adapt these technologies to Russian conditions first, otherwise we will be pushed (out of the market) by competitors. The only problem is with the good workers. We will educate our own”.

### 3.2 Case 2: “The technological daisy”. The metal fabrication industry cluster

Most common models of the structured networks are vertically and horizontally integrated companies.

Horizontally integrated companies, which have common business profile, build their knowledge management system on the principles of a competency building approach. The variant of a technology transfer centre is a technology competence centre – hi-tech production, which every network participant uses as a production unit and educational centre, allowing the technology level to rise rapidly. In 2008 for description of architecture of such networks by P. Plavnik and K. Soloveychik suggested the term “technological daisy” (fig. 3)

Presently this centre is acquiring the characteristics of a full-scale research subdivision and participates in the development process of a new diesel unit. A wide range of the companies is participating in this work, and development is conducted on the principles of open innovation. This was prompted by the complexity of the problem.

In the assessment of general director JSC Zvezda, P. Plavnik, organizer of the metal fabrication industry cluster, “the level of the losses of engineering competence … allows us today to invest in the new diesel intellectual product at a level of only 20-30% of the investment required for the creation of a new diesel”.

![Figure 3: Knowledge management structure in a metal fabrication industry cluster](image)

### 3.3 Case 3: “The technological funnel”. Polymer cluster of St Petersburg

A graphic example of the horizontal integration of enterprises, research organisations, commercial structures and engineering firms is the polymer cluster. This cluster was built around a scientific problem, the solution of which has great commercial potential. The problem of development of a polymer coating with particular characteristics united a great circle of participants. Working as an open innovation network this cluster successfully commercialized a range of side products, which resulted from solving the main problem. The functional model of this cluster is shown in fig. 4.
3.4 Case 4: The integrated networks. Transport engineering cluster “Metrodetal” (St Petersburg – Tikhvin – Saratov)

Integrated networks, as a rule, unite organizations connected by subcontracting and outsourcing contracts. Such type of networks are characterized by the tendency to vertical integration. Without a large enterprise, which could assume the core functions, the special subdivision is formed. This subdivision assumes the functions of the parent company. For instance, a transport engineering cluster develops this way. The cluster management structure is shown in fig. 5.

As you can see on the schematic shown, in this network the system of knowledge and intellectual resources management is developed and all the companies of the cluster implement a common innovation policy. At the same time the innovation process involves external organizations when this meets the interests of the cluster development. This cluster gradually undergoes the process of transformation into a corporation, which poses a question on institutional aspects of network development.

Figure 5: “Corporate” structure of the transport engineering cluster “Metrodetal”

The transformation process of the knowledge management in networks as they develop is shown in fig. 6.
4. Institutional problems of the network development in the Russia

From an institutional point of view the network development process can be completed by the process of vertical, horizontal or heterogenic integration into a holding or cross-holding structure. Consequently, the open innovative systems are characterized by the features inherent to the network organizations. And the companies that decide to use this business model have to address an open question about the level of innovation synergies generated by the network interaction. Isn’t an open innovation system worse than a closed one, such as existing in the vertically integrated corporation?

The problem of the comparative effectiveness of cooperation of independent companies and vertical integration was defined, for example, in the works by Kapitonenko (1994), Jacobides, Knudsen and Augier (2006), Tkachenko (2007).

We believe that a similar approach can be implemented to the analysis of the benefits of open innovation systems that use acquired intellectual capital.

The likelihood of a successful transition from one R&D phase to the next one for the organization of non-integrated participants in the innovation process is determined by several factors such as:

- the level of supply and demand for an innovative product;
- the correlation between market and contractual prices;
- the communication effectiveness;
- the duration of parallel and sequential steps;
- the stability of relations between the participants of the innovation system;
- the degree of solvency of the end user;
- the degree of scarcity of consumed resources, etc.

The probability that a failure may occur at any stage of the innovation cycle increases with the unfavourable scenario. Naturally, the probability of deviation from the performance time is less and determined by the probability of performance by each division of the research or production programme within a vertically integrated corporation in the context of complete dependence of research and production departments on the administrative centre. There exists a possibility of information leakage within the corporation in the early stages. However, the level of information security will be significantly higher than in the union of non-integrated companies because of the strategic management unity realized through a system of bilateral long-term contracts.
To get quantitative estimates, we consider the full innovation cycle where each result \( i \) is used to get the following result \( (i+1) \) with a certain expenditure ratio \( a_{i(i+1)} \). Let us suppose as a first step that the companies involved in the development process and companies that produce prototypes are organizationally independent. In this case, each result theoretically has its market \( R_i \), the subjects of which are vendor-manufacturer of the product or result \( i \) \( S_i \) and the consumer of the product or result – the manufacturer of the product \( (i+1) \) \( S_{(i+1)} \):

\[
S_1 \rightarrow R_1 \rightarrow S_2 \rightarrow R_2 \rightarrow ... \rightarrow S_{n-1} \rightarrow R_{n-1} \rightarrow S_n \rightarrow R_n, \quad (4.1)
\]

where \( n \) is a final product. Thus the open innovation system may experience adverse results of research and development that lead to the creation of an additional final innovation product. In this case (1) takes the following form:

\[
S_1 \rightarrow \{ R_{11}; R_{1r} \} \rightarrow \{ S_{21}; S_{2m} \} \rightarrow \{ R_{21}; R_{2r} \} \rightarrow ... \rightarrow \{ R_{n1}; R_{nm} \} \quad (4.2)
\]

The effectiveness of the innovation process for the project participants will be determined not only by the success of the implementation of the planned end-product \( N \), but also by the results of the implementation of side projects. In that way, from the point of view of the participants, the effectiveness of the open innovation system will be different from the effectiveness of a closed system as follows (3):

\[
\Delta E = E (\{ R_n; R_{n2} \}) - E (R_n), \quad (4.3)
\]

where \( E \) is a function of the effectiveness of the final products of the innovation process.

Consequently, it is obvious that an open innovation system has a higher potential for efficiency compared to a closed one, even without considering the results of the qualitative parameters of the innovation process; but the involvement of the external intellectual capital also entails certain risks related to the inability to secure the rights to the intellectual property at some stage that the interpreters of the model do not take into account (Plotnikov, Sobolev, 2012).

The problem of choosing the form of institutional integration from a theoretical point of view comes down to the problem of control of ownership. According to the logical comparative analysis of efficiency of formal and informal integration, other factors are not crucial. In the stable cooperation network stability of supply is provided on the same high level as in a corporation. However in the Russian Federation cluster policy pushes networks and clusters towards the corporate form of integration. To ensure authorities support for the cluster it is necessary for the management company of the cluster to register with the government as a non-commercial partnership, which contradicts the purpose of commercial efficiency of the cluster. Networks and clusters reviewed above do not exist from official St Petersburg statistics and city authorities’ point of view. There is no information about those clusters on the web-site of Industrial Policy and Innovations Committee of St Petersburg administration. In fact there are more than 25 networks and clusters operating in the city in different spheres, while according to official data there are only 5, and notably only one cluster receives support - the pharmaceutical cluster.

One more reason for many networks to choose the corporate form of integration is to receive the access to the public procurement system. For a large joint stock company it is easier to receive a government order than for a small or medium-sized company or for a partnership of such companies. Now, according to the new public procurement law, discrimination against small and medium-sized enterprises is prohibited, but in fact it’s difficult for SMEs to compete with large enterprises in open tender conditions.

5. The problem of the capacity for evolution of knowledge and intellectual capital management systems in innovation networks

The number of network units may be quite considerable, just as the number of enterprises making up the system. In this case, we are dealing with proactive cooperation initiated by economic agents in order to improve the competitiveness of each participant in the network, based on benefiting from the synergetic effect provided by the interaction of elements of the network system.

Consequently, it is possible to use mechanisms facilitating the formation of network structures at the level of regional management. In this case, reactive cooperation will take place; that is, formation of networks must be the reaction of a regional economic system to changes in business environment in the form of opening the door to development of
networks in the thematic priorities of business activities. The research revealed direct interrelation between the way a network is formed and its further capacity for evolution.

Let us consider the factors giving rise to network structures.

- Increased competition that resulted in the formation of stable long-term cooperation;
- Changes in business environment (tax, legislative, political, and other changes), that increase the effectiveness of performance of associations of enterprises;
- Outside pressure on a sector of the economy, requiring a combination of efforts to successfully resist the pressure;
- Introduction of new technologies that precondition the spontaneous formation of association of enterprises based on core technology;
- The need for scientific and technical cooperation in technology intensive sectors of the economy.

Networks that are proactive in nature have the capacity for self-development. Cooperation brought about for economic reasons was the basis for their formation. At a later stage, when influenced by the change in external conditions, these networks manifest a high degree of adaptiveness. The more complex the conditions, the more structured amorphous networks become, and the higher is the probability of network transition to hierarchic interaction and to the formation of quasi holdings. The intellectual asset management system then becomes one, ensuring effective transfer of knowledge, technological development, employee training and education and, as a consequence, improved competitiveness. As the external pressure is reduced, the degree of organization may become lower. In some cases, degradation or transformation of the network may be observed.

According to our research, networks formed under the reaction principle, as a consequence of the stimulating impact from regional authorities, are far from being able to evolve. As a rule, they are initially grouped around technology (technological daisy), or around a core task (technological funnel). The reaction of those networks to changing basic conditions is to seek external assistance and support, in the first instance, from local authorities.

6. Conclusion

The research enabled us to organize the types of knowledge and intellectual capital management systems in innovation networks. Our research revealed two factors influencing the evolution of knowledge management within networks.

First, we identified a direct correlation between the network structuring level and the development of a knowledge management system. Task-oriented knowledge and intellectual capital management does not depend on the scale of the network or on the size of participating enterprises. Evolution of models of knowledge management in networks directly depends on degree of rigidity of cooperation communications. Indistinct, soft networks usually use intuitive methods of knowledge management. The structured networks aspire to ordered and organized models of knowledge management. The changes of environment influence the speed and the direction of evolution process. Awareness of the need of knowledge management development is dictated by competition strengthening.

Second, and this is a practical contribution of this study, it revealed direct interrelation between the way a network is formed and its further capacity for evolution. Proactive way of networks forming provides more possibilities for evolution of knowledge management within networks. Thus, the competition and the way of networks forming cause evolution of knowledge management in networks.

References


The Communication of Intellectual Capital – Prevalence and Relationship with Organizational Performance

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Abstract: While intellectual capital (IC) as an asset is long noted, one area that has begun to attract attention is the communication of IC. The past decade of increasing global competition and economic downturns have enhanced the importance of the communication of IC, in particular, how IC supports organizational performance (OP). Current literature on the communication of IC is limited to reporting metrics, which does not provide sufficient insights on OP. Yet, the need for the communication of IC is growing globally as investors are demanding for more non-financial information to reflect organization’s sustainability. Hence, the objectives of this study are three-fold. First is to ascertain the prevalence of the communication of IC, where past studies have reported low occurrence. Secondly, the study aims to examine the communication of IC in terms of content; and finally, to investigate the correlation of the communication of IC with OP. The dataset used in this study was drawn from annual reports and supplementary corporate disclosure (ARS) published for FYE2011 in English by 299 banks listed on the stock exchanges globally. The communication of IC was reviewed from three angles, namely human capital, relational capital and structural capital; and OP encompasses business continuity, risk management and organizational productivity. Content analysis was used to evaluate the communication of IC and to highlight nuances and trends. Findings showed that the communication of IC was prevalent in more than half of the banks in the dataset, where the communication of Human Capital content was most widely reported. Smaller banks, in particular, were found to be lacking in the communication of IC. Three peculiarities were also identified, namely inclusion of information on women, importance of training to organizational productivity, and extensiveness of risk management processes in banks. The significance of this study lies in its effort to highlight relevance of the communication of IC from the perspective of IC components and its correlation to OP.

Keywords: intellectual capital, communication of intellectual capital, organizational performance, correlation, annual report and corporate disclosures

1. Introduction

Competition, deregulation and the series of economic downturns in the past decade have highlighted the importance of intellectual capital (IC) in supporting organizational resilience, particularly the sustainability of organizational performance (Kamath, 2007; Lengnick-Hall et al., 2011). While prior literature has long noted the significance of IC as an organizational asset, one area that has attracted little attention in both the research and business communities is the communication of IC (Abeysekera, 2006; Boedker et al., 2004; Miller and Whiting, 2005). In fact, organizations that have weathered economic shocks seem to be those that recognize the value of IC and regularly publicize their performance to stakeholders (Dumay, 2009). Here, IC represents an organizational asset while the communication of IC refers to the information on the organization’s IC publicized to stakeholders.

In spite of the importance of IC to organization, past studies have reported low prevalence in the communication of IC (Ahmed and Hussainey, 2010; April et al., 2003). There were two common thoughts of arguments to explain such low prevalence. First, the difficulty faced in expressing and codifying IC, and secondly, the lack of mechanism to recognize and quantify IC (Bontis, 1998; Vafaei, et al., 2011). There is, however, a changing trend in the communication of IC, fuelled by advancement in technology, social media, and stakeholders’ expectation (Eurosif, 2011; Marsh, 2012; Rudrajeep et al., 2011). This gives rise to the opportunity to update the literature on the prevalence of the communication of IC.

As the communication of IC is increasingly used to interpret the sustainability of the organization, scholars have called to better comprehend the content in the communication of IC (Abhayansa and Abeysekera, 2009). The content in the communication of IC can be reviewed from the three broad categories of IC, namely, human capital, relational capital and structural capital (Bontis, et al., 2000). Such content is often found in organization’s corporate disclosures to reflect the organization’s sustainable competitive advantage (Oliveira and Russell, 2010). The existing literature on the communication of IC is focused mostly on reporting metrics that emphasized the numerical value of IC such as revenue per employee and the number of patents registered (Abeysekera and Guthrie, 2002). However, the communication of IC can also be expressed in non-numerical terms, such as pictures, diagram, illustration, and narration (Beattie and Thomson, 2007).
While IC has long been acknowledged to be positively correlated with organizational performance (OP), there is limited reference made on the relationship between the communication of IC and OP (Chan, 2009; Zéghal and Maaloul, 2010). Past studies reasoned that the limited reference could be due to the inadequacy of traditional financial and management accounting reports to incorporate content on the communication of IC, and thus were unable to systematically convey the performance and status of IC to organizational managers and stakeholders (Firer & Williams, 2003). Scholars are calling for deeper understanding of the communication of IC in relation to OP, in view that industries are becoming more global, dynamic, competitive and knowledge intensive (Abhayawansa and Abeysekera, 2009; Ousama, Fatima, et al., 2011).

The demand for the communication of IC is growing as investors are pushing for more non-financial information to assess the potential of organizations to generate future revenues and achieve sustainable results (Bismuth and Yoshiaki, 2008). Likewise, the communication of IC is growing as organizations need to monitor and develop their competencies and strengths to perform (Bukh et al., 2005). Hence the objectives of this study are three-fold. The first examines the prevalence of the communication of IC in annual reports and supplementary corporate disclosures (ARS) in view of the changing trend in organizational disclosure (Chan, 2012). The second analyzes the content in the communication of IC disclosed in the ARS, and finally this study investigates the correlation of the communication of IC with OP. This study centers on banks, listed on global stock exchanges, as the banking sector is a knowledge intensive sector, highly dependent on IC to remain competitive (Demirguc-Kunt et al., 2010; Gigante and Previati, 2013).

2. Literature review

Intellectual capital (IC) is an important asset in organizations and has drawn interests across discipline and stakeholders in the past decade (Serenko and Bontis, 2009). IC represents human intellectual and organizational knowledge collectively to encompass knowledge, experience and creativity of employees as well as resources embedded in databases, systems and processes (Al-Ali, 2003). Scholars have broadly categorized IC into three components, namely, human capital, structural capital and relational capital. Human capital is closely associated with the employees and it refers to their knowledge, competencies, experiences and know-how, their combined skills and innovativeness necessary to solve customer needs and problems (Edvinsson and Malone, 1997; Sveiby, 1997). Structural capital concerns the mechanisms and structures of the organization that support employees in their quest for performance (Bontis et al., 1999). It comprises knowledge resources embedded in databases, systems and processes that provide the environment to encourage employees to create and leverage knowledge within the organization. Relational capital refers to the knowledge embedded in the relationships that the organization has developed internally and externally (Bontis et al., 1999). The most important relational capital are customers, suppliers, business partners, shareholders and other stakeholders such as the local community (Sveiby, 2001).

While the importance of IC to organizations has long been widely covered, the communication of IC as a topic has begun to gain attention (Abeysekera, 2006; Miller and Whiting, 2005). The communication of IC in this study is defined as the information disclosure of the organization’s IC through the ARS. Generally reported as part of non-financial information, the communication of IC focuses on a narrower definition of the organization’s IC, in particular, the organization’s sustainable competitive advantage and performance (Oliveira and Russell, 2010). For example, in the communication of IC, the content on human capital includes training, human resources and employee retention or attrition; content on relational capital comprises customers, suppliers and business alliances; and content on structural capital covers intellectual property, processes and accreditation (Beattie and Thomson, 2007). As IC is tacit in nature, the communication of IC can also be presented as visual images, numbers, tables and charts (Husin et al., 2012).

The prevalence in the communication of IC is further fuelled by advancement in technology, social media, and stakeholders’ expectation (Eurosif, 2011; Marsh, 2012; Rudrajeep et al., 2011). Investors, in particular, are demanding more non-financial information, such as the content used in the communication of IC, to assess the potential of organizations to generate future revenues and achieve sustainable results (Bismuth and Yoshiaki, 2008). This impetus has led organizations to explore different ways of communication, ranging from business reporting models and Internet reporting, to disclosure through face-to-face investor relations meetings (Beattie and Pratt, 2001). The past decade also saw more organizations disclosing their competencies in annual corporate reporting such as the corporate social responsibility (CSR) reports, which traditionally have focused on philanthropy, environmental and social responsibility statements of the organizations (Chan, 2012). As such, the communication of IC is becoming an
important aspect of documentation used to connect with and manage stakeholders’ expectations, to inform how resources are managed within the organizations and used for decision-making (Cinquini et al., 2012).

The study of IC is recurrently linked to organizational performance (OP), one of the most important constructs in management research that is synonymous to output, productivity, health and organizational excellence (Aubry and Hobbs, 2010; Richard et al., 2009). Traditionally, OP is associated with revenue and profitability. However, economic uncertainty and global competition render these measures insufficient to provide present and forward perspective of OP (Ousama, Abdul Hamid, et al., 2011). As such organizations augment performance review with business continuity, risk management and organizational productivity (Al Bawaba, 2010; Eurosif, 2011; Marsh, 2012; Rudrajeep et al., 2011).

Business continuity refers to the ability of organization to maintain its critical business functions and performance in emergency or bad economic conditions (Elliott et al., 2010; Hiles, 2010). This means safeguarding organizations’ assets by having sufficient capital and liquidity to ensure business continuity (Federal Reserve, 2012; Johnston and Nedeleascu, 2006). Risk management is the organization’s awareness, assessment and preparation for risks surrounding its market and environments, to minimize, monitor and control impact to the organization (Hubbard, 2009; Kerzner, 2009). Banks, for example, must maintain solvency, and are monitored for their Tier 1 capital ratio, a regulatory risk indicator that measures the bank’s financial strength (Fahlenbrach and Stulz, 2011; Pagach and Warr, 2011). Organizational productivity refers to maximizing the use of organization’s resources, reducing costs and duplication, and running an efficient and effective operation (Goodman and Harris, 1995; Pritchard, 1990). Return on Assets indicates the organization’s asset utilization, and Return on Equity measures income available to shareholders as a percentage of the book value of their investment in the organization (Carton and Hofer, 2007; Pritchard, 1990).

Though literature exists on the communication of IC, limited references were available in respect to OP, in contrast to availability of studies on IC and OP (Chan, 2009; Murray et al., 2006; Zéghal and Maaloul, 2010). There are three possible reasons highlighted by scholars for the gap in literature. Firstly, current mandatory corporate filings in most countries are not sufficient to disclose and provide insights on the organization’s ability to address business continuity, risk management and organizational productivity issues (Holder-Webb et al., 2009). Secondly, the difficulty faced in expressing and codifying IC (Bontis, 1998; Edvinsson and Sullivan, 1996). Finally, organizations do not report systematically information about their capacity to generate revenue, value drivers, trends, risks, uncertainties and ability to achieve sustainable results to stakeholders (Bismuth and Yoshiaki, 2008; Vafaei et al., 2011). In view of IC’s contribution to the organization’s sustainability, scholars and practitioners call for deeper understanding of the communication of IC and its relationship with OP as industries are becoming more competitive and knowledge intensive (Abhayawansa and Abeysekera, 2009; Ousama, Fatima, et al., 2011).

3. Methodology

This study was drawn from ARS published for the financial year ending 2011 (FYE2011) in English by 299 banks listed on the stock exchange globally. A two-step approach was adopted in selecting banks. Firstly, banks listed on stock exchanges were shortlisted. Secondly, data of banks with the communication of IC were filtered for FYE2011. The FYE2011 was considered as not all banks reported FYE2012 performance at the point of this study. Each bank was checked for completeness of data to address jurisdictional regulatory differences. The result was 503 banks, where each bank was further reviewed for content on the communication of IC. A final number of 299 banks are used for this study.

The banking sector is focused in this study for three reasons. Firstly, the banking sector is a knowledge intensive sector and is highly dependent on IC to remain competitive (Demirguc-Kunt et al., 2010; Gigante and Previati, 2013). While physical assets are important to banks, it is the IC that determines service quality, product differentiation and value added services, which in turn affects the performance of the banks (Goh, 2005). Secondly, banks operate in a highly regulated environment under great scrutiny to perform. They are required to produce annual reports of their performance to regulators and stakeholders, and are thus publicly available for analysis. Finally, by limiting the analysis to the banking sector where most of these organizations are large organizations, the effects of disparate organizational sizes and operating environments can be reduced.

Data on the communication of IC is reviewed from three angles of the IC component, namely human capital, relational capital and structural capital. Guided by literature and previous studies using binary coding methodology (Alsaed, 2006; Goh and Lim, 2004), relevant content reflecting the communication of IC was compiled, reflecting the availability of each IC component. Two independent reviewers evaluated the dataset of 299 banks. A sample size of
100 banks representing 33.4% of the dataset was used to test for inter-coder reliability, measuring 0.805, which indicated an acceptable level (Cohen, 1960). Table 1 provides examples of the communication of IC compiled from the dataset of 299 banks.

### Table 1: Examples of the communication of intellectual capital recognized for coding

<table>
<thead>
<tr>
<th>IC Components (Organizational Asset)</th>
<th>Type</th>
<th>Examples of the Communication of Intellectual Capital data collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Capital</td>
<td>Training</td>
<td>“Training programs”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Diversity training and mentoring”</td>
</tr>
<tr>
<td>Human resources</td>
<td></td>
<td>“Employment diversity”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Gender distribution”</td>
</tr>
<tr>
<td>Employee attrition</td>
<td></td>
<td>“Staff turnover”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Annual hiring and attrition rate”</td>
</tr>
<tr>
<td>Relationship Capital</td>
<td>Customers</td>
<td>“Customer service”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Customer satisfaction statistics”</td>
</tr>
<tr>
<td>Suppliers</td>
<td></td>
<td>“Support services”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Important contracts”</td>
</tr>
<tr>
<td>Alliances</td>
<td></td>
<td>“Foreign correspondents”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Key partnerships”</td>
</tr>
<tr>
<td>Structural Capital</td>
<td>Intellectual property</td>
<td>“Patents and know-how”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Branding”</td>
</tr>
<tr>
<td>Processes</td>
<td></td>
<td>“Workplace security and health”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Risk management and internal control”</td>
</tr>
<tr>
<td>Accreditation</td>
<td></td>
<td>“Ranking and awards”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Good corporate government assessment”</td>
</tr>
</tbody>
</table>

To add granularity, the two independent reviewers ranked the level of communication of IC in each bank from a scale of 1 to 3, based on disclosure rating scale inspired by psychology and behavioral scholars (Barak and Gluck-Ofri, 2007; Chelune, 1979; Vondracek and Vondracek, 1971). The rating scale denotes (1) low communication; (2) average communication; and (3) high communication. Table 2 provides examples of the three levels shown. To test for inter-coder reliability, both reviewers evaluated a sample size of 31 banks, representing 10.4% of the total dataset. Cohen’s Kappa measures of 0.810 indicate an acceptable level of agreement between reviewers (Cohen, 1960).

Organizational performance is reviewed from three perspectives, namely Business Continuity, Risk Management and Organizational Productivity, representing three dependent variables (DV). This study considers two proxies for each DV, as previous studies showed that the use of a single proxy might be considered simplistic and lacking accuracy, and generalizability (Richard et al., 2009; Shah and Corley, 2006). Guided by literature, Table 3 shows the choice of six proxies to represent Business Continuity, Risk Management and Organizational Productivity.
Table 2: Examples of the communication of intellectual capital based on three levels

<table>
<thead>
<tr>
<th>IC Components/ Type</th>
<th>Level of Communication</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Capital - Training</td>
<td>1</td>
<td>“Number of employees”</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>“Segmentation of employees”</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>“Diversity of employees”</td>
</tr>
<tr>
<td>Relational Capital - Customers</td>
<td>1</td>
<td>“Number of customers”</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>“Customer segmentation”</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>“Customer segmentation – New/ Repetition”</td>
</tr>
<tr>
<td>Structural Capital - Accreditation</td>
<td>1</td>
<td>“Awards”</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>“Awards and description”</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>“Awards, description and peer ranking”</td>
</tr>
</tbody>
</table>

Table 3: Calculation of proxies used for dependent variables (organizational performance)

<table>
<thead>
<tr>
<th>Organizational Performance</th>
<th>Description</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Continuity</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Liquidity</td>
<td>Current Assets/Current Liabilities</td>
</tr>
<tr>
<td></td>
<td>Market Growth Capitalization</td>
<td>(Market Capitalization in FYE2011 – Market Capitalization FYE2010)/ Market Capitalization FYE2010</td>
</tr>
<tr>
<td></td>
<td>Growth</td>
<td></td>
</tr>
<tr>
<td>Risk Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tier1 Capital ratio</td>
<td>(Total Equity - Revaluation Reserves)/(Risk Based Assets)</td>
</tr>
<tr>
<td></td>
<td>Solvency</td>
<td>(Net Profit After Tax + Depreciation) / Total Liabilities</td>
</tr>
<tr>
<td>Organizational Productivity</td>
<td>Return on Assets</td>
<td>Total Revenue/Total Asset</td>
</tr>
<tr>
<td></td>
<td>Return on Equity</td>
<td>Net Profit/Shareholders’ Equity</td>
</tr>
</tbody>
</table>

In determining the correlation between the communication of IC and OP, non-parametric Kendall’s tau-b method is used when assumptions of normality or linearity cannot be met (Weiss, 1999), as is the case with dataset used in this study. Kendall’s tau-b correlation was chosen because of its ability to measure the strength of the relationship between any two variables. The tau correlation presents values between -1 to +1, with positive correlation indicating that ranks of both variables increase together, whilst a negative correlation indicates that as the rank of one variable increases, the other one decreases (Conover, 1980). Content analysis is also used to evaluate content and presentation used in the communication of IC prevalent in ARS to highlight nuances and trends.

4. Findings

4.1 Description

There were 299 banks in this dataset with the highest representation from the Asia Pacific region (52.1%), followed by Europe, Middle East and Africa (EMEA, 38.5%) and the America (9.4%). In terms of country, this dataset represented banks from 66 countries globally. Guided by literature, there are three dependent variables, each with two proxies for each dependent variable. For Business Continuity, the proxies used are liquidity and market capitalization growth (MCG). For Risk Management, the proxies are Tier1 capital ratio (Tier1) and solvency ratio (Solvency), and finally for
Organizational Productivity, the proxies used are Return on Assets (ROA) and Return on Equity (ROE). The unit of measurement for all dependent variables is in ratio. Table 4 shows the descriptive statistics of the dependent variables and the respective proxies used in this study.

Table 4: Descriptive statistics of banks

<table>
<thead>
<tr>
<th>Organizational Performance</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Continuity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquidity</td>
<td>0.0</td>
<td>2.0</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Market Capitalization</td>
<td>-0.9</td>
<td>3.1</td>
<td>-0.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Risk Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tier1 Capital Ratio</td>
<td>5.1</td>
<td>43.3</td>
<td>13.7</td>
<td>5.2</td>
</tr>
<tr>
<td>Solvency</td>
<td>2.5</td>
<td>29.7</td>
<td>10.1</td>
<td>4.4</td>
</tr>
<tr>
<td>Organizational Productivity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return on Assets</td>
<td>-4.5</td>
<td>7.2</td>
<td>1.4</td>
<td>1.1</td>
</tr>
<tr>
<td>Return on Equity</td>
<td>0.1</td>
<td>1.8</td>
<td>0.4</td>
<td>0.2</td>
</tr>
</tbody>
</table>

4.2 Prevalence of the Communication of Intellectual Capital

There were a total of 299 banks in the dataset that reported IC in their ARS after reviewing 503 banks that are listed on the stock exchange located globally. A Pearson’s chi-square test of contingencies (with $\alpha = 0.05$) was used to evaluate whether the size of the banks was related to the communication of IC. The chi-square test was statistically significant, $\chi^2(2, N=503) = 27.58, p < .001$, although the association between size and the communication of IC was actually quite small, $\Phi = .21$. As illustrated in Figure 1, banks that did not report IC were banks that were smaller in size. The same test undertaken for age did not yield a significant result. From Figure 1, age did not impact the communication of IC in banks as compared to size.

4.3 The content in the communication of intellectual capital

The data on 299 banks was analyzed for its content in the communication of IC from the perspectives of the three components of IC in terms of Human Capital, Relational Capital and Structural Capital, as reflected in Figure 2. The bulk of the communication of IC was made on Human Capital, where 235 banks or 78.6% of banks had disclosed information on IC in their ARS. The communication of IC focusing on Structural Capital was the next highest reported with 192 banks (64.2%), followed by Relational Capital with 57 banks (19.1%).

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Figure 1: The Communication of Intellectual Capital in Banks, by Age and Size

Figure 2: The Communication of Intellectual Capital in Banks, by Component
Figure 2: The communication of intellectual capital by banks

The communication of information on Human Capital covered mostly information on banks’ human resources (40.5%) and training (36.8%). For human resources, most information focused on staff by geography, seniority, function and gender. Details of women, including their percentage or representation in the workforce, were commonly found in human resource disclosure. Information on training included hours of training per staff and training spend per profession or function. In Structural Capital information, the prevalence of information on the banks’ processes such as risk management and operational flow was significant. Prevalence of Relational Capital information was limited, and those available focused on customer segmentation data and customer satisfaction results.

Table 5: Level of the communication of intellectual capital, number of banks (percentage)

<table>
<thead>
<tr>
<th>Level of Communication</th>
<th>Human Capital Information</th>
<th>Relational Capital Information</th>
<th>Structural Capital Information</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Training</td>
<td>HR*</td>
<td>EA*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Customer</td>
<td>Supplier</td>
</tr>
<tr>
<td>1</td>
<td>110</td>
<td>121</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>(36.8%)</td>
<td>(40.5%)</td>
<td>(8.7%)</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>88</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>(4.0%)</td>
<td>(29.4%)</td>
<td>(1.0%)</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>(0.3%)</td>
<td>(2.0%)</td>
<td>(0.0%)</td>
</tr>
</tbody>
</table>

4.4 The correlation of the communication of IC with organizational performance

Kendall’s tau-b was used to examine the correlation between the communication of IC and OP. As shown in Table 6, the correlation between the communication of Human Capital and a number of OP DV was significant. The correlation between Human Capital and Business Continuity, in particular, liquidity of the banks was significant (τ=.088, p<.001; MCG τ=.127, p<.001, two tailed, N=299). This relation reflected the importance of communicating information on Human Capital, which could affect the long-term sustainability of banks. Even though employees are important to
organizations, over publicizing information on human resources could negatively impact market perception of the banks. The communication of information on human resources also negatively correlated to risk management, Tier1 (τ=−.097, p<.05) and Solvency (τ=−.159, p<.001). Communicating information on training, however, was significant and positive with Organizational Productivity, ROA (τ=+.169, p<.001) and ROE (τ=+.155, p<.001). The above results highlighted the importance of human capital to banks and the latter’s dependency on employees.

Table 6: Correlation between the communication of intellectual capital and organizational performance using Kendall’s tau-b

<table>
<thead>
<tr>
<th>THE COMMUNICATION OF IC</th>
<th>BUSINESS CONTINUITY</th>
<th>RISK MANAGEMENT</th>
<th>ORGANIZATIONAL PRODUCTIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Liquidity</td>
<td>MCG</td>
<td>Tier1</td>
</tr>
<tr>
<td>Human Capital</td>
<td>.088**</td>
<td>-.127**</td>
<td>-.083</td>
</tr>
<tr>
<td>Training</td>
<td>.115*</td>
<td>-.131**</td>
<td>-.033</td>
</tr>
<tr>
<td>Human Resources</td>
<td>.069</td>
<td>-.127**</td>
<td>-.097*</td>
</tr>
<tr>
<td>Employee Attrition</td>
<td>-.019</td>
<td>.005</td>
<td>-.029</td>
</tr>
<tr>
<td>Relational Capital</td>
<td>.098*</td>
<td>-.102*</td>
<td>.021</td>
</tr>
<tr>
<td>Customers</td>
<td>.076</td>
<td>-.101*</td>
<td>.032</td>
</tr>
<tr>
<td>Suppliers</td>
<td>.011</td>
<td>.001</td>
<td>-.058</td>
</tr>
<tr>
<td>Alliances</td>
<td>.132**</td>
<td>-.077</td>
<td>.023</td>
</tr>
<tr>
<td>Structural Capital</td>
<td>.036</td>
<td>.003</td>
<td>.112*</td>
</tr>
<tr>
<td>Intellectual Property</td>
<td>-.015</td>
<td>-.003</td>
<td>-.004</td>
</tr>
<tr>
<td>Processes</td>
<td>.027</td>
<td>-.005</td>
<td>.138**</td>
</tr>
<tr>
<td>Accreditation</td>
<td>.088</td>
<td>.041</td>
<td>-.028</td>
</tr>
</tbody>
</table>

** Significant at p<0.001, * Significant at p<0.05

In terms of the communication of Relational Capital, there was significant correlation with Business Continuity and Organizational Productivity. On Business Continuity, the communication of information on Relational Capital was positively correlated to liquidity (τ=.098, p<.05), in particular, information on banks’ alliances, where the relationship was significant and positive to liquidity (τ=.132, p<.001). Relational Capital information, however, was negatively correlated to MCG (τ=−.102, p<.05), attributed to the communication of customers’ information (τ=−.101, p<.05). Hence, banks should disclose less customers’ information, due to negative impact on the perception of banks. In terms of Organizational Productivity, customer information was positive and significant with ROA (τ=+.106, p<.05) and ROE (τ=+.111, p<.05). Suppliers’ information had no correlation on OP, due to the limited information available on suppliers in the ARS.

The study findings showed that Structural Capital information was positively related to Risk Management. Specifically, the communication of internal processes was significant and positively correlated to Tier1 (τ=.138, p<.001) and Solvency (τ=.094, p<.05). Thus banks that reported more internal processes appear to have better risk management.

Most of the significant relationships (p<.05 and p<.001) had Kendall’s tau-b values between .1 and .2 (|.1|≤|τ|≤.2), which showed moderate strength of relationship (Cohen, 1998). This result was an improvement to previous studies,
which were unable to show a definitive relationship between the communication of IC and OP. Consistent to this study, other studies supported the correlation between OP and Human Capital information (Abdolmohammadi, 2005; Ousama, Abdul Hamid, et al., 2011; Saenz, 2005).

5. Discussion

5.1 Higher Prevalence of the Communication of Intellectual Capital

This study investigated the prevalence of the communication of IC in 503 banks that are listed on the stock exchange located globally. The findings in this study found more than half of the banks in the dataset have included the communication of IC in their ARS, as opposed to prior literature that found limited or low levels of the communication of IC (Ahmed and Hussainey, 2010; April, et al., 2003; Bontis, 2003). In line with Legitimacy Theory (Lindblom, 1994), which states that organizations are obliged to report and disclose their activities and performance, both financial and non-financial information, the study found that the communication of IC to be prevalent particularly on Human Capital information (78.6%), followed by Structural Capital information (64.2%) and lowest on Relational Capital information (19.1%).

Human Capital information covered mostly information on the banks’ human resources (71.2%) and training (41.1%). For human resources, most information were focused on segmented data of staff by geography, seniority, function and/or gender, while training information included hours of training per staff and training spend per profession or function. In Structural Capital information, the prevalence of information on the banks’ processes was significant. The prevalence of Relational Capital information was limited, and those available focused on customer segmentation data and customer satisfaction results. Past literature argued that the low or limited prevalence of communication of IC reported were based mostly on annual reports of organizations and did not include other supplementary corporate disclosure. Such exclusion could distort the true evaluation on communication of IC (Beattie and Thomson, 2007). Annual reports were the focus for most prior studies in view of their easy access and availability, while the supplementary corporate disclosure was used as the document contained more non-financial information, including the communication of IC (Guthrie, et al., 2004; Pedrini, 2007).

5.2 The communication of intellectual capital is prevalent, not organized

While the communication of IC was prevalent, the content of the communication was not organized or standardized like a financial statement. In reviewing the content from 299 banks that have disclosed information on IC in their ARS, the content of at least one component of IC was represented, with Human Capital information forming the bulk of the communication of IC, followed by Structural Capital and lesser on Relational Capital.

There was no consistency in the use of content in the communication of IC. This study supports past findings where content was found to be inconsistent and could differ from one industry to another (Bruggen et al, 2009). However, the analysis of the content saw that the communication of IC had found its way around the issue on the lack of mechanism from the accountant’s perspective in recognizing IC raised in previous literature (Firer and Williams, 2003; Vafaei et al., 2011). This issue was addressed through disclosure in supplementary reports or part of management discussion.

5.3 Content in the Communication of Intellectual Capital are Lacking in Smaller Banks

Findings from the study showed that banks that did not include content in the communication of IC in their ARS were smaller in size. A Pearson’s chi-square test of contingencies (with α = .05) showed statistical evidence that the size of the banks was related to communication of IC ($2(2,N=530) = 27.58, p < .001$. Although the association between size and communication of IC was actually quite small, $Φ = .21$. The same evaluation undertaken on the age of the banks showed that age of the banks had no impact on communication of IC. This contradicted previous studies that suggested age could influence the communication of IC (Bukh, et al., 2005). At the same time, the finding on organizational size influencing communication of IC updates studies that found similar trends more than a decade ago (Ahmed and Courtis, 1999; Robb and Zarzeski, 2001).

There are two possible reasons why small banks tend not to include the communication of IC in the ARS. Firstly, smaller banks may lack the appropriate human resources to undertake the compilation of IC to be reported. Previous literature has highlighted the difficulty in expressing and codifying IC (Bontis, 1998; Edvinsson and Sullivan, 1996). Secondly, smaller banks may not have the budget to incur the information handling costs, which may be
proportionately higher, compared to larger banks as the latter have higher revenue and earnings capacity (European Commission, 2013). This could raise the overall administrative burden disproportionately high for smaller organizations, particularly SMEs, if communication of IC is made compulsory.

5.4 Peculiarities of the communication of intellectual capital

There were three peculiarities arising from the analysis of the communication of IC, namely, the inclusion of information on women, importance of information on training and extensiveness of risk management processes in banks. Firstly, information on women includes narratives and numbers tabulated on roles, responsibilities and seniority of women within banks. Such inclusion could be due to the rise of CSR disclosure to reflect organizational diversity and equality that portray fair employment and equality (Vuontisjärvi, 2006; Wilmshurst and Frost, 2000). Studies have shown that women have a positive impact on organizations as they bring forth essential managerial skills in building relations, facilitation, empowerment and development of self-knowledge (Colwill and Townsend, 1999; Peebles, 2014).

Secondly, banks reported significantly more information on human resources compared to training. Most training information reported content in line with GRI guidelines “LA10 - Training per year per employee” (GRI, 2013) and provided limited details on the type of training programs, the relevance to employees, or even the effectiveness of the training received. Statistically, training had stronger and positive correlation with Business Continuity (liquidity, \( \tau=1.15, p<.05 \); N=299) and Organizational Productivity (ROA, \( \tau=-.169, p<.001 \); ROE, \( \tau=-.155, p<.001 \)), compared to human resource, as shown in Table 6. Organizations may want to publicize less on human resource and more information on training, as training directly impacts Organizational Productivity and Business Continuity, and possibly could increase organizational competencies (Tohidi, 2011).

Finally, information on Structural Capital particularly on risk management processes stands out among banks. Some banks reported detailed risk management processes beyond compliance requirements. These contents were mostly narratives, but supported by pictured flowcharts of methodology, and highlighting strategy and operational processes adopted (Hiles, 2010). The extensiveness of risk management processes in banks can be seen in the highest level of communication of IC. Twenty-two banks that reported such detailed information for processes versus only six banks disclosing a similar level of communication for human resource, as shown in Table 5.

6. Conclusion

The study showed that the prevalence of the communication of IC was evident. The communication of IC was significantly less in smaller banks compared to its larger peers \( \chi^2(2, N=503) = 27.58, p < .001 \), while age did not yield any significant result. The content in the communication of IC was most dominantly represented by information on Human Capital, followed by Structural Capital that emphasized mostly on risk management process and least information on Relationship Capital. Statistical evidence showed correlation between the communication of IC and OP, as shown in Table 6. Human Capital information moderately correlated with Business Continuity and positively with Organizational Productivity, Relational Capital, in particular, customer information, positively correlated with Organizational Productivity, and finally, Structural Capital information positively related to Risk Management.

There are four contributions arising from this study. Firstly, this study helps to ascertain the validity of previous findings that reporting limited or low levels in the communication of IC (Ahmed & Hussainey, 2010; April, et al., 2003). Secondly, the study increases the generalizability of such a line of research, where studies were often derived from small datasets, covering mostly one jurisdiction (Beattie and Smith, 2012; Striukova et al., 2008; Unerman et al., 2007). Thirdly, this study assists management to better comprehend and make informed decisions through the communication of IC for monitoring and reporting. Finally, the study will enhance stakeholders’ knowledge in the communication of IC to better understand the communication and effect of IC within the organization.

There are four limitations to this study. Firstly, the current data source was limited to banks that were listed on the stock exchanges globally. It did not include other banks that were not listed, merged or acquired, or wounded up due to insolvency, in view of the lack of financial information. Secondly, the study is focused on the banking sector, which may not be representative of the organizations operating in different industry sectors. Thirdly, the study is reliant on secondary data, not primary views. Finally, English language publications of banks were focused in this study, removing publications in other mediums such as Japanese, Chinese and several European languages due to insufficient ability to translate or comprehend the language concerned. Further research can be undertaken, expanding research
to other industries, exploring drivers of the communication of IC, the use of formats in the communication of IC and the motivations of management in the communication of IC.

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Knowledge Management, Intellectual Capital and Project Management: Connecting the Dots

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Abstract: Traditionally, the fields of knowledge management (KM), intellectual capital (IC) and project management (PM) have been studied separately. More recently, scholars have started to call for convergence between these disciplines in order to broaden research interests and opportunities in academia and enhance their value to practice. Following the current trend, the purpose of this paper is to propose a new conceptual model that merges elements of knowledge management (KM), intellectual capital (IC) and project management (PM) and thus connects dynamic (KM), static (IC) and performance (PM) aspects of project-based organisations. It is expected that the proposed model will serve as a valuable theoretical basis for future empirical research of modern knowledge organisations.

Keywords: knowledge management, intellectual capital, project management, conceptual model

1. Introduction

Organisations operating in today’s world face increased global competition, technological advances and a knowledge-based economy. To grow and survive in such a world, organisations need to continually learn and transform their knowledge into improved and innovative products and services. Typically, these products and services are delivered as the end results of the organisational project initiatives. The current literature on project management reports a high percentage (up to 70%) of failed projects. These projects are not delivered on time, within budget and/or scope (King 2003, Lewis 2003). Among potential reasons given for such a high project failure rate is insufficient knowledge acquired and transferred from past projects to enhance the success rate of future projects (Yeong and Lim 2010).

The ability to identify and leverage the required knowledge assets plays a critical role in project-based organisations competing in the new economy (Drucker 1993, Stewart 1997). Therefore, companies are facing challenges to better manage knowledge assets in the project’s environment. Effective knowledge management is seen as the key to survival and prosperity in the new economy. In order to improve project success and thus increase organisational competitiveness, this paper argues that aspects of knowledge management (KM), intellectual capital (IC) and project management (PM) should be merged. Accordingly, the paper proposes a new conceptual model that combines elements of KM, IC and PM into a single converged model. Prior to this, the paper reviews the existing concepts and frameworks of KM, IC and PM and discusses some past attempts on their integration. It derives the proposed model from the literature presented and discussed in the following sections.

2. Knowledge Management

In order to make sense of the variety of perspectives of KM that exist in literature, there have been a number of attempts to categorise or group them (Holsapple and Joshi 1999, McAdam and McCreedy 1999, Earl 2001, Alavi and Leidner 2001, Handzic 2004). In this paper, we use the notion of “generations” as a context for discussing different types of strategies or schools of KM.

2.1 Three Generations of Fragmented KM Models

The first generation of KM can be described as technocratic (Earl 2001). It views knowledge as an object and places emphasis on the role of information and communication technologies in KM. The systems focus on formalised knowledge bases in which the knowledge of human experts is made explicit so that they can be used by non-expert workers. Knowledge directories and Yellow Pages of experts allow other workers to locate those who have the knowledge they need more easily. KM systems are designed to document knowledge processes and store best business practices. Data captured in shared databases, data warehouses and document management systems are used to support planning and decision making to meet customers’ needs. Hahn and Subramani (2000) identify a number of issues and challenges related to the utilisation of information and communication technologies for KM: the need to balance knowledge exploitation and exploration, overload and useful content, additional workload and...
accurate content. There is also a need for flexibility, evolutionary development and user acceptance of knowledge systems.

Second generation KM is orientated towards people and organisations. It emphasises knowledge as a competitive weapon and sees KM as a firm’s strategy. Sveiby’s (1997) model of Intellectual Capital (IC) incorporates human capital as one of the key knowledge assets from which organisations extract value. Other assets include relational and structural capital. The essence of second generation KM is the pooling of knowledge by networked employees and communities of practice. It focuses on organisational structures and cultures that facilitate knowledge sharing and pooling. It also considers physical spaces for greater facilitation of knowledge exchange. These facilitators are reflected in the concept of “ba” introduced by Nonaka and Konno (1998). These authors suggest that ba (or place) acts as a promoter of the knowledge creation spiral proposed by Nonaka (1998). In general, second generation KM models address issues of organisational culture and learning, change and risk management, and the support of communities of practice.

Third generation KM departs from the earlier held universalistic perspective on KM by arguing that the effectiveness of a knowledge management practice depends on the context in which the knowledge is being used. A number of researchers have taken a contingent theoretical approach to KM and provided considerable empirical support for the view (e.g. Hansen et al. 1999, Snowden 2002, Becerra-Fernandez and Sabherwal 2001; Becerra-Fernandez et al. 2004). Among these, Snowden (2002) holds an interesting position that a bureaucratic context is good as a training environment, communities of practice encourage knowledge exchange through socialisation, informal contexts use stories and symbols to provide shared understanding, while innovative contexts require action and risk taking to impose order on chaos.

The above-mentioned discussion on the groupings of KM approaches shows that KM frameworks encompass a broad range of issues, methods and theories. In addition, a KM survey by Edwards et al. (2003) reveals a significant difference between Eastern and Western approaches to KM. Serious paradoxes are found to exist in KM due to competing unitary views of KM on a variety of concepts leading to a call to look at KM dialectically (Chae and Bloodgood 2004). Ultimately, according to Davenport and Prusak (1998), the full power of knowledge can only be realised by taking a holistic approach to KM.

### 2.2 Integrated KM Models

Handzic and Hasan (2003) have reviewed a number of projects worldwide that are working on integrated models of KM. The reviews reveal that all integrated frameworks consider KM as a complex and multidimensional concept; synthesise the object and human perspectives of knowledge; view KM as both a social and technological concept; and recognise the evolutionary and contextual nature of KM. In this paper, we use the context-driver-enabler-process-knowledge-outcome model adapted from Handzic et al. (2008) and presented in Figure 1 as a basis for discussing the fundamental concepts of KM in a holistic manner.

![Integrated KM Model](image)

*Figure 1. Integrated KM model (adapted from Handzic et al. 2008)*
The integrated KM model builds on the author’s earlier work (Handzic and Hasan 2003; Handzic 2004) and essentially provides a link between three generations of fragmented KM approaches. The main contribution of the model is that it helps organise various individual factors in a more meaningful way. Figure 1 depicts the model’s six main components and their interrelationships. The model distinguishes between core and extended elements.

The model core views KM as configurations of an organisation’s socio-technical knowledge enablers, knowledge processes and knowledge stocks. Supported by Nonaka and Konno’s (1998) concept of ba, the model brings together technology- and people-orientated approaches to KM. It emphasises the importance of both social and technical factors in enabling and facilitating knowledge processes. Organisational structures, cultures and technologies are believed to be tightly interconnected.

With respect to knowledge processes, the model recognises their dynamic nature. It covers various processes through which knowledge is moved (e.g. transfer person-to-person, person-to-document) and modified (e.g. creative idea generation, mining of hidden patterns in captured data). The underlying assumption is that the better the processes of knowledge generation, sharing, capture and/or discovery, the greater the likelihood that the knowledge needed will be available, leading to more effective and innovative organisational performance.

Since knowledge is seen as the most valuable organisational asset in the knowledge economy, the model core incorporates the knowledge stock component. More importantly, it synthesises different human- and object-orientated perspectives on knowledge and proposes a multidimensional view of the concept (e.g. human, structural and relational; explicit and tacit; know-what and know-how; etc.)

In its extended form, the model recognises explicitly that KM is driven by forces from its surrounding external environment. Acting as strategic levers through which an organisation delivers its desired outcomes, drivers prioritise projects competing for its limited resources. Typical strategic drivers of KM found across business and government entities include operational excellence, stakeholder intimacy, service delivery, growth, sustainable profitability and risk mitigation (AS5037 2003).

Taking into consideration that KM creates value for an organisation in the form of improved productivity, innovation, agility or reputation, the extended model incorporates the component of KM outcome. While it may be hard to identify all the immediate benefits from a KM initiative, organisations need to get some feedback on the degree to which KM fulfils their articulated drivers.

Finally, the extended model promotes a contingency view of KM, which argues that no one solution is best under all circumstances. Various knowledge task, environment and worker related factors influence the “right” choice. Organisations need to select among multiple possible paths the one that best fits their particular set of circumstances.

Overall, the integrated model points to the importance of KM consciousness in a firm’s business strategy. The major challenge for an organisation is to develop a knowledge management solution that will enable knowledge workers to effectively perform their tasks within the organisational context. The special focus of this paper is on KM in the project’s environment, more specifically on enhancing project success.

3. Intellectual Capital

In management literature, the term intellectual capital (IC) refers to intellectual material in its various forms that drives growth and value creation for an organisation. The term is synonymous with intellectual assets, intangible resources and knowledge capital (Guthrie, 2001). One of the most recent definitions of IC describes the concept from the static “stock” perspective as “the sum of all the intangible and knowledge-related resources that an organisation is able to use in its productive processes in the attempt to create value” (Kianto et al., 2014). These resources may include professional skills and experience of people, organisational technologies and features embedded in organisational processes, as well as the relationships with customers that the organisations draw upon to convert to profit and achieve competitive advantage (Evidson and Malone, 1997; Sullivan 1998).

While the majority of KM literature addresses the mechanisms by which knowledge resources can be managed, IC literature examines primarily the kind of intangible resources that contribute to value creation. Typically, stocks of knowledge assets are divided into human (people), structural (organisational) and relational (customer) capital. To date, this remains the most popular categorisation of IC (Edvinsson and Malone, 1997; Stewart, 1997). However, more recently, multidimensional views are being suggested of human capital consisting of the abilities of management and
human resource capabilities; structural capital covering innovation and internal process capabilities; and relational capital involving networking capabilities and customer loyalty (Molodchik et al., 2014). Other dimensions seen as plausible parts of organisational IC include renewal capital in terms of innovative products and services; trust capital in terms of internal and external relationships; and entrepreneurial capital in terms of competence and commitment to entrepreneurial activities (Kianto et al., 2014).

The overall IC can be viewed as a raw material, a measurable and categorisable asset or resource for organisational value creation (Stewart, 1997). IC can create or add value to an organisation, its customers and stakeholders by synergistic combinations and interactions among human, structural and relational capital (Bontis, 1998). However, different organisations may require different types and combinations of knowledge assets. Hence, an important challenge for a company is to determine which knowledge assets are best suited for its particular needs.

3.1 Organisational IC Assets Portfolio

Every organisation possesses valuable intellectual materials in the form of data, documents, procedures, capabilities, etc. These can be found in people, organisational structures and processes, and customer relationships. To succeed, organisations need to have a clear understanding of which knowledge assets are important to their success and how these assets are distributed over different parts of the company and among different functions and workers. According to Grant (1991), the portfolio of knowledge assets is typically determined by an organisation’s strategic plan. The following sections present some examples of knowledge assets under each IC category: human capital (people), structural capital (organisational capital) and relational capital (customer capital).

Human capital refers to human intellect of organisations' employees. Bontis (1998) defines the concept as a combination of employees' genetic inheritance, education, experience and attitudes. It has been recognised that a significant proportion of a company's knowledge assets is often stored in the minds of its employees. When organisational knowledge is concentrated in the minds of highly skilled individuals, they can become irreplaceable and their departure from the company may create gaps that are difficult to fill. Therefore, vital people’s competencies need to be carefully identified and evaluated. In general, human capital is considered as an important source of organisational innovation and strategic renewal. According to Handzic and Zhou (2005), the success of many projects and strategies depends not only on the individual abilities of knowledge workers, but also on whether different knowledge workers and different components in the knowledge base can be combined efficiently. Collective knowledge is more than the sum of individual knowledge. It is particularly important for the long-term survival and success of a company.

Structural capital deals with systems and procedures, mechanisms and structures of an organisation that can help support employees in their actions and performance, and thus business performance (Bontis, 1998). This kind of organisational knowledge is usually manifested in the organisation's behaviours: its culture, infrastructure, purpose and strategy (Handzic and Zhou, 2005). An organisation's culture comprises basic assumptions and beliefs that govern participants' activities; infrastructure regulates participants' roles and relationships between co-workers; and purpose and strategy define an organisation's mission, vision, objectives and a plan to achieve its purpose. Some organisational knowledge is manifested in the form of artefacts. Examples include books, memos, business plans, manuals, patents and products (Handzic and Zhou, 2005). A knowledge artefact embodies that knowledge in an object, thus facilitating its preservation and sharing.

Relational capital represents external organisational links. It is a valuable asset of an organisation due to external environment intangibles, such as the knowledge embedded in customers, suppliers, the government or related industry associations (Bontis, 1998). Such knowledge can become a critical factor in determining a firm's competitive edge in a mature and highly competitive market environment (Handzic and Zhou 2005).

3.2 IC and Organisational Performance

In his exploratory work on IC measures and models, Bontis (1998) proposed and empirically tested several model specifications relating different dimensions of IC to the business performance of an organisation. The model specification presented in Figure 2 proved to be the best fit to empirical data. The main contribution of this model is to show that there must exist an interplay among human, structural and customer capital in order for an organisation to leverage its knowledge base. According to Cabrita and Vaz (2005), the more IC components interact, the more value is generated. Isolated stocks of knowledge that reside in the employees’ minds that are not turned into organisational knowledge will not significantly affect business performance.
In this paper, the special focus is on IC in the project environment. The prime objective is to identify which IC components represent the most valuable project assets and determine how they interact to enhance project success. Therefore, the next section reviews the relevant literature on the concepts of project management (PM).

4. Project Management

A project can be defined as an achievement of a specific objective, which involves a series of activities and tasks which consume different resources. It should be completed within a defined specification, having definite start and end dates (Munns and Bjéirmi 1996). According to Lowery (1994), a project is a set of activities related to a particular period of time that end by a specific accomplishment. Morley (2006) finds that ISO 10006 stipulates that a project is a unique process that consists of a set of coordinated and controlled activities, undertaken in order to achieve an objective in accordance with specific conditions such as time, costs and resource constraints. A similar definition is given by Diallo and Thuillier (2005), who say that a project is a complex and temporary organisational system that produces goods or services contributing to satisfying a goal on time, within budget and with respecting its specifications (Zouaghi and Laghouag 2012).

Of particular interest for this paper is the information system (IS) project. An IS project can be considered as an IT enabled system intended to meet the information processing needs of an organisation. IS can also be characterised as a socio-technical system. There are three characteristics that make IS different from non-IS projects that organisations undertake. These are: (a) IS projects are unique in that they require intense involvement and collaboration of three groups of stakeholders: IS staff, end users, and management. Therefore, IS projects are sets of group-oriented activities, organised and executed in teams. (b) IS projects tend to be conceptual in nature. For that reason, they are very often subject to risks and uncertainties associated with them, if they are difficult to assess with any degree of reliability prior to their start. Those risks can come from the project, its nature, team or their knowledge. (c) IS projects depend on substantial capital and human resources (Ewusi-Mensah 1997).

Project management (PM) is an important aspect of IS implementations. Its focus is on making sure that the project goes in the direction which will make it meet the success criteria. It covers planning, organising, leading and controlling project implementation by taking into account its different characteristics. Lewis (2006) defines PM as the application of knowledge, competences, tools and techniques in project activities in order to fulfil the assigned requirements. This fulfilment is attained through the application and integration of initiation, planning, implementation, monitoring, control and closure processes of the project (Zouaghi and Laghouag 2012). PM uses numerous methods and techniques to accomplish its goal. Charvat (2003) also defines PM as a set of tools, techniques, and knowledge that, when applied, helps the three main goals of scope, cost and time to be achieved (White and Fortune 2002, Hoffer et al. 2008, Attarzadeh and Ow 2008).
4.1 Process Aspect of PM

For IS projects, the process of phases and activities undertaken during their development is defined based on the Software Development Life Cycle (SDLC) models, such as those proposed by Kumar et al. (2013), IBM (2012) and Hoffer et al. (2008).

According to Kumar et al. (2013), the exact sequence of steps in a software development life cycle can depend a lot on the methodology used, but in general all of them come down to five main phases: requirement analysis, design, coding, testing and maintenance.

According to IBM (2012), the SDLC is also comprised of five phases, but organised differently than in Kumar et al. (2013). These phases are: planning, implementation, testing, deployment and maintenance. For smaller teams these steps may occur unconsciously, with individuals being involved in more than one role. However, for larger organisations, where hundreds or thousands of individuals can be devoted to one project, the SDLC becomes a valuable tool for the project development process (IBM 2012).

Hoffer et al. (2008) organise the SDLC as a set of following phases: planning, analysis, design, implementation and maintenance. They highlight the following four steps: analysis, design, code and test as the heart of the IS development process. Furthermore, Hoffer et al. (2008) warn that the SDLC should not be considered as a sequentially ordered set of phases, because the specific steps and their sequence should be adapted as required for a project, consistent with management approaches.

Based on the comparison of similarities and differences between the phases in the above-reviewed approaches, three common aspects of the project process have been identified, namely (1) project planning, (2) project execution and (3) project verification.

During the planning phase, the goal and vision of a project are determined, as well as the business requirements based on customers’ requests, market projections, the competitive environment and other business drivers, and time and budget parameters. After the project business goal is set, the responsible team members proceed with the feature requirement analysis, prioritising the partial tasks to be done during the development phase and making the final project plan.

The execution phase that comes right after planning combines design and coding activities. It involves architecture design, coding, code review and source control. Its goal is to move the problem domain towards the solution domain, so as to transform the requirement specification into structure. The design phase converts the description of the recommended solution into logical and then physical system specifications. During this phase the software architects evaluate the project and make relevant decisions about the best model to use for development and the best programming language. Once the decisions are made, the coding starts.

The final phase focuses on code verification activities, as well as the overall status of the project, the amount of work completed, the quality of work, actual costs compared to budget costs, how much time has elapsed and how much time is necessary to complete remaining work, etc. It becomes clear whether some adjustments need to be made if a problem arises during programming, or potential risks can be predicted that could have a negative effect on one of the project success parameters.

4.2 People Aspect of PM

None of the process phases explained in the previous section would be possible without people – people requesting projects, building them and monitoring them. Sambamurthy and Zmud (2014) classify people involved in the project development process from its starting to ending point into three groups: people internal to the project, people internal to the organisation and people external to the organisation.

People internal to the project include project manager(s) and team members. Project managers are responsible for achieving project outcomes and planning, organising and controlling project tasks, while team members are responsible for achieving the project task outcomes (Sambamurthy and Zmud, 2014).

People internal to the organisation are internal end users (employees), project sponsors, co-workers, business/IT senior managers, business/IT middle managers (Sambamurthy and Zmud, 2014). Internal users use project outcomes
or are affected by them. They gain benefits or suffer losses from project outcomes. Sponsors provide funding, specify project outcomes and provide political support. Co-workers possess project-relevant expertise and perspectives. Senior IT managers hold funding and resource allocation rights, while middle IT managers hold direct authority over project team members and control access to needed resources.

People external to the organisation are external end users (customers and suppliers), subcontractors, vendors and IT service providers, strategic partners and regulatory bodies (Sambamurthy and Zmud, 2014). External end users are the people who requested the project and gain benefits or suffer losses from project outcomes. Subcontractors carry out the project tasks. Vendors and IT service providers supply project resources and carry out project tasks. Strategic partners collaborate on project activities, and regulatory bodies specify project outcomes and constrain project activities.

4.3 Critical PM Factors and Project Success

Project success or failure is the ultimate outcome of project management. According to Kumar et al. (2013), Bakker et al. (2009), Hoffer et al. (2008), Attarzadeh and Ow (2008) and many other researchers in the field of information systems, a quality and successful system, that is delivered on time, within budget and within scope, is achieved by following the systems development life cycle (SDLC) guidelines. In addition to the importance of this traditional concern of PM, some researchers such as Sambamurthy and Zmud (2014) also pointed out the importance of people-related PM factors for the ultimate project success.

Figure 3. Critical PM factors model of project success

Figure 3 illustrates a model that includes critical PM factors (i.e. project people and process) and shows how they influence project success. In summary, project people include the project team and project customers involved in project development; the process aspect is defined by planning, execution and verification phases; while project success represents the desired outcome of PM in terms of time, budget and scope parameters.

5. Merging KM, IC and PM

There have been a number of recent attempts by various scholars to develop theoretical models connecting KM and IC, as well as KM and PM. Among those arguing the connections between KM as dynamic and IC as static perspective on knowledge, Kianto et al. (2014) proposed several alternative models on how these knowledge-based issues affect organisational performance. In some proposed options, KM practices moderate or mediate the effect of IC assets on performance. In other options, IC assets moderate or mediate the effect of KM practices on performance. Based on the existing literature, differing conceptual, theoretical and empirical arguments were presented for each option.
The view concerning the manner in which KM practices and IC assets interact in organisational value creation adopted in this paper is based on Handzic’s view (2008). The assumption here is that greater utilisation of KM practices results in either creation of new or enhanced levels of existing knowledge stocks (IC assets), leading to innovative or improved performance as the ultimate KM outcome.

Advocates of KM integration with PM claim that it is necessary to enable the people involved in the project to combine individual contributions to the project’s objectives and align them with the organisation’s strategic objectives (Levin 2010). So far, several attempts have been made to combine aspects of KM and PM in order to improve project success.

For example, Cope et al. (2006) proposed that organisations would benefit greatly from capturing and sharing knowledge within the project management community. Similarly, Lierni and Ribiere (2008) recognised that in the project environments, knowledge comes primarily from explicit knowledge sources, but suggested that project managers could strongly benefit from sharing tacit knowledge associated with the management of former projects. Furthermore, Owen (2008) proposed that knowledge is embedded throughout the project life cycle at both tacit and explicit levels. According to her, tacit knowledge is developed and transferred via mentoring from project members with more experience, while explicit knowledge is reused in terms of project documentation captured during the project life cycle.

Expanding on this, Ismail et al. (2009) developed a model that relates motivational factors with knowledge-sharing behavior and project success. Their model suggests that providing appropriate motivators will lead to more efficient and effective knowledge sharing in projects, which in turn will lead to increased likelihood of project success. Furthermore, in modelling the role of KM in PM, Gudi and Becerra-Fernandez (2006) identified many external (e.g. political, economic) and internal (e.g. innovation, complexity, coupling) factors that affect project risk in organisations. Then, they proposed that KM mechanisms and technologies contribute to project success by influencing the project team’s adaptation to project risk. Finally, Yeong and Lim (2010) proposed several common factors that influence both KM and PM. These include culture, process and technology. In addition, they suggested that the alignment of KM and PM and continuous feedback enhance project success.

5.1 Proposed Merged Model

Based on the literature on KM, IC and PM reviewed in previous sections, a new conceptual model is introduced here which combines factors from all three fields in a way that can increase the rate of project success in organisations. The proposed model is presented in Figure 4.

Figure 4 shows a set of interrelated model components derived from KM, IC and PM frameworks presented earlier in Figures 1, 2 and 3. From KM, the proposed model adopted contextual contingencies and drivers of KM, as well as KM practices comprising socio-technical knowledge enablers and processes. From PM, the model adopted people (project team and customer) and process (project planning, execution, verification) elements as critical IC dimensions, and project success as PM, as well as KM outcome component.

With respect to relationships, the proposed model recognises that various motivational forces (Ismail et al., 2009) and contextual contingencies (Gudi and Becerra-Fernandez, 2006) drive and influence the choice and application of KM practices in PM and thus indirectly impact project success.
The model further proposes that KM practices in terms of various social and technical knowledge enablers and knowledge processes foster the development of the project team’s competencies and relationships with a project customer. Two most frequently mentioned practices include transferring of tacit knowledge via mentoring and explicit knowledge via documenting (Owen 2008, Cope et al. 2006, Lierni and Ribiere 2008).

Next, the model proposes that the project team and project customer jointly influence the project process, which in turn affects project success. From the IC perspective, human and relational capital (project team and customer) contribute to performance (project outcome) indirectly via structural capital (project process). Thus, in the proposed model, project process (as a structural capital) represents a key factor that can enhance project quality and success.

Finally, the model proposes a feedback loop to indicate the need for continuous development of both tacit and explicit knowledge assets in the project environment. Each project should build on these (Levin 2010).

6. Conclusion

The main purpose of this paper was to respond to the recent calls for a new generation of conceptual models that would converge KM with other disciplines. This is accomplished by proposing one such model that merges knowledge management (KM), intellectual capital (IC) and project management (PM) aspects. Based on the review of relevant literature in these fields, the proposed model was developed to suggest the way in which the fusion of KM, IC and PM can enhance project success. Essentially, it involves fostering the development of project team and customer knowledge and relationships through suitable KM practices and their application in the project life cycle. The model also emphasises the importance of continuous feedback from projects for innovative knowledge creation. By developing a new conceptual model, this paper makes a significant contribution to multiple fields of study. More importantly, it provides a foundation for conducting further empirical research to better understand the value of knowledge stocks and flows for project-based organisational performance.

References


Innovation Strategies as Outcomes of KM Practices and Antecedents of Firm Performance: Evidence from European Economies

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Abstract: An organisation’s ability to successfully operate in a competitive environment hinges to a large extent on innovation performance. In the paper, knowledge management (KM) practices, including methods stimulating new ideas and creativity, are viewed as antecedents of innovation strategies, and variance in organisational performance is presented as a consequence of implementation of different innovation strategies. Which KM practices contribute to the emergence of the most and least sophisticated innovation strategies? Which methods stimulating new ideas and creativity have the greatest potential in producing innovation? How is KM, via innovation strategies, related to firm performance? Where do the differences in innovation strategies and KM practices lie across countries? The paper is aimed at answering these questions and identifying KM practices typical of innovation strategies with varied levels of sophistication. Here, the sophistication depends on coherence (e.g. positive or negative, strong or weak) between the extent of an innovation strategy of an enterprise and the enterprise’s performance indicators. For the identification of innovation strategies, CIS8 database was used. It covers 60 innovation variables across 127,674 organizations from 12 core and 19 additional sectors and from 16 European economies. The innovation variables include different KM practices as well. Two firm performance indicators were also used in the research. For the identification of methods stimulating new ideas or creativity, CIS10 data were used. It covers six such methods; the sample includes enterprises from 24 European economies within innovation core sectors. The methods included exploratory factor analysis, correlation analysis, hierarchical cluster analysis and k-means cluster analysis. At each stage, the analyses were accompanied by rigorous validity and reliability tests. The originality of the paper lies in its attempt to interrelate different KM practices with not only innovation strategies and firm performance, but national economic-institutional contexts as well.

Keywords: creativity; economic-institutional context; firm performance; innovation strategy; knowledge management practices; organisation

1. Introduction

Innovation has long been understood as a part of KM that supports organisational excellence. The existing research has much proliferated in demonstrating benefits of interconnecting KM, innovation and firm performance, and has presented many KM practices as prerequisites for successful innovation and/or firm performance. The ability to use knowledge assets effectively is said to be one of the key warranties of enterprises’ success. For modern enterprises that are “in constant fight with the rest of competitors and strive to distinguish in the market saturated with innovations, success mostly depends on the use of knowledge-based assets as well as knowledge, innovation management and its integration practice” (Sedziuvienė, Vveinhardt 2010, p. 531). Hence, the integration of different kinds of KM and their combinations into firm activities, especially into innovation activities, results in varied firm performance. Just as the nature of innovation conditions firm innovativeness (e.g. new-to-market innovation is considered to be superior to new-to-firm innovation), so too different kinds of KM lead to the implementation of more and less sophisticated innovation strategies, thus resulting in unequal firm performance. To put it differently, superior firm performance indicates the successful implementation of more sophisticated innovation strategies, while worse performance points to the adoption of less sophisticated innovation strategies. And consequently, because different innovation strategies invoke different KM practices, those KM practices can be associated with the performance level: ones as much contributing to the improved firm performance, while others as little helpful in attempts to reach excellent performance.

So, which KM practices contribute to the emergence of the most sophisticated innovation strategies? How is KM, via the innovation strategies, related to firm performance? What methods stimulating new ideas and creativity are the most successful? To answer these questions, the paper is aimed at the identification of KM practices across innovation strategies with different levels of sophistication and, respectively, across different firm performance levels. Thus, the link between kinds of KM and firm performance is not proximate in the paper, and innovation strategies are employed as mediators.

2. Literature review

The paper is consistent with the recently emerging approach towards innovation strategies, often also referred to as innovation routines or innovation modes. The approach is typical of this strand of work and stresses the integral
nature of innovation. Hence, whenever “innovation-oriented activities carried out together to create and market a new good or service, or improve on production, delivery and business processes” (Frenz, Lambert 2010, 2012) are implemented purposefully and in a systemic way, these activities can be referred to as an innovation strategy.

Highly successful innovation strategies are often considered as outcomes or consequences of knowledge management (Lee et al. 2013; Aboelmaged 2014). The very definitions of innovation types and innovation strategies are often defined through the lens of knowledge types. For instance, the well known distinction between ‘product technology’ and ‘production technology’ is typically defined by knowledge about how to create or improve products in the first case versus knowledge about how to produce them in the second case (Stankevice, Jucevicius 2013). It is also quite common to differentiate between innovation strategies through the prism of, for example, external or internal knowledge sources. Examples include such strategies as ‘stand-alone (internal sources of knowledge), ‘local buzz’ (external local sources), ‘global pipeline’ (globally external sources) (Stankevice, Jucevicius 2013).

Competitive innovations emerge from the interplay between superior knowledge arising from the repeated application of a few elements and variety generated through distinctive combinations of these elements (Leal-Rodríguez et al. 2013). Hence, varied combinations of knowledge resources address the causes of heterogeneous innovation performance. In order to design a unique input into its future innovation strategy, an enterprise necessitates a set of knowledge activities that it can apply, integrate, re-engineer, etc. It is rather common to differentiate between internal and external sources of knowledge. For example, Urgal, Quintás and Arévalo-Tomé (2013), who investigated the relationship between knowledge resources and innovation performance in 9432 firms and whose research was also based on Community Innovation Survey (CIS), treated R&D manpower, patents and utility models as internal knowledge resources, while cooperation with other firms or entities and R&D contracts were employed as external sources of knowledge. Similarly, other scholars, more often than not, state that ‘innovation is a collective process that, to be successful, requires the integration of complementary external knowledge in order to enhance the firm’s knowledge base’ (Doloreux, Shearmur 2013, p. 723).

The discussed variety of knowledge sources correspond to the variety of knowledge management activities proposed by Community Innovation Survey (CIS8). In this way, continuous engagement in intramural R&D, feasibility studies, testing, routine software development, tooling up, industrial engineering, training for innovative activities are linked with internal knowledge, whereas knowledge born at professional conferences, trade fairs, meetings, commercial labs or R&D institutes can be referred to as external knowledge. Collaboration with different partners also reveals the level of openness of knowledge and innovation management. For instance, firms which source knowledge for innovation from clients, customers and suppliers are more reserved than firms which co-operate with competitors or other enterprises in the same industry.

In addition, Rundquist (2012) distinguishes between domain-specific knowledge, procedural knowledge and general knowledge. Domain-specific knowledge is acquired due to previous or ongoing product development projects. Procedural knowledge is know-how about the process of new product development, it transforms learning into a systematic process. General knowledge is knowledge in fields that may seem peripheral to ongoing innovation projects. Rundquist (2012) finds that domain-specific knowledge, be it initially internal or external, is the only type of knowledge that has a definitely favourable effect on innovation performance. Hence, the author stresses the importance of learning and knowledge exchange. In this respect, CIS8 database is also beneficial because it allows us to make assumptions concerning the intensiveness of learning and exchange. For instance, collaboration between firms and higher education institutions or research institutes produces greater knowledge exchange and better learning than acquisition of external knowledge, machinery, equipment or software. In this paper, the variety of KM activities presented above is distributed into bundles that are then interrelated with core innovation strategies.

It is also important to note that not only varied combination of knowledge management practices leads to unequal innovation performance and distinct innovation strategies, but innovation performance, in turn, has an effect on firm performance. Thus, Aboelmaged (2014) provides evidence that innovation performance plays a mediating role between knowledge management capability and operations performance. Another example is knowledge-based view of the firm (Urgal, Quintás, Arévalo-Tomé 2013), according to which varied knowledge bases among firms are the main determinants of firm performance differences. Hence, the indirect link between kinds of KM and firm performance that is employed in this paper (i.e. via innovation strategies as mediators), is also justified.
3. Methodology

For the identification of the typology of innovation strategies, Community Innovation Survey (CIS8) microdata from 16 European countries, collected by Eurostat, were used. At the point of data collection in 2012, the CIS8 microdata were the newest available source of the required data. Several studies were done in accordance with the similar logic. Nonetheless, they invoked previous CIS editions (CIS3: Shrollec, Verspagen 2008) or more limited spectrums of variables, sectors and/or countries (CIS2 for Denmark and Finland: Leiponen, Drejer 2007). Meanwhile, this paper presents the findings based on 60 innovation variables, 12 core and 19 additional sectors. The total sample size equals 127,674 enterprises.

The innovation variables were subject to EFA. First, factor analyses were carried out individually at the country level. The average factor loading of a variable represented how important the variable was for the whole taxonomy of innovation strategies in each country. Thus, a new sample consisting of 60 variables (i.e. average factor loadings) across 16 countries (Bulgaria (BG), Cyprus (CY), the Czech Republic (CZ), Germany (DE), Estonia (EE), Spain (ES), Hungary (HU), Ireland (IE), Italy (IT), Lithuania (LT), Latvia (LV), Norway (NO), Portugal (PT), Romania (RO), Slovenia (SI) and Slovakia (SK)) was obtained. Again, EFA was performed; principal component analysis was used as an extraction method, Varimax rotation with Kaiser normalisation was used as a rotation method. During EFA, missing values were replaced by means in order not to exclude from the analysis countries with at least one missing value.

The appropriateness of principal component analysis requires the KMO MSA be greater than 0.5 for individual variables as well as for the set of variables. It also requires the probability associated with Bartlett’s test of sphericity to be less than the level of significance p = 0.05. Hence, informed post hoc tests were performed to validate the results. In addition, communalities were estimated. These represent the proportion of the variance in the original variables accounted for by the factor solution, meaning that the communality value for each variable should be 0.5 or higher. The obtained solutions were verified for the proportion of variance explained; the cumulative proportion of variance criterion was met when it explained 60% or more of the total variance. The solutions were also examined for internal consistency within each component. Cronbach’s alpha was used to measure this consistency with a value 0.6 or higher the minimum acceptable level. Ultimately, the obtained solutions were also verified for the absence of outliers and if their elimination from the sample did not alter the composition of emerged innovation strategies. The more detailed methodology and statistical results (i.e. for each of the six emerged strategies) are presented in my previous works (Stankevice 2013a, 2013b; Stankevice 2014).

What makes this paper original is its focus on KM activities as integral parts of the innovation strategies. Even though innovation strategies are the key elements of the research, the paper is concerned with which KM practices contribute to the emergence of the most sophisticated innovation strategies and how KM, via the innovation strategies, is related to firm performance. Hence, first, the innovation strategies were assessed and KM practices incorporated into them were discussed. And second, the innovation strategies were ranked from the least to the most sophisticated. Here, an assumption was made that the more an innovation strategy was related to firm performance, the more sophisticated it was. In KM literature, organisational performance is associated with the achievement of a number of strategic and financial goals (Makore, Eresia-Eke 2014). Regrettably, CIS8 dataset that was used in my research provides little information about firm performance, and therefore, two available firm performance indicators were used to measure firm performance: total turnover and expenditure on innovation. To rank the innovation strategies in accordance with firm performance, correlation analysis between the given variables and the factor scores of strategies was employed.

Based on even newer CIS data (CIS10), the findings were enriched by including methods stimulating new ideas and creativity: brainstorming sessions, financial incentives for employees to develop new ideas, job rotation of staff, multidisciplinary or cross-functional work teams, non-financial incentives for employees, and training employees on how to develop new ideas or creativity. All innovative enterprises from 24 European economies (Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Finland, France, Hungary, Ireland, Italy, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Sweden, Turkey) and innovation core sectors (according to NACE Rev. 2, they correspond to B-M71) were included into the sample. From the publicly available aggregated data provided by Eurostat it is not possible to identify whether a same enterprise provided several positive answers at a time. However, ‘yes’ to the given methods as being good in stimulating new ideas or creativity sounded 258,668 times.

For further analysis of methods stimulating new ideas and creativity, rates as opposed to numbers were used in order to make the countries comparable. Hierarchical cluster analysis and dendrogram (Ward’s methods, Squared Euclidean distance) let us to visually identify countries-outliers (Cyprus, Luxemburg, Italy and Sweden) and the most appropriate
number of clusters, i.e. 2. Based on the data from the remaining countries, 2-means cluster analysis was performed in order to distribute the countries into groups. ANOVA table showed the result to be reliable ($p = [0.000; 0.016]$), except job rotation of staff that by both groups was almost equally considered as a method stimulating new ideas or creativity ($p = 0.428$). Ultimately, the country clusters were interrelated with the previous findings.

4. **Innovation strategies and their KM practices**

Let us explore the first innovation strategy that is referred to as semi-open, knowledge-intensive leadership innovation strategy (IS01). It:

- is aimed at improving communication and information sharing, and reducing labour costs per unit output (**objectives of innovation**);
- includes innovating products and/or processes (**targets of innovation**);
- sources knowledge from universities or other higher education institutions, and competitors or other organizations in the same industry, and received funding from FP6 or FP7 (**foundations of innovation**);
- includes continuous engagement in intramural R&D (**pace/scope of innovation**).

Hence, firms that embark onto IS01 are continuously engaged in intramural R&D and networking. One can conclude that, by means of collaboration with universities or other higher education institutions, firms engaged into IS01 are not in severe shortage of well educated and skilled workers. Besides, university-industry-competitor collaboration and are popular topics, especially in emerging countries (e.g. Brazil in Medeiros Rocha’s et al. 2012 study or Turkey in Temel’s et al. 2013 study) and SMEs (Hemert, Nijkamp, Masurel 2013). Moreover, Spithoven (2013) found that registering patents (as opposed to out-licensing) depended strongly on R&D staff having a doctoral degree. Let us explore the next assessed innovation strategy – expansive, marketing-intensive leadership innovation strategy (IS02). It:

- is aimed at entering new markets and, to a lesser extent, increasing capacity for producing goods or services (**objectives of innovation**);
- includes developing new methods of pricing goods or services, and new methods of workplace organization (**targets of innovation**);
- sources knowledge from government or public research institutes (**foundations of innovation**);
- includes developing innovations that are new to the market (**pace/scope of innovation**).

Hence, IS02 invokes marketing innovations. Interestingly, Drechsler et al. (2013) demonstrate “that the relationship between marketing capabilities and innovation performance is generally mediated by the decision influence of marketing on NPD [new product development]. In particular, both marketing research quality and the ability to translate customer needs into product characteristics serve to increase marketing’s influence on NPD. This increased influence, in turn, positively contributes to overall firm innovation performance.” (p. 298). In IS02, marketing capabilities are coupled with organisational innovation: firms introduce new methods of organising work responsibilities and decision making, such as the first use of a new system of employee responsibilities, teamwork, decentralization, the integration or de-integration of departments or education/training systems.

Another marketing-related innovation strategy is product marketing- & scale-based follower innovation strategy (IS03). It:

- is aimed at replacing outdated products or processes, improving the quality of goods or services and increasing their range, and introducing products to new customer groups (**objectives of innovation**);
- includes the development of new media or techniques for product promotion, and new methods of organising external relations (**targets of innovation**);
- sources knowledge from professional conferences, trade fairs, meetings, etc., and engages in training for innovative activities (**foundations of innovation**);
- includes cooperation with other enterprises or institutions in process development and innovations that are new at firm level (**pace and scope of innovation**).
The results illustrate also that innovations in case of IS03 are more new-to-firm than new-to-market. Firms look for leftover markets and customer groups in order to realize their production because the major target markets and customer groups are lead by other firms. The major obstacles to organisations in becoming leaders in existing markets is that they lack a wider range and better quality of goods or services and do not always replace outdated products or processes in a timely manner. Similarly, Paananen (2012) argues that firms constrained by finance tend to search for innovation knowledge both internally (e.g. training) and externally (e.g. professional conferences, trade fairs).

One more innovation strategy to discuss is process- & cost-oriented incremental innovation strategy (IS04). It:

- is aimed at improving ability to develop new products or processes (objectives of innovation);
- includes the introduction onto the market of a new or significantly improved logistics, delivery or distribution system (targets of innovation);
- sources knowledge from clients or customers, suppliers of equipment, materials, etc., receives public funding for innovation from the EU, but not local or regional authorities, and includes engagement in the acquisition of external knowledge, machinery, equipment and software (foundations of innovation);
- includes the production of products that were developed originally by other enterprises or institutions and are new at firm level (pace/scope of innovation).

However, Guisado-González et al. (2013) find that the acquisition of machinery has a statistically significant negative impact on innovation performance. Hence, when firms lack the ability to develop new products or processes, they engage in the acquisition of external knowledge, such as the purchase or licensing of patents and non-patented inventions, know-how and other types of knowledge. The present findings demonstrate that market sources, such as those from customers or suppliers, provide more information for new innovation projects or better contribute to the completion of existing ones. In other words, local sources of information and direct ties prevail. However, these sources have negligible impact on firm performance and are not strong predictors of innovative performance (Kafouros, Forsans 2012; Kesidou, Snijders 2012). Another estimated finding to discuss is transformative, strategic innovating (IS05) that is mostly oriented towards organisational innovation. It:

- is aimed at reducing labour costs per unit output, increasing market share, improving flexibility for producing goods or services, and, to a lesser extent, increasing capacity for producing goods and services, improving communication or information sharing and the quality of goods or services, and entering new markets (objectives of innovation);
- includes the implementation of new business practices for organizing work or procedures (targets of innovation);
- foundations of innovation depend on the innovation strategy (-ies) that are concomitant with IS05;
- pace/scope of innovation depends on the innovation strategy (-ies) that are concomitant with IS05, but new-to-market innovations prevail.

Interestingly, incentives implemented by many firms in order to embark on other innovation strategies can be associated with IS05. This insight is also supported by the recent findings of Trigo (2013). Based on the analysis of 10 innovation types and five innovation activities, a taxonomy composed of two R&D-intensive and two non-R&D-intensive clusters is proposed. The findings indicate that organisational innovations count for three of the four proposed clusters, with “the new management techniques being the most common organisational innovation in all clusters” (Trigo 2013, p. 46). This result is also consistent with previous findings that show that a synergy of organisational and non-organisational innovations results in better economic performance (Battisti, Stoneman 2010; Filippetti 2011).

Finally, the empirical findings point to the existence of one more innovation strategy, i.e. responsive, service-oriented innovation strategy (IS06). It:

- is aimed at reducing time to respond to customer or supplier needs (objectives of innovation);
- includes introducing onto the market a new or significantly improved service (targets of innovation);
- sources knowledge for innovation from consultants, commercial labs or private R&D institutes and is not sponsored by local or regional authorities; it includes such activities as feasibility studies, testing, routine software development, tooling up, industrial engineering, etc. (foundations of innovation);
- includes processes that were originally developed by other enterprises or institutions (pace/scope of innovation).
Hence, the major concern of IS06 is reducing time in order to better respond to customer or supplier needs. Bettencourt and Brown (2013), who investigated the service innovations of product-dominant companies, also concluded the following: “As such, the primary goal of a product-dominant company seeking service innovation should not be to innovate service. Rather, it should be to help customers get a specific job done better or to help them get more jobs done” (p. 277). It is also interesting that IS06 relies on either internal or globally distributed sources of information, with some recent findings (Doran, Jordan, O’Leary 2012) showing this pattern to be effective.

5. KM and firm performance: Any patterns?

Based on the correlations of the factor scores of emerged innovation strategies with firm turnover and expenditure on innovation (i.e. measures of firm performance), the strategies can be ranked as following (Stankevice 2013a, 2014):

- Most sophisticated: semi-open, knowledge-intensive leadership innovation strategy;
- Sophisticated: expansive, marketing-intensive leadership innovation strategy;
- Medium-sophisticated: process- & cost-oriented incremental innovation strategy and transformative, strategic innovating;
- Less sophisticated: responsive, service-oriented innovation strategy;
- Least sophisticated: product marketing- & scale-based follower innovation strategy.

Accordingly, KM practices, as inner components of the innovation strategies, can be ranked by the degree by which they contribute to better firm performance (Table 1). In the table, the KM activities are coloured according to the degree of sophistication of the innovation strategies where the KM activities are used as their inner component: the darker the colour, the higher degree of sophisticaton.

Table 1: KM practices and firm performance

<table>
<thead>
<tr>
<th>KM aimed at technological / product / process innovations</th>
<th>Higher firm performance</th>
<th>Medium firm performance</th>
<th>Lower firm performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS01: continuous engagement in intramural R&amp;D;</td>
<td>IS04: acquisition of external knowledge, machinery, equipment and software</td>
<td>IS06: knowledge for innovation from consultants, commercial labs or private R&amp;D institutes</td>
<td></td>
</tr>
<tr>
<td>sources of knowledge from universities other higher education institutions;</td>
<td>knowledge for innovation from clients or customers, suppliers of equipment, materials, etc.</td>
<td>feasibility studies, testing, routine software development, tooling up, industrial engineering, etc.</td>
<td></td>
</tr>
<tr>
<td>sources of knowledge from competitors or other enterprises in the same industry</td>
<td>IS02: new methods of pricing goods or services</td>
<td>IS05: new business practices for organising work or procedures</td>
<td></td>
</tr>
<tr>
<td>IS02: new methods of workplace organisation</td>
<td>IS03: new media or techniques for product promotion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sources of knowledge from government or public research institutes</td>
<td>training for innovative activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KM aimed at organisational / marketing innovations</td>
<td>new-to-market innovations</td>
<td>new-to-firm innovations</td>
<td></td>
</tr>
</tbody>
</table>
As Table 1 indicates, KM activities that are used to produce technological, product and/or process innovation, more often than not, contribute to the production of new-to-market innovations and to better firm performance more than KM activities employed for organisational or marketing innovations. Product-, process- and/or technology-oriented KM activities include continuous engagement in R&D, acquisition of external knowledge, machinery, equipment and software, and feasibility studies, testing, routine software development, tooling up, industrial engineering, etc. On the other hand, marketing- and organisation-oriented KM activities include the development of new methods of pricing goods or services and new media or techniques for product promotion, workplace organization, new business practices for organising work/procedures, as well as training for innovative activities.

However, this distinction concerning “hard” or “soft” KM orientation and new-to-market or new-to-firm innovations is rather conditional. For example, the most sophisticated innovation strategy (IS01) includes improving communication and information sharing, i.e. organisational innovations; IS02, the second most sophisticated innovation strategy, is predominantly based on marketing and organisational innovations, but it is more sophisticated than IS04 or IS06 and conditions better firm performance; IS05 that is based on organisational changes better contributes to firm performance than IS06 that includes feasibility studies, testing, routine software development, tooling up, industrial engineering, etc. In general, one could agree with the statement that the synergy of technological and non-technological innovation activities is concomitant with firm performance and that firms that introduce complex innovation strategies show better economic performance (Frenz, Ietto-Gillies 2009; Battisti, Stoneman 2010; Filippetti 2011; Hollen, Van Den Bosch, Volberda 2013).

Figure 1 illustrates factor scores of the emerged innovation strategies in the sample economies. The scores vary from -3 to +3 (0 = average). The factor scores, in turn, indicate the extents of the strategies in the countries. Hence, the greater a factor score of a strategy in a country, the greater the strategy’s extent in that country, i.e. a greater number of organisations embark onto this strategy. As mentioned above, different innovation variables constitute the obtained factor solutions: the variables related to the objectives of innovation activity, the variables related to the pace and scope of innovation, the variables related to KM practices for innovation, etc. Thus, each innovation strategy incorporates KM practices typical of it. Therefore, the extents of innovation strategies in the CIS8 countries represent the extents of different sets of KM practices as well.
As Figure 1 indicates, the sample countries include varied innovation strategies and, consequently, varied KM practices at a time. It is important to note that KM practices that are associated with better firm performance (i.e., IS01 or IS02: continuous engagement in intramural R&D, new methods of pricing goods or services, new methods of workplace organisation, etc.) can also be associated with more economically and institutionally advanced economies (e.g., Germany, Norway), if to rely on the terminology of the varieties of capitalism. On the other hand, KM practices that are associated with poorer firm performance (IS03 or IS06: training for innovative activities, participation in conferences, trade fairs, etc., private consultations, feasibility studies, etc.) are mostly observed in less advanced economies (e.g., Romania, Latvia).

However, this distinction is also conditional. For example, in addition to the high factor scores on IS02-related KM practices, Norway also scores high on the medium competitive KM practices, such as new business practices for organising work or procedures. These business practices relate to IS05 innovation strategy that was estimated to be medium-competitive. Similarly, Ireland scores highest on new media or techniques for product promotion and training for innovative activities that both relate to the least sophisticated KM practices (IS03 innovation strategy).

On the other hand, Slovakia, a less developed European economy, scores very high on the most sophisticated KM practices (KM practices related to IS02 and IS01 innovation strategies), and Slovenia scores high on continuous engagement in intramural R&D (an integral part of IS01 innovation strategy). This means that organisations are not always restricted by their dominant imperfect institutional environments and can find a strategic leeway towards more competitive KM practices that result in greater innovativeness.

To sum up, beyond some general conditional observations, there is no consistent cross-country KM-for-firm-performance pattern typical of more or less institutionally and economically advanced economies.

6. Methods stimulating new ideas and creativity

According to the methods that innovative enterprises considered being successful in stimulating new ideas or creativity, two groups of countries emerged. The first group included Belgium, Estonia, Finland, France, Ireland, Malta, Netherlands, Norway, and Slovenia. The second group included Bulgaria, Croatia, Czech Republic, Hungary, Lithuania, Poland, Portugal, Romania, Serbia, Slovakia, and Turkey. Once again, with a few exceptions, the groups can be traditionally recognised as more developed economies in the first case, and as less developed economies in the second case. Interestingly, opinions about the success of methods that stimulate new ideas or creativity differ across the clusters as well. This is illustrated by Figure 2.

![Figure 2: Methods stimulating new ideas or creativity](https://www.ejkm.com)
Figure 2 illustrates that, on average, less than 20% of all the sample countries consider job rotation of staff as successful method stimulating new ideas or creativity, and there are no significant differences (p = 0.428) between the two groups. It is also clear that non-financial incentives for employees are less popular methods stimulating creativity: on average, less than 20% of enterprises support such opinion in both groups; however, enterprises in latecomer economies are more prone to stimulating creativity by non-financial means than the ones in developed economies.

Further, greater differences between the two groups should be noted. In countries that are recognised as less developed, all methods of stimulating new ideas or creativity are evaluated almost equally, and four out of six methods fall into the range between 20-25% (on average). On the contrary, enterprises in more developed economies rely much more heavily on multidisciplinary or cross-functional work teams (on average, 33,52% of enterprises in the group find this method successful) and brainstorming sessions (on average 42,35% enterprises consider this method successful in stimulating new ideas or creativity).

The difference in attitudes to financial incentives is also impressive and equals 11% on average - enterprises in latecomer economies tend to promote financial motivation to employees more actively. Different trainings are also quite commonly acknowledged in less developed countries as successfully stimulating new ideas. Besides, precisely employee trainings and financial incentives can be associated with greater corruption and money laundering rates in the given less developed economies.

To sum up, the key distinction between the two groups is that enterprises from more developed economies put greater effort into methods that promote knowledge sharing and exchange, such as brainstorming and multidisciplinary or cross-functional teamwork. Contrarily, enterprises from less developed economies rely on methods that are based on individual rewards for new ideas or creativity (e.g. financial and non-financial incentives), or on knowledge-input methods (e.g. employee training) without being sure about outputs.

7. Discussion

KM practices that contribute to the best firm performance inevitably include continuous engagement in intramural R&D. Moreover, they are combined with collaboration between private and public sectors, between industry and science, and with competitors, thus reconfirming the significance of open innovating. The importance of knowledge sharing and learning is also supported by the methods considered successful in stimulating new ideas or creativity. They are predominantly oriented at learning, cross-fertilisation of knowledge and knowledge sharing. However, typically, the extent of the given KM practices is less in less advanced economies, such as Romania, Latvia or Lithuania. Currently, these competitive innovation activities and KM practices are enhanced by external funding from the EU and participation in FP6, FP7, Horizon 2020, etc. Some countries, i.e. Bulgaria, have much benefited from the given framework programmes. However, one might question whether innovation strategies based on continuous intramural R&D can remain sustainable in these countries without the external funding from the EU.

The next most sophisticated KM activities are the ability to introduce new methods of pricing goods or services and new methods of workplace organisation. They are the inner parts of the expansive, marketing-intensive leadership innovation strategy. The given KM practices are rather uncommon in the investigated economies, except Norway, Slovakia and, to a lesser extent, Hungary. Actually, the informed KM practices could be seen as highly dependent on internal sources and especially on marketing competence. On the other hand, the marketing capabilities are supported by strong local R&D infrastructure that provides knowledge for marketing and organisational innovations. For example, in 2011 and 2012, the Budapest Winter Invitation promotion – with EUR 1 million – welcomed the application of hotels for a joint partnership in order to enhance winter tourism of Budapest.

Further, KM practices that are a part of medium-sophisticated innovation strategies can include acquisition of external knowledge, machinery, equipment and software, as well as new business practices for organising work or procedures. In other words, such innovation strategies are focused on learning and accumulation of knowledge, innovations are developed by others. Thus, innovations resulting from such learning are typically more new-to-firm than new-to-market, except the introduction onto the market of new or significantly improved logistics, delivery or distribution systems. Besides, acquisition of external knowledge, machinery, equipment and software is often aimed at the reduction of costs and the maintenance of existing positions more than innovating. Therefore, the informed KM practices are medium-competitive. It is also interesting to note that the implementation of new business practices is concomitant with acquisition of knowledge or machinery in better-off countries, such as Germany or Portugal, thus meaning that, again, complex innovations benefit from strong innovation infrastructure.
Ultimately, KM practices that little contribute to better firm performance are of two types. In service-oriented enterprises, feasibility studies, testing, routine software development, tooling up, industrial engineering, etc. are quite common (e.g. in Latvia, Cyprus). Consultants, commercial labs or private R&D institutes help to implement the informed KM activities. On the other hand, production- and/or trade-oriented enterprises concentrate on new media or techniques for product promotion (e.g. in Norway, Cyprus, Ireland, Slovenia). However, in this case, innovations are new-to-firm more often than new-to-market. Usually, new-to-firm ideas are found at professional conferences, trade fairs, meetings, etc., and enterprises engage in trainings for innovative activities as well. However, the enterprises are typically constrained financially to embark onto KM activities that better contribute to excellent firm performance, e.g. R&D.

An economy may include varied KM practices at a time, with different levels of firm innovativeness and strength of contribution to firm performance. However, one should note that strong internal competence of enterprises, be it R&D in a certain field or unique marketing competence, coupled with strong R&D infrastructure and with networking, is most likely to become a success story. Therefore, organisations may be recommended to engage into continuous R&D and to build a strong marketing competence. Alternatively, organisations with intense R&D effort may want to establish a network with organisations characterized by strong marketing capabilities. On the other hand, policymakers may be recommended to further invest into the development of national or regional innovation infrastructures. As the results indicate, the most sophisticated KM practices and the most competitive innovation strategies require strong research infrastructure and effective mechanisms aimed at fostering innovation.

It is also important to note that KM activities which are used to produce technological, product or process innovations contribute to the production of new-to-market innovations and to better firm performance more often than KM activities employed for organisational or marketing innovations. More often than not, this could be explained by a greater added value of technological innovations. However, this trend is based on a generalised observation of the results and could not be confirmed in each and every case. For instance, expansive, marketing-intensive leadership innovation strategy (marketing innovations predominate) better contributes to firm performance and its innovativeness than process- & cost-oriented incremental innovation strategy (process innovations predominate). Hence, whether KM activities are new-to-firm or new-to-market depends on an innovation strategy in which they are integrated.

8. Conclusion

Cross-country KM pattern typical of more or less institutionally and economically advanced economies is not very consistent. Typically, the extent of the given KM practices is less in less advanced economies. However, an economy may include varied KM practices at a time, leading to varied organisational performance. This paper has indicated the most typical sets of KM practices across European economies, as well as which of them are associated with the best firm performance and vice versa. Hence, the presented results could be used as a guideline for further KM and innovation development. Further research on the dynamics of KM practices and innovation strategies is also attractive for a scientific mind.

Concerning new-to-market as opposed to new-to-firm pattern, it is important to note that product or process innovations better contribute to the production of new-to-market innovations and higher firm performance than other innovation types. However, more often than not, the success of product and process innovations depends on what KM practices they are combined with and what methods stimulating new ideas and creativity are used alongside. Therefore, for organisations, it is important to be able to design a competitive mix of KM practices, be they aimed at organisational innovations, product innovations, technological innovations, etc., or, preferably, several at a time.

Probably the most important insight of this paper is that it highlights the importance of being open. The most sophisticated innovation strategies include collaboration between private and public sectors, between industry and science, between different industrial sectors, and with competitors. In addition, the most potentially successful methods stimulating new ideas and creativity are also based on knowledge creation and exchange during brainstorming sessions, mutual and collective learning, knowledge decomposition and knowledge re-engineering, and new applications of knowledge due to multidisciplinary or cross-functional teamwork.
References


A Practical Approach to Process-Oriented Knowledge Management

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Abstract: Due to global competition and increasingly dynamic markets, the importance of intangible resources such as knowledge has been growing dramatically, especially for small and medium-sized enterprises (SME). SMEs have to be more innovative, flexible, and efficient to successfully cope with typical challenges such as growing competition and rapidly changing demand patterns. In the past, knowledge management has been successfully implemented and developed by large enterprises in particular. In contrast, knowledge management for SME is not a matter of course yet. However, current survey results affirm that activities in the area of knowledge management depend less on the size of an enterprise or its industry, but rather on an enterprise’s business strategy and core competencies. In the light of these results, SMEs seem not to have disadvantages regarding the implementation of knowledge management because of their size or industry, but rather because they need to take strategic decisions to implement such solutions and have difficulties in doing so. Against this background, the German Federal Ministry of Economics and Technology started the initiative “Fit für den Wissenswettbewerb” to support especially SMEs on the way to the knowledge society. In the course of the initiative, the research institutes Fraunhofer IPK and Fraunhofer IFF initiated the project “ProWis – Prozessorientiertes und integriertes Wissensmanagement in KMU”. Within this project, researchers designed methods meeting the specific needs of SMEs allowing the implementation of process-oriented knowledge management at reasonable efforts. Building up on the developed methods, both institutes accompanied 15 SMEs during the implementation of knowledge management and used the findings from these implementations to refine the methods. The results of the project are summarised in the guideline “Praxisleitfaden Wissensmanagement”, which is freely accessible to interested parties and enables SMEs to systematically and autonomously implement knowledge management. Based on the aforementioned results, this article illustrates the process-oriented implementation of knowledge management according to the ProWis approach and, by means of a case study, leads the reader through the single steps of the implementation process towards a business process-oriented knowledge management.

Keywords: Knowledge Management, Intellectual Capital, Process-orientation, Knowledge management activities, knowledge management methods

1. Introduction

In the past, knowledge management has been successfully implemented and developed by large enterprises in particular. In contrast, knowledge management for SME is not yet a relevant matter of fact although knowledge management can increase value creation in business processes and thus support competitiveness (Gronau, 2009). However, current surveys results affirm that activities in the area of knowledge management depend less on the size of an enterprise or its industry, but more on an enterprise’s business strategy and core competencies (Pawlowsky et al., 2011). In the light of these results, SMEs seem not to have disadvantages regarding the implementation of knowledge management because of their size or industry, but rather because they need to take strategic decisions to implement such solutions. (Alwert et al., 2008). In this context, the German Federal Ministry of Economics and Technology started the initiative “Fit für den Wissenswettbewerb” to support especially SMEs on the way to the knowledge society. In the course of the initiative, the research institutes Fraunhofer IPK and Fraunhofer IFF initiated the project “ProWis – Prozessorientiertes und integriertes Wissensmanagement in KMU”.

Within this project, researchers designed methods meeting the specific needs of SMEs allowing the implementation of process-oriented knowledge management at reasonable efforts. Building up on the developed methods, both institutes accompanied 15 SMEs during the implementation of knowledge management and used the findings from these implementations to refine the methods. The results of the project are summarized in the guideline “Praxisleitfaden Wissensmanagement”, which is freely accessible to interested parties and enables SMEs to systematically and autonomously implement knowledge management (Orth et al., 2011). In this paper, the authors will illustrate the steps that a SME passes through towards the implementation of process oriented knowledge management from the initialisation, through the analysis, objectives and solutions to the assessment of the adopted measures. In the course of this description tools from the ProWis toolbox supporting the implementation of the single steps as well as the ProWis toolbox itself are outlined. In the second chapter of this contribution the importance of intellectual capital, knowledge management and their relation are addressed introductory. The fundamentals of the ProWis approach are explained in chapter 3, whereas chapter 4 focuses on the description of the single steps for
implementing KM according to ProWis approach. In chapter 5 the application of the approach is illustrated by means of the anonymised “Engineering Ltd.” in a case study. Chapter 6 closes with a brief summary and some final remarks.

2. Intellectual Capital and Knowledge Management as Drivers of Business Success

The concept of intellectual capital (IC) has received and still receives a great deal of attention in research and practice. In both areas intellectual capital is subject on the organisational, regional and national level as well as on layers in between such as for organisational networks. In science the field of intellectual capital with regard to small and medium-sized enterprises (SME) as well as in larger companies and organisational networks has been adequately researched (Wuscher et al., 2015).

The subject of research on this topic has evolved significantly over the past two decades according to Guthrie et al. (2012) whereas they differentiate three distinct stages. In a first stage of research on IC the focus was on raising awareness of why intellectual capital is important for competitive advantage. This stage has its origins in the 1980s and into the 1990s and helped to develop a framework of intellectual capital firmly grounded in the work of practitioners such as Edvinsson’s work at Skandia or Sveiby’s work at Swedish publisher Affärsvärlden Group (Edvinsson, 1997).

According to Guthrie et al. (2012) the second stage is characterised by the focus on approaches for measuring, managing and reporting IC as well as the investigation of the impact of IC on financial performance and value creation (Dumay and Garanina, 2013). Against this background, “by the mid-2000s more than 50 methods were created which either helped to define IC as a whole or define different elements of IC” (Dumay and Garanina, 2013: 11). As a result of these two stages it is nowadays widely acknowledged that IC plays a fundamental role in value creation and a common terminology of IC has been developed. However, with regard to the second stage Dumay and Garanina (2013) criticise that it is predominantly focused on measuring the impact of IC on financial performance and value creation rather than on methods for the development of IC in practice. On the basis of these observations, the third stage of research as outlined by Guthrie et al. (2012) is characterised by research that critically examines IC in practice and is dedicated to the managerial implications of how to use IC in managing a company.

Two methods that have been developed in the context of the latter stage are the management methods “Wissensbilanz – Made in Germany” and “Intellectual Capital Statement – Made In Europe” whereas the latter represents an extension of the method from Germany. The former method was especially developed for the implementation of IC management in German SME and has already been applied in more than 1000 organisations in Germany and beyond since its development (Mertins et al., 2012).

A "Wissensbilanz" (intellectual capital statement or report) “[..] is an instrument to precisely assess and to develop the intellectual capital of an organisation. It shows how organisational goals are linked to the business processes, the intellectual capital and the business success of an organisation using indicators to visualise these elements” (Alwert et al., 2004: 11). It is a tool for the systematic development of strategy and of the organisation that makes it possible to targetedly manage projects and initiatives internally so as to improve intellectual capital management. In addition, it can be used for external communication such as the acquisition of funding (Alwert et al., 2013).

The method builds on the well-established categorisation of IC into human, structural and relational capital (Dumay and Garanina, 2013). The human capital comprises all characteristics and capabilities which employees contribute to an enterprise. The structural capital comprises all structures which are applied by the employees to conduct business and the relational capital consists of all relations to external groups and persons used for conducting business. To capture the IC of an organisation these three types of capital each comprise a set of single factors which are defined and assessed in a participatory, bottom-up approach within workshops (Alwert et al., 2013).

The transferability of the single factors was analysed on the basis of the empirical data collected in more than 50 pilot implementations of the method. The analysis showed, that approx. 80-90% of individual IC elements could be harmonised on an aggregated level, while remaining 10-20% are individual respectively organisational (Mertins and Will, 2008). The result is a set of 15 factors which capture 80% of the enterprise-specific IC (European Commission, 2008).

On the basis of this standard set of factors added by some factors for material resources, the empirical survey “Wissensstandort Deutschland – Deutsche Unternehmen auf dem Weg in die wissensbasierte Gesellschaft” firstly underpinned the importance of IC for German enterprises in 2010 with 947 participants (Mertins et al., 2010) and
again in 2014 with 139 participants (Orth et al., 2014). In both surveys the participating enterprises were asked how important certain factors are with regard to their business success and how well these factors are developed in their enterprise at present on a scale from 0-10. Thus, it was possible to derive the importance of the specific factors for the surveyed enterprises.

**Figure 1: Impact and rating of the different types of capital with regard to business success**

As illustrated in the figure above from the study in 2014 the aggregation of the single factors for each type of capital show that the different types of IC are of higher importance for business success than the material resources. In addition the IC is also rated better by the surveyed enterprises. The impact of the human capital on business success is by far the greatest (7.9) and has the best rating (6.6) as well. The factors of the structural capital (7.1) are seen as the second most important type of capital by the surveyed participants and were rated with 5.9 in the mean.

When analysing the difference between impact and rating it becomes obvious that the rating of the factors is in most cases lower than their impact on business success. The biggest difference is to be found in the human capital (-1.3) followed by the structural capital (-1.2) and the Relational Capital (-0.3). The factors of the material resources only show slight differences. In conclusion the highest demand for action of knowledge-based corporate management constitutes itself in the human capital. Material resources on the other hand already seem to be well managed today and might even consume more effort than they require.

These results are in line with the insights gained in the frame of the previous study and thus indicate the prevailing importance of IC for corporate success from an entrepreneurs’ perspective (Mertins et al., 2010; Orth et al., 2014). In addition, both studies show that there is still potential for improvement with regard to IC in German organisations.

The positive direct and indirect relationship between IC and business goals or performance have also been investigated within further studies across Europe and beyond (e.g. Bramhandkar et al., 2007; Chu et al., 2010; Kianto et al., 2013; Hormiga et al., 2013; Jardon, 2014; Costa et al., 2014 ). Bramhandkar et al. (2007) follow an industry-specific approach and use data of companies from the pharmaceutical industry in North America to analyse the relation between IC development and returns. The gained result suggests that a strong relationship may exist between successful development of IC and organisational performance. Chu et al. (2010) conducted a survey among companies located in Hong Kong and found that the structural capital had a positive impact on profitability. Hormiga et al. (2013) analysed the relation of IC in new ventures and their sustainability and found that having IC measurement in place supports business development. Kianto et al. (2013) were for example able to prove that the management of IC has a significant impact on company performance in terms of competitiveness, as well as financial revenues in a survey among companies from Finland, Russia and China. In contrast to the studies mentioned before, Jardon (2014) analysed the processes companies use to turn IC into competitive advantage and found that IC has a direct effect on innovativeness which finally leads to improved business performance. Costa et al. (2014) focused on the relation between IC and product innovation in Portuguese SMEs and gain the insight that IC actually influences innovation performance, whereas only three elements from the different types of capital show a relevant effect.
Taking the research results above it can be concluded that IC plays a fundamental role as it has direct and indirect effects on organisations' performance. Thus IC should be understood as a fundamental source or asset of an organisation’s success.

This implies that IC is rather static and requires certain processes and management activities to make it useable for value creation. Kianto et al. (2014) understand these knowledge-related processes and management activities as KM practices and conclude “while the intangible resources controlled by an organisation are a key factor determining its value creation potential, the other necessary factor in the equation is the means by which these are controlled and managed” (Kianto et al., 2014: 365). Thus, only the combination of the rather static IC and the dynamic KM enables value creation in organisations.

The general importance of KM is also reflected in the great revision the new ISO standard 9001:2015 which will for the first time contain the clear requirement of comprehending knowledge as a central resource which must be managed systematically. KM has always belonged to quality management and plays a prominent role in this context. This approach is taken up by the new standard which introduces a process to capture an organisation’s knowledge according to the PDCA-cycle:

- **Plan:** The organisation has to capture the knowledge that is required for carrying out processes and to achieve conformity of products and services
- **Do:** This knowledge has to be maintained and imparted to a sufficient scale
- **Check:** In order to take into account changing requirements and trends the organisation has to analyse its present knowledge and
- **Act:** must determine how the required additional knowledge is obtained or how it is accessed.

According to the ISO/DIS 9001:2014 the acquired knowledge of an organisation and the collected experience must be secured (security function of the management system). KM related aspects are particularly made a subject of discussion in the seventh section of the new ISO 9001 under the headlines resources, competencies, communication and documented information. Specifically the sub-section knowledge of the organisation takes into account that relevant knowledge must be maintained and be made available to the employees sufficiently. In addition, organisations should have specific provisions on how the required knowledge can be obtained. For obtaining knowledge internal as well as external sources shall be used.

Another objective of the updated standard is a more stringent orientation towards an effective process management. Thus, processes related to product realisation and customer satisfaction will be more strongly emphasised and therefore the process-oriented approach will be accentuated more clearly. The process-orientation provides a solid foundation for interlinking quality and KM. On the one hand knowledge about the own processes need to be captured and secured. Dealing with business processes increases the transparency and comprehension of general inter-connections and relationships within an organisation. On the other hand knowledge is used within business processes and is thus fundamental for the production of products and services as well as the creation of value added.

After the publication of the revised standard in September 2015 all certified organisations will be required to adapt to the changes within a three year transition period, which will inevitably lead to companies tackling KM to a greater extent again (Orth and Karcher, 2015).

According to current literature in the field of KM strategic KM and operative KM can be distinguished. Taking the before illustrated connection of IC and KM as given it is of particular interest how these two different types of KM affect organisations’ IC and its performance. On the one hand the IC needs to be managed on a strategic level whereas long-term measures are derived to improve or optimise the IC regarding a company’s objectives and on the other hand the handling of knowledge needs to be taken into account to improve the company’s ability to apply knowledge within its operative business more efficiently. For the latter, business process-oriented KM constitutes an appropriate means, which might be implemented according to the ProWis approach.

3. Fundamentals

The Fraunhofer IPK reference model provides the conceptual basis for the analysis, design and implementation of knowledge management according to the ProWis approach (Mertins and Seidel, 2009). The reference model...
illustrates the way how knowledge circulates within an organisation and forms the basis for optimising and systematising the handling of knowledge. The value adding business processes (e.g. research and development or production process) and the central knowledge domains (e.g. knowledge about customers or markets) are the focus of the model. This knowledge is created, stored, distributed and applied in business processes to secure the provision of needed knowledge and thus enable the supply of the required performance (Figure 2).

**Figure 2:** KM reference model of Fraunhofer IPK

The alignment of the KM activities with the business processes ensures that the internal operative procedures are considered. This guarantees the integration of KM into everyday activities.

4. Implementation of KM According to the ProWis Approach

The ProWis approach supports enterprises in creating transparency in the handling of knowledge and proposes, to that end, the most important steps towards the implementation of a process-oriented knowledge management (Figure 3).

**Figure 3:** ProWis approach for the implementation process

For the implementation of the five steps illustrated above numerous support materials are provided in the online portal www.prowis.net. These comprise practically tested tools for self-assessment, a comprehensive collection of knowledge management solutions with case studies as well as checklists and templates. In the following sections of this article the five steps will be outlined.

The implementation of knowledge management should be planned as a project. At the beginning, of the project basic decisions regarding the objectives of the project have to be taken. These include, among other things, the selection of a suitable pilot sector within the organisation. For the team members who are able to make basic decision regarding the application area (divisions), objectives and direction are needed. Optimally, the project team is composed of professional experts and people who have a significant influence within the organisation. In addition, it is helpful to involve a management representative in the project to keep direct contact with the management and induce change.
Experience has shown that setting a clear focus on where to introduce KM has a positive impact on its successful implementation. Therefore, it makes sense to select one or more divisions or business processes as a pilot sector for the implementation of KM within the organisation. The determination of such a pilot sector is also important for the selection and composition of the project team during the analysis phase.

During the initialisation phase it is of particular importance to introduce and communicate the KM implementation project to the employees. Therefore, in a third step the communication of the project and its benefits for the employees should be planned and carried out systematically. This ensures the sensitisation of the employees for the topic and increases the probability of the project’s success.

The process-orientation already delivers value at this stage, as the reflection of business processes promotes the creation of transparency and a deeper understanding of connections and relations in an enterprise in a wider context. The alignment of the knowledge management activities with the business processes ensures that the internal operative procedures are considered. This guarantees the integration of knowledge management into everyday activities.

In the course of the project, different approaches for the description of knowledge in business processes were tested. As a result, a simplified procedure using knowledge-oriented process descriptions has proven to be particularly efficient and constructive. In a “knowledge-oriented process description” the most important steps, involved persons as well as inputs and results of a process are described. Furthermore, it is also documented which specific knowledge is relevant for the related process and which instruments and tools are currently used to carry out the process. This simplified process description supports the following steps of the analysis.

4.1 Analysis

During the analysis, strengths and weaknesses regarding the handling of knowledge are identified and some first ideas for improvement are collected. In order to support the analysis, ProWis provides two complementary procedures: a multi-functional questionnaire and an interview guideline that allows assessing the knowledge management core activities in a workshop.

**KM-Fitness-Check and KM-Audit (Questionnaire)**

The KM-Fitness-Check is used to identify strength and weaknesses regarding the handling of knowledge and is carried out through a self-assessment questionnaire. The result of the KM-Fitness-Check is an overview about the status quo of the handling of knowledge with regard to the specific knowledge management core activities (create, store, distribute, and apply) as well as the enterprise’s internal framework conditions. Important knowledge domains are identified and assessed according to their availability. The KM-Fitness-Check questionnaire allows a quick evaluation and gives an overview on the handling of knowledge in an enterprise. The questionnaire may be used by a single individual for assessment as well as for a basis for an employee survey.

The KM-Audit is a more comprehensive questionnaire which was the basis for the development of the KM-Fitness-Check. It has been continuously developed and can be adapted to the specific needs of an enterprise (Finke, 2009). The KM-Audit is usually carried out as an online survey and therefore enables the involvement of a higher number of employees and the analysis as well as comparison of different divisions. Furthermore, it can be used to capture potential solutions and transferable best practices directly.

**BPO-KM-Analysis**

In the frame of the ProWis project the established procedure by Heisig (2005) was used and further developed as well as simplified in some places. Primarily carried out in workshops the method of business process-oriented knowledge management (BPO-KM) is a method to analyse and design knowledge management practice (Heisig, 2005). The aim of the method is to assess the handling of knowledge in the context of a specific business process, to identify strengths and weaknesses as well as potential for improvement, and to develop solutions together with the participating employees. The knowledge domains (e.g. knowledge about customers, products or markets) build the basis for the assessment. Supported by simple electronic templates and in a standardised procedure it is possible to assess selected knowledge domains with respect to the four knowledge management core activities (Mertins and Orth, 2009). The implementation of the BPO-KM-Analysis includes three main steps. On the basis of the business processes selected within the initialisation phase the knowledge domains which should be analysed must be determined and the most important factors for these should be documented in a first step. For this purpose ProWis provides a simplified
process description template that includes a section for knowledge-related aspects such as the most important knowledge domains of the process and knowledge carriers. In the following the workshop participants should be invited to the workshop and a moderator should be appointed.

In the second step, the KM core activities (create, store, distribute and apply) are assessed for each of the previously selected knowledge domains by the workshop participants. For this purpose, the team at first supplements the description of processes and knowledge domains for the respective process and thus captures the status quo of the respective business process from their perspective. Furthermore, the personnel and material knowledge carriers that hold the respective knowledge are recorded. Subsequently, the selected knowledge domains are analysed with regard to the KM core activities. To this end, supporting instruments that are used for each KM core activity are documented and core activities are assessed with regard to the need for action by the team using the logic of a traffic light. Each team member receives one moderation card in green, yellow and red whereas they represent no need for action, medium need for action and high need for action, respectively. For the assessment all team members hold up the card that is most appropriate from their point of view and discuss the assessment whereas strength and weaknesses as well as ideas for improvement are documented by the moderator. The documentation is of particular importance for the understanding of the assessment in the following steps. According to this scheme all selected knowledge domains and KM core activities are assessed.

The last step of the procedure is focused on the preparation of the workshop results for the following steps of the implementation of KM according to the ProWis approach and is carried out by the moderator. The results give an overview on the fields of action with regard to the KM core activities and knowledge domains of the respective business process.

4.2 Objectives and Solutions

During this phase, the objectives for the enterprise-specific knowledge management program are elaborated in detail: “Which solutions should be used to achieve which objectives until when?” For this purpose, measures are defined and solutions are elaborated and assessed with regard to their feasibility. It is also of importance to provide the project team with the needed resources and competences. For this phase, ProWis offers different tools as well:

**ProWis Toolbox**

The identified potentials of improvement can be developed through suitable design components of knowledge management. As a portal-based internet platform, the ProWis Toolbox includes about 50 selected methods for implementing knowledge management. This creates the possibility of getting information about benefits, opportunities, risks and procedures regarding the implementation of each single solution. All of this is available to the end-user (Voigt, 2009).

In order to derive solutions from the results of the KM-Audit or the BPO-KM-Analysis, the central components of both instruments were picked up within the ProWis toolbox. The methods provided within the ProWis toolbox are structured according to different and combinable criteria. The navigation, for example, can be done on the basis of the core activities or the design areas of knowledge management (Figure 3). In addition, further access routes have been developed and include, for example, specific questions regarding the corporate practice: “Which methods can be used to retain the knowledge of leaving employees? How can knowledge be transferred between projects and departments? How can we optimise our data storage?” Furthermore, solutions can be selected with regard to the three dimensions of intellectual capital (human capital, structural capital and relational capital) (Alwert et al., 2008). Through this feature, enterprises which prepared an intellectual capital statement may use the ProWis portal in an objective-oriented manner in order to plan adjustment measures.
Prioritisation-Matrix and Roadmap

The number of possible solutions is often large. To make best use of the scarce resources of an enterprise, ProWis provides two further methods.

Among the pilot users, it has been proven effective to use a two-dimensional matrix. The matrix differentiates between the dimensions “need for action (urgency)” and “feasibility” – each of them assuming the characteristic values low, medium and high. The matrix can help identifying which measures are urgent and how easy or difficult they are to implement (Figure 5).

![Prioritisation-Matrix](image)

**Figure 5:** Prioritisation-Matrix

Within the next step, the implementation plans have to be specified for the identified fields of action and related solutions. For this task, the “solution roadmap” can be used. It makes clear the schedule for changes and illustrates which stages have to be achieved until when on a timeline.

### 4.3 Implementation

During this phase, the enterprise implements the selected solutions. This step is usually the longest and is crucial to the success of the whole project. However, its duration as well as the amounts of goals achieved should be kept under
control as low project progress can lead to the loss of interest which can only hardly be reversed. Implementing some “initial actions” which lead to quick wins is therefore recommendable.

From another perspective, the implementation of knowledge management is also to be seen as a change of processes within the enterprise: habitual/ordinary work and related routines might have to be changed as well as new methods and tools might have to be tested. This also means that employees have to be involved and actively participate in a learning process as transparency about objectives and procedures for the implementation of measures is essential during this phase. However, experience shows that enterprises communicate such contents often irregularly and too rarely. Therefore, especially the managers (participating) play an important role within such a project.

**Motivation Assistant**

Against this background, ProWis provides another tool to handle this challenge, the “Motivation Assistant” (Kohl, 2009). This tool helps to sensitize and qualify especially managers for the communication of the necessary steps and for the motivation of the employees during the change process. The development of a communication plan, the systematic preparation of arguments concerning the project’s benefits as well as the reflection on management behaviour have proved to be effective in practice.

### 4.4 Assessment

In the course of the assessment, the project results are assessed with regard to overall success. Building up on the assessment results, new measures can be derived or running measures can be adapted. Several methods can be applied for the assessment:

**KM Project Evaluation (Debriefing)**

In a debriefing, the focus is put on the people who were directly involved in the project. With this procedure, the success of the project is assessed ex post in order to learn from the past for future tasks. Emphasis should be placed on the following questions: “What has worked well? In which areas did we have difficulties? What can we do better in future?” (Voigt et al., 2009).

**Repeat the Analysis**

The performance of the enterprise with regard to knowledge management has already been measured through the usage of the KM Audit or the BPO-KM Analysis. Thus, an appropriate basis has been built for the development of a control instrument. It could therefore be useful to use again the instruments already applied in order to examine changes. Using such instruments continuously supports the establishment of knowledge management in an enterprise.

### 5. Case Study – Application of the ProWis Approach

The case used in this paper follows the implementation of KM according to the ProWis approach described in the previous chapter. It is illustrated by means of the anonymised “Engineering Ltd.” case study, which is based on the practical experience gained through the accompaniment of 15 pilot companies.

#### 5.1 Initialisation

The management of the Engineering Ltd. is convinced of the importance of KM for their approximately 200 employees and starts a relevant project accordingly. From the point of view of the managing director the knowledge transfer between the divisions R&D and Services shows the greatest need for action. The management’s assistant is appointed as the project manager. As a neutral person, she is most likely able to mediate between both departments and can additionally give direct and unbiased feedback to the management on the project’s progress. The directors of both departments, each of them comprising around 20 employees, also belong to the project team. The processes to be analysed are on the one hand the R&D process for individual customer orders, and on the other hand the commissioning process at the customer’s site.

In a first step, the management informs all employees about the planned initiative and points out the central objective increased productivity through an optimised knowledge transfer between both departments”. The managing director encourages the employees to participate in the project and limits the scope of the measures to be implemented to an acceptable number of one to three. The directors of both departments inform their employees during meetings in...
which the appointed project manager presents the concrete procedure of the project and distributes related information material.

5.2 Analysis

KM-Fitness-Check and KM-Audit

Due to the fact that within the pilot sector only 20 employees shall be questioned, the project manager of the Engineering Ltd. decides to use the KM-Fitness-Check for a survey. The printed Excel-questionnaires are handed out to the employees and collected anonymously in the mailbox of the project manager. Their evaluation is made using excel. As a result of the survey, the knowledge about products and customers is identified as being the most critical for success. Both knowledge domains are not sufficiently available to the employees. As part of their workflows, every employee has individually optimised the needed content and knowledge, but the view beyond the horizon is missing. Hence, the main challenge is the interdepartmental distribution of knowledge.

BPO-KM-Analysis

Within a training, the project manager was trained to apply the BPO-KM methodology. Using the ProWis guideline and the online available templates, she conducts and moderates four workshop-sessions. For each process, one workshop is conducted regarding the knowledge about products and customers, where the following challenges are identified:

- Gained knowledge about products and customers in the service department does not flow back into the R&D department. Necessary methods and tools are missing and, additionally, knowledge transfer only occurs randomly and delayed.
- Within the R&D department there is no procedure for the documentation of experience from already concluded projects available.
- The service employees only meet infrequently, as their presence is requested mostly at the customers’ sites. Each employee records and reports customer visits differently, resulting in individualised styles and different templates. Hence, different information is documented in different depth and in addition, it is not sufficiently distributed.
- Both departments’ employees use different terms to describe identical objects, often causing misunderstandings.

5.3 Objectives and Solutions

In the ProWis Toolbox, the project manager of Engineering Ltd. looks up suitable methods to better distribute knowledge, since the main problems have been identified in this area. The findings of her research which she will present to the employees are the following:

- Debriefing to capture and secure projects experiences after project conclusion.
- Wikis to support the documentation and distribution of information.
- Checklists – e.g. for the preparation and follow up of customer visits.
- Micro Articles – e.g. for the documentation of customer visits
- Knowledge Dictionary for the unification of special terms

The management of Engineering Ltd. limited the implementation to one to three measures in advance. The project manager now has the task to assess possible solutions jointly with the involved employees. The illustration below shows the result of this process. The debriefing in the R&D department as well as the implementation of a wiki to support the communication of both departments (internal and inter-departmental) are the priorities. Since the debriefing shows the highest need for action and feasibility it is decided to implement the debriefing before initiating further measures. The selection of the measures is coordinated with the management and then presented to the employees in dedicated department meetings.
5.4 Implementation

Before the implementation of the debriefing method the project manager develops an enterprise-specific concept for the execution of workshops on the basis of the content from the ProWis Toolbox. The toolbox provides information for conducting a standardised workshop for retaining experience which was developed by Fraunhofer IFF in another research project funded by the German Federal Ministry of Education and Research on the basis of the well-established methods “lessons learned” and “debriefing” (Schnauffer et al., 2004).

Afterwards, the project manager conducts two pilot workshops with selected employees from the R&D department to test the applicability of the method. To this end the project manager selects one relatively new employee with limited project experience and another one with many years’ experience. According to the enterprise-specific concept the implementation of the method is realised in six steps, namely workshop entry, project review, collection and assessment of project experience, elaboration of recommendations for action, derivation of measures and workshop conclusion.

For the entry into the workshop the project manager planned appropriate time for the establishment of a pleasant atmosphere and to communicate the objectives of the workshop. In this context, she presented the items of the agenda and illustrated important rules for carrying out the workshop.

During the project review the most important events as well as external and internal disruptive factors in the projects are reviewed ex post to bring back the memories of the employees and prepare them for the collection of experiences. In this context, a project timeline in combination with a so called mood curve proved to be effective as it supported the employees in reflecting their projects in detail.

The collection and assessment of the project experience starts with the collection of positive and negative experiences made within projects. For this purpose, guiding questions such as “What went well and what went wrong?” , “What experience could be useful for other projects”, “What would I do differently next time?” or “What could have been done to improve the project?” are used. As a result of this phase it appeared that the relatively new employee especially had negative experience during the starting-phase of projects which continuously improved over time. The other employee with many years of experience mainly made good experience throughout the entire project in contrast.

Therefore, the negative experiences of the relatively new employee were analysed in detail and measures to encounter these were elaborated. The analysis showed that the employee had only carried out projects with long-term customers, who already conducted projects with the enterprise before and were thus used to certain communication and project procedures the new employee was not familiar with. For this reason, the unification of account management, the introduction of a standardised project management and knowledge transfer between experienced employees were elaborated as potential recommendations for action.
In the course of the derivation of actions the potential recommendations for action were assessed and selected with regard to feasibility. The result was the introduction of a process for account management and the establishment of a personnel knowledge transfer between long-term employees who already carried out projects with certain customers and new employees who will carry out projects with these customers for the first time.

During the conclusion of the workshop the results achieved throughout the workshop were discussed to gain detailed insights for the successful implementation of the two derived measures and receive feedback on the applicability of the developed method for further development. Both employees clearly communicated that they deem the method as appropriate and favour its continuation. The results were documented and prepared for internal marketing for the project manager in order to be able to show to the employees the value of the additional effort.

5.5 Assessment

Roughly one year after the initiation of the project, the regular employee survey is measuring, among other things, the success of the KM project. To this end, the questions of the KM Fitness Check were integrated into the employee survey in order to be able to identify changes. Amongst a higher availability of needed knowledge about customers and projects, a higher satisfaction regarding the intra-departmental distribution of knowledge within the R&D department can be detected.

6. Conclusion and Outlook

In particular, SMEs are facing the challenge of implementing KM with scarce resources parallel to working on their daily business. In order to overcome this challenge, ProWis provides them with a practically tested and dedicated contribution. By means of the guideline and the online available tools, SMEs can implement step by step a company-specific KM. The recommendation from the pilot applications is the following: focus on simple and manageable measures to ensure success and prevent frustration over unattainable objectives. It is just as important to appoint a person responsible as well as a budget for the KM project and for the actual support by the management. The communication of the change processes in the enterprise, in real practice often neglected, is highlighted in the ProWis guideline. This paper briefly summarises and explains how SMEs can successfully have access and implement a process oriented KM. In fact, through the ProWis approach and its standardised guidelines, it is possible to quickly analyse and discover a firm’s business process’ strengths and weaknesses and to find potential for improvement with regard to its KM. Moreover, the ProWis toolbox offers a list of possible solutions and measures, aiming at helping a manager’s decision making process. Hence, thanks to the ProWis approach and its guideline, it is made possible for SMEs to gain the right skills to manage the creation, storage, distribution and application of knowledge in an enterprise effectively. Up to know, only big corporations seemed to have enough resources and capacity in order to be successful in this field. With this article the authors would like to encourage further firms to make use of the ProWis approach to improve their efficiency and competitiveness through the systematic implementation of KM. Finally, a standardised method as the one illustrated in this paper is particularly interesting for SMEs, as it only involves limited personnel and further capacity constraints and hence lowers the barriers for the implementation of KM in SMEs.

As mentioned before within the ProWis project 15 SME applied the developed methods and were scientifically supported. In the course of the project the following general problem areas could be identified within the 15 pilot companies:

- Inconsistent file repository – absence of generally valid directory structure as well as rules for file and directory names
- Insufficient knowledge and information transfer between departments
- Lack of transparency regarding competencies and responsibilities
- Absence of systematic capturing and documentation of project experience
- Unstructured formal communication (e.g. meetings, e-mail exchange etc.)
- Insufficient central storage of codified knowledge and information
- Expendable usage of available information systems
- Potential for improvement regarding process descriptions

Along with the identification of general problems within the pilot companies the following success factors for the implementation of knowledge management could be identified:

- Small steps and quick wins
• Accompanying communication towards the employees
• Participation of employees
• Project managers with defined responsibilities and budget
• Support by the management
• Clear, simple and systematic procedures
• External assistance – help for self-help

References


Blueprinting a Knowledge Sciences Center to Support a Regional Economy

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Abstract. As cities and regions transform from an industrial to a knowledge economy, there is a need to build new working relationships among academic, business communities, labor and workforce, civil society, and the technology sector – to create Knowledge Cities. A Knowledge City values all kinds of knowledge, is grounded in an economy that runs on knowledge and intellectual capital, and encourages knowledge markets and transactions. The 21st century knowledge economy is dependent upon knowledge cities and regions, representing a major shift from the industrial economy. Transforming an industrial city to a Knowledge City is not a trivial task. It requires that all members of the society make the transition together. Currently, there are no institutions that can facilitate this role. This paper considers how a Knowledge Sciences Center might fulfill that role, and reports on the thoughts of over 200 participants of the Knowledge Sciences Symposium held in Canton, Ohio, and Washington DC in 2013. The paper also references recent initiatives to establish Knowledge Sciences Centers in the Eastern and Midwest regions of the United States. The role of a transformational leader in establishing a Center is also highlighted.

Keywords: Knowledge sciences center, transformational leadership, use cases, knowledge communities, knowledge economy, economic transformation, Knowledge Sciences Symposium

1. Knowledge Sciences Symposium

There is a need to redefine many of our institutional relationships and the way that our institutions work as we transition to a knowledge economy and a knowledge society in the 21st century. No aspect of society remains unchanged in a knowledge economy – every sector, every individual, every organization and business changes. What we value shifts – intellectual capital is as important as is financial or physical capital (Andriessen 2004) (Bontis 2001) (Bontis 2002) (Bounfour and Edvinsson 2005) (Kratke 2011). In an industrial economy, academia was a haven for cutting-edge knowledge. It was where you went to learn. Solutions to industrial economy challenges are structured and managed because industrial economy challenges are linear, predictable and manageable.

In the knowledge economy, there is as much or more knowledge being created outside of academia as there is within (Peters 2007). Knowledge economy challenges are chaotic, dynamic and “wicked”. The knowledge economy is not as segmented or hierarchically structured as was an industrial economy – the transformation requires that all sectors and all stakeholders move together rather than move individually. Businesses understand the challenges of competing in a knowledge-based economy. Academia needs to learn from and deliver outcomes that can be used by business. Technology needs to move away from an industrial way of working or designing products for structured work to designing for a knowledge economy. The labor force needs to continuously learn – and learn not just from business or from union provided training – but to engage with academia. Learning today goes beyond formal degree programs. MOOCs, workshops, online webinars, in house training, and continuous lifelong learning are the norm. Academia needs to provide learning opportunities not just for those who can pay for formal credentials but to those who need to learn (Vardi 2012) (Rodriguez 2012).


In September 2013, an emergent community of 200 people from across the country gathered in Canton, Ohio, and in Washington DC, to hold a Knowledge Sciences Symposium (www.kent.edu/slis/programs/lakm/symposium/index.cfm).
The purpose of the Symposium was to bring together knowledge management thought leaders from businesses and organizations, technology sector, academia, civil society organizations and the broader workforce to design a blueprint for a Knowledge Sciences Center in order to support the transformation of local industrial economies into the 21st century knowledge economy. The Symposium discussions were preceded by five webinars in July 2013.

The Symposium participants (“Participants”) designed a blueprint for a 21st century Knowledge Sciences Center that focused on learning and career development, research and development, advocacy, advising and outreach and partnerships. The goal of this paper is to share that blueprint with the knowledge management community in order to elicit feedback and to find other people interested in moving the vision forward.

1.1 Rationale for a Knowledge Sciences Center

Participants envisioned a Knowledge Sciences Center as a source that would help a local economy and society make an effective transition to the 21st century knowledge economy. It was important to capture within the name of this Center the idea that the activities would go beyond what has typically been described as Knowledge Management. As a science, the range of activities would need to span the theoretical and academic foundations as well as the commercial and practical applications. The Knowledge Sciences Center we envisioned required a new blueprint if it was to serve this purpose.

1.2 Existing Models

There are many examples of research institutes, science centers and think tanks, but none that aligned with the community and economy focus of the Knowledge Sciences Center. Research institutes and science centers are designed to leverage expert knowledge, often focused on theoretical research or the R&D needs of specific funding organizations (Anttiroika 2004) (Appold 2003) (Chen and Choi 2004) (O’Mara 2005). The intended stakeholders are other highly credentialed or deeply resourced organizations, and the engagement models are heavily dependent upon public or endowment funding sources. Another example of a science center is a Think Tank where experts focus on investigating current topics for the purpose of advocacy or public policy development (Mendizabal 2010) (Goodman 2005). While these models certainly serve a purpose, Participants agreed that they do not meet the needs of a city or region making the transition to a knowledge economy. There was a clear consensus that a new model was needed.

1.3 Design Issues

The Participants envisioned a new kind of Center that would act as a bridge between the worlds of academia, business, labor and technology, and could find no existing models to use as a blueprint. The design and vision emerged as we explored five issues (Figure 1). We needed to know who would participate in the center (Issue 1). We needed to know what kinds of activities the center would support to achieve its goals (Issue 2). We needed to know how stakeholders would engage (Issue 3). We needed to know how we would fund the Center (Issue 4). Finally, we needed to know what it would look like — physically and virtually (Issue 5).

Figure 1: Knowledge Center Vision and Design – Five Key Issues
**Issue 1: Who are the Participants in a Knowledge Sciences Center?**

We began the discussion of stakeholders with an assumption that there were five primary interest groups, including academic, business, labor, civil society and technology developers. It quickly became obvious that these groups were neither comprehensive nor inclusive of possible stakeholders. We realized we needed to look at potential stakeholders from multiple perspectives. In the end, the Participants concluded that any member of the community that was being served by the Knowledge Sciences Center was a potential stakeholder, including but not limited to: academic, religious, and educational institutions, libraries, localized ownership, NGOs, governmental organizations – federal, state, local, county, academics, congressional staff, service organizations (boy scouts, girls scouts, youth groups, 501(3)c organizations, charitable organizations, military support organizations, professional societies, chambers of commerce, city visitors’ bureaus, unions, local government agencies such as fire, police, emergency management, innovators in search of partners, elected government officials, and voluntary sector organizations. The list of participants clearly requires a different kind of organization than traditional institutes, science centers or think tanks.

Understanding stakeholders along a single dimension such as their economic role presented a risk, but understanding stakeholder interests and needs will be necessary for brainstorming the types of activities, products and services the Center should provide. As a first step, Participants suggested a Knowledge Sciences Center should prepare persona. Persona templates would help to understand stakeholders’ goals, their different roles and responsibilities, their technology environment and skill levels, social media behaviors, and pain points. All of these dimensions are critical to planning activities, to designing access and supporting collaborative environments, to financing activities and to designing engagement models.

**Issue 2: What Do We Do?**

A core question for the blueprint is, “What does the Center do for these stakeholders?” We were fortunate to have more than 200 seasoned knowledge management professionals share their ideas on activities. We were also fortunate that this group had an implicit understanding of what we meant by knowledge sciences – its goals, its scope – and by what it means to practice knowledge management - its methods and tools. The participants proposed five areas of focus drawing upon their profound knowledge of the field and the challenges inherent to the transformation (Figure 2).

![Figure 2: Business Capabilities of a Knowledge Sciences Center](image)

The five broad areas were: (1) Learning and Career Development; (2) Research and Development; (3) Advocacy; (4) Advising; and (5) Networking and Partnerships. A significant portion of the in-person meetings in Ohio and Washington DC were devoted to brainstorming activities for these five areas. As shown in Tables 1-5, there was no shortage of ideas. Use cases are provided for each of the five activity areas to provide a deeper understanding of the value that such a Center might provide to the community.
**Table 1: Learning and Development Activities**

<table>
<thead>
<tr>
<th>Activity Name</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center of Excellence Reference materials</td>
<td>Business Growth Maps, Case Studies, Lessons Learned/Smart Lessons, Information Repositories – Wikimedia Repositories for Other Hubs/Chapters, KM Body of Knowledge, KM Standards, Knowledge Visualizations, Open Repository or Wiki, Real Work Scenarios, Roadmaps, ROI Methods, Scalable Solutions, Standards Organizations, KM Principles</td>
</tr>
<tr>
<td>Knowledge Sciences (KS) Learning Programs</td>
<td>MOOCS, ADDIE Model Training and Collaborative Workshops, Webinars, in House Training Programs for Organizations, Retraining Programs With Economic Development Units.</td>
</tr>
<tr>
<td>KS Book and Journal Clubs</td>
<td>Open Discussions of Recent Works to Help Promote Research Uptake</td>
</tr>
<tr>
<td>KS TV</td>
<td>KM Tedtalks, Open Webinars, KM Internet Travel Channel, Community of Practice Study Tours (Virtual and Physical)</td>
</tr>
<tr>
<td>Knowledge Sciences Learning Center</td>
<td>Certificate Programs, Competitions for Knowledge Games, Learning Games – Simulations, Pointers to Courses, Pointers to Programs, Transformation Learning Support</td>
</tr>
<tr>
<td>Knowledge Visitor Center</td>
<td>Orientation to the Knowledge Society and Knowledge Economy, KM Tourism, KM Conierge</td>
</tr>
<tr>
<td>KS FAQs</td>
<td>Basic Q&amp;A for KM Novices, FAQs for Individual Topics, KM Study Guides</td>
</tr>
<tr>
<td>Student Internships and Practicum</td>
<td>Project and Internship Opportunities, Student Resumes and CVs, Matchup Projects and Industry Needs</td>
</tr>
</tbody>
</table>

For Learning and Development, we have identified three use cases that could be developed and launched with the support of academia, the business community and public sector agencies, technology vendors, and private citizens.

**Use Case 1: Capture and Preservation of Knowledge Management Historical Grey Literature.** Much of the body of knowledge supporting the discipline of knowledge management assumes the form of grey literature. Because of the fragility of grey literature, this means that much of the body of knowledge of knowledge management is at risk of disappearing. No single academic institution or publisher can take on the responsibility of assembling, digitizing, preserving and making it accessible. Research (Bedford 2015) tells us that there is a need to make the body of knowledge accessible through an open web search tool. Knowledge Sciences Center assembles a project team consisting of federal agencies who were at the helm of knowledge management in the 1990s, engages academia – students and faculty – to prepare a plan to identify and preserve key sources, identifies vendors to help digitize and semantically process the materials, and negotiates with commercial vendors to make sources searchable. The project team also puts in place a submission function which allows individuals to contribute their historical materials to the repository.

**Use Case 2: Knowledge Audit and Knowledge Management Maturity Assessment Workshops.** Knowledge management techniques are challenging to learn because there are few practical guidebooks, because workshops at conferences are expensive and few have resources to travel, and because many methods take more than a half-day or a full-day to learn. Knowledge Sciences Center works with practitioners and academics to craft low- or no-cost open workshops on key techniques, e.g. knowledge audits, knowledge management maturity modeling, knowledge capability modeling, knowledge network analysis, knowledge elicitation and representation, etc. The workshops are recorded and posted to YouTube, and materials are available for anyone to use. They can be used by local groups to organize learning events, or used for self-study purposes.

**Use Case 3: KM Journal Discussion Clubs.** There is a substantial body of high quality knowledge management research in the peer-reviewed journals. There are challenges, though, in accessing and interpreting the research due to the nature of scholarly writing and presentation standards. Because the field is application- rather than theory-focused, it is important to increase the uptake of current research. The Knowledge Sciences Center will sponsor monthly "Research Clubs". These clubs will function like book clubs. Each month, an article from a peer-reviewed journal will be selected by the group for discussion in an interactive webinar. The author will be invited to join the online discussion. The author has an opportunity to explain the value of the research, to extend the impact of the reach in practical ways, and the discussants have an opportunity to gain a better understanding of the research. The expectation is that the discussions will lead to further applications of the research and to new research projects.
<table>
<thead>
<tr>
<th>Activity Name</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Sciences Collaborative Research &amp; Development</td>
<td>Collect Research Needs Ideas , Creation of Use Cases and Case Studies, Enterprise Scalable Solutions, Interoperable Solutions, New Approaches to Translation and Interpretation of Regulations, Policies and Standards, Provide Real World Problems for The Center to Work On, Research Agenda, Research Needs Statements, Standards and Guidelines for Findability</td>
</tr>
<tr>
<td>Knowledge Sciences Information Access Improvement</td>
<td>Knowledge Sciences Languages, Knowledge Sciences Organization Systems (e.g., Classification Schemes, Thesauri, Authoritative Lists)</td>
</tr>
<tr>
<td>Knowledge Challenge Workshops and Projects</td>
<td>Global Expert Teams, Special Topics, Wicked Problem Teams</td>
</tr>
<tr>
<td>Knowledge Elicitation Lab</td>
<td>Knowledge Elicitation Training, Knowledge Loss Prevention and Capture Strategies</td>
</tr>
<tr>
<td>General Research &amp; Development</td>
<td>Assess Research Capabilities, Benchmarking Opportunities, Knowledge Cities Index, Knowledge Economy Models, Knowledge Society Behavior Codes and Ethics, Project Assessments, KM Research Agendas, Innovation Research</td>
</tr>
<tr>
<td>Knowledge Economy Future State Visions</td>
<td>Economic Sector Scans, Industry Scans</td>
</tr>
<tr>
<td>Knowledge Sciences Research for Economic Sectors and Industries</td>
<td>Knowledge Society Futures. Knowledge Futures for Specific Organizations</td>
</tr>
</tbody>
</table>

For Research and Development, we have identified three use cases that be considered for the initial roll out of a knowledge Sciences center.

Use Case 4: Small and Medium Sized Business Consortium Services. A key business capability or the knowledge economy is semantic management of an organization’s knowledge and information assets. Small and medium sized businesses cannot afford these services, which often cost more than their annual operating budgets. They also cannot afford the expertise that it takes to sustain these technologies. Because the semantic technologies are expensive to develop and sustain, there needs to be a large market for vendors to survive. The market is currently limited due to lack of knowledge and skills to implement the technologies. The Knowledge Sciences Center can bring students and faculty together with vendors to provide affordable services in a consortium environment. This allows software vendors to expand their market for semantic products and services. Through the consortium, the academy is creating a cadre of trained semantic engineers to help business implement the solution.

Use Case 5: KM Access Tool Development and Adoption. Knowledge management is a cross-disciplinary field. Finding the literature of the field is challenging because commercial databases and web search tools do not support KM-specific discovery. There is a lack of knowledge organization tools specific to the KM discipline. The Knowledge Sciences Center can draw upon the skills of the academy to draft discovery tools. The Center can provide a context for deployment and testing of the tools by stakeholders across all sectors. Once developed, the discovery tools can be given to commercial database producers and libraries to use in their search systems.

Use Case 6: Knowledge Elicitation Training Courses. With the Silver Tsunami – the mass retirement of the Baby Boomer generation – upon us, there is a need for effective and efficient methods of knowledge elicitation and representation. There are many books on the subject, but there are few methods that have been proven to work for organizations. The Knowledge Sciences Center can engage with those experts who have developed effective methods to extend their reach across sectors. The Center can engage with experts and academics to transform methodologies into training materials. By training students in effective methods, the Center increases capacity across the field, and makes it possible for organizations to mitigate knowledge loss.
Table 3: Advocacy Activities

<table>
<thead>
<tr>
<th>Activity Name</th>
<th>Activity Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Engagement with Knowledge Economy Transformation</td>
<td>Adaptive Society Change Information Technologies, Innovation to Gain Market Share, Libraries Coached to Communicate Knowledge Management in Real-World Terms</td>
</tr>
<tr>
<td>Executive marketing and communication about KM</td>
<td>Knowledge Sharing Workshops, Lessons Learned Engaging With Corporate Executives</td>
</tr>
<tr>
<td>KM Competencies</td>
<td>Cost Reducing Solutions, Early Maturity Needs, Efficient and Effective Solutions, Facilitation Services, Larger Strategic Perspective, Problem Solving Approaches That Leverage KM, Standards Graphs Showing ROI</td>
</tr>
<tr>
<td>Sponsorship and Representation at Major Conferences and Social Activities</td>
<td>Marketing Center for All Things KM, Ability to Integrate with Other Domains, Providing Opportunities for Professionals to Socialize and Exchange Ideas</td>
</tr>
<tr>
<td>Development of KM Legal and Ethical Codes</td>
<td>Advocacy With Professional Societies, Collaboration With Human Capital and Human Resource Management</td>
</tr>
<tr>
<td>KM Standards Development and Promotion</td>
<td>Establish Committees to Define Standards for KM Professionals, Develop Standards for KM Professionals, Assess the Validity for Standards for KM Professionals, Disseminate Standards for KM Professions</td>
</tr>
<tr>
<td>Promotion of KM at all levels of education</td>
<td>Criteria for Teaching and Selection, Subversive Missions - Influencing Education and R&amp;D, Gaming and Simulation, Education Technology, Cognitive Sciences, Lifelong Learning, Communications</td>
</tr>
<tr>
<td>Promotion of KM Project Opportunities</td>
<td>Receiving and Broadcasting Knowledge Management Projects Throughout the KSC Network, Promoting Stakeholder Capabilities</td>
</tr>
<tr>
<td>Knowledge Management Industry Awards</td>
<td>KM Awards and Recognition of Leading Organizations and Individuals</td>
</tr>
</tbody>
</table>

Advocacy is another critical capability for the field. A Knowledge Sciences Center could play an important role in advocacy for the field and also for a local knowledge community.

Use Case 7: KM Standards Development. In order for the field to achieve the level of a professional discipline, there must be a set of professional competencies for individuals, standards for coverage of knowledge management education programs, and guidelines for operationalizing knowledge management in organizations. This is a challenge in a field which has such a broad reach. Knowledge Sciences Centers – acting in a network structure across the country – can provide the advocacy and support for this effort. The role of the Center is one of convening and mobilization, and advocacy across sectors.

Use Case 8: Promotion and Adoption of KM Education Across Levels. At the present time, knowledge management education and training is focused on graduate level programs or advanced certificates. A general education base for knowledge management is missing across the field. Developing knowledge management education programs below the graduate level will take a considerable mobilization and advocacy effort. Knowledge Sciences Centers can engage educators, curriculum developers, artists, and trainers to engage in the creation of materials which will support the introduction of knowledge management at the primary and secondary school levels.

Use Case 9: Local Knowledge Notes. Knowledge management is an application-focused discipline. It is important that knowledge management methods be accessible to local businesses. At the same time it is important that local solutions and practices be promoted to the larger discipline. There is a need to communicate about knowledge management efforts at the local level. Local businesses may not have the capacity to report on their progress to the peer-reviewed press. A local Knowledge Sciences Center could provide a local reporting and publishing capability – Local Knowledge Notes – that would create a vibrant dialogue around knowledge management activities. Local high school students, undergraduates, and graduate students could develop and publish stories.
Table 4: Outreach and Partnership

<table>
<thead>
<tr>
<th>Activity Name</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual KM Surveys</td>
<td>Understand Stakeholder Needs, Local and Networked Resources</td>
</tr>
<tr>
<td>Consulting and Advising</td>
<td>Establish Requirements, Create “People Finder” (e.g., through LinkedIn), Differentiate</td>
</tr>
<tr>
<td></td>
<td>Types of Consulting the Center Does / Pilots, Develop a Methodology for Matching</td>
</tr>
<tr>
<td></td>
<td>Stakeholders with Expertise for Consulting Purposes / Services, Identify Tools Repository</td>
</tr>
<tr>
<td>Development and Collection of Metrics and Stories</td>
<td>Performance Plan Examples, Price Points, Provide Strategic Maps and Assistance to Cities and Towns</td>
</tr>
<tr>
<td>Funding proposals and opportunities</td>
<td>Crowdsourced Solutions, Crowdsourced Funding for KM Research Needs, Short Term Services</td>
</tr>
<tr>
<td>Knowledge Management Mentorships</td>
<td>Mentoring Across Organizations, Mentoring Across Ages</td>
</tr>
</tbody>
</table>

Outreach and Partnerships are the core activities of a Knowledge Sciences Center. It is through partnerships that the Center undertakes activities. Outreach is a critical function that helps to grow the discipline and to also spur the growth of the local knowledge economy and society.

Use Case 10: State of the Discipline Surveys. Knowledge management suffers from a lack of routine, periodic and repeated assessments of the state of the field. Such surveys are generally undertaken by practicing professionals or professional associations. Because there is not a single discipline-wide professional association, we lack a good survey base. Knowledge Sciences Centers – working together across the country – will have a strong sense of the surveys that are needed, the base to be surveyed, and the interventions and projects that would follow the surveys. Eventually, a professional association might evolve from the collaborative efforts of knowledge science centers.

Use Case 11: Clearinghouse for KM Opportunities and Expertise. It is challenging to find and evaluate sources of knowledge management expertise. It is also challenging to find opportunities for new professionals to grow their expertise and build their portfolio. Local Knowledge Sciences Centers can act as clearinghouses for opportunities and expertise. Opportunities may include consulting contracts, new position advertisements, student course projects, as well as general directories of knowledge management expertise.

Table 5: Advising Activities

<table>
<thead>
<tr>
<th>Activity Name</th>
<th>Activity Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Networking and Public Outreach</td>
<td>Community Networking, Linking Consultants and Clients, Affinity Grouping within and across Sectors, Networking across City Organizations, Links From Citizens to Thought Leaders, Knowledge Connectors – Linking Those with Problems and Those with Solutions, Knowledge Practitioners Directory</td>
</tr>
<tr>
<td>Open Meetings Spaces</td>
<td>Experiments, Brainstorming Sessions, Knowledge Jams,</td>
</tr>
<tr>
<td>Outreach to Other Disciplines and Economic Sectors</td>
<td>Partnership Outreach and Extension Service</td>
</tr>
<tr>
<td>Social Media Support for Dynamic Conversations</td>
<td>Links to Twitter Feeds Related to Knowledge Sciences</td>
</tr>
</tbody>
</table>

The field of knowledge management is rich with consulting and advisory services. Many of these services, though, lack a cohesive community from which to draw and to which to offer their services. The Knowledge Sciences Center can help to fill this gap.

Use Case 12: Local Calendar of KM Activities. As the level of knowledge management activity grows in response to the efforts of the Knowledge Sciences Center, there will be a need to identify and promote a local KM calendar of events. The local Knowledge Sciences Center would be a good resource to maintain such an event calendar. The Center could
also promote national and international KM activities through the calendar to ensure the local community is connected to the broader community.

Use Case 13: Local Communities of Practice. The need for knowledge sharing and brainstorming increases as knowledge management practices grow in a city or a local economy. Sponsoring knowledge conversations or a local community of practice can be a heavy burden for a single organization. A local Knowledge Sciences Center can act as a catalyst for these conversations either by arranging to host lunch meetings or informal gatherings, or by managing the logistics and communication for the group. A local community of practice can also provide opportunities for students and faculty to engage in the conversation.

The list serves as a catalog of opportunities for any group that wishes to take up the challenge of building a Knowledge Sciences Center. It serves as a tool for prioritizing and implementing activities as relationships with stakeholders develop. Clearly, there are variations in cost, value, duration and sustainability, and lead times. The significant number of activities recommended reinforces both the need for and the lack of existing support provided by current players. It is clear that no one organization or institution can fulfill all of these needs. Only through working in a consortium or cooperative environment can a Knowledge Sciences Center meet these needs. Different activities and stakeholders also mean different engagement models.

**Issue 3: How Do We Engage?**

The Center’s engagement strategy is complex. Multiple engagement models would be required because different kinds of activities require different ways of working. Multiple models are needed because stakeholders’ interests, environments and resources vary. Participants discussed five possible engagement models, including: (1) Traditional academic R&D model; (2) Agricultural extension service model; (3) Knowledge services corps model similar to that of the Peace Corps; (4) Consortium model; and (5) Business franchise model.

The first envisioned model would support applied research that is needed by the community or for which there is no other logical source. This engagement model looks like a traditional academic science center where knowledge resides in the center and is channeled out to the community. Such a model assumes there would be formal contracts in place with funding agencies or organizations, and that all research standards, records and protocols would need to be maintained. In order to support research, access to library resources is also required. The Center would have to work with the university or college to contract for access.

The second envisioned model resembles that of an agricultural extension service. This model would support the development of solutions needed by the community, the non-formal learning needs of the community, and technology transfer issues. In this model the Center uses visits to stakeholders as a way of staying in touch with the needs of the local community, gather input to policy formulation, and provide targeted client advice. This engagement model would be a good fit for Learning and Career Development, and Advising activities.

The third envisioned model resembles a Knowledge Services Corps – similar to a missionary model or Peace Corps structures where knowledge evangelists engage directly with the community to foster conversations and knowledge transactions while leveraging the Center’s infrastructure and resources. This engagement model might leverage graduate students, students fulfilling practicum or internship requirements, who were supported by community scholarships, or volunteers earning community service or continuing education credits. This model would align well with Outreach and Partnership activities.

The fourth envisioned model resembles that of a consortium where the Center acts as a cooperative partner with other universities, institutions, and agencies to support activities. This model supports activities that require or benefit from a collaborative environment. This engagement model would be a good fit for Advocacy activities, where the Center would partner with other organizations to move initiatives and standards forward on behalf of the larger community.

And a fifth envisioned model – business franchise – was suggested. This was a particularly interesting model because it would allow the Center to reach out into the community through a hub-spoke model, and because it would provide conceptual buy-in and ownership relationships. “Franchise owners” at local libraries or universities or agencies would provide space or connectivity through which stakeholders could engage with the Center.
Each of the use cases discussed earlier would leverage one or more of these engagement models. It is important for a Knowledge Sciences Center to have multiple models from which to draw and design engagements.

### Issue 4: How Do We Fund the Center?

As a Knowledge Sciences Center our goal would be to mobilize and promote ideas. As with any such venture, funding will be necessary for sustained effect. Participants were asked to consider what kind of an innovative funding model would support Learning and Career Development, Research and Development, Advocacy, Advising and Networking. The answer to this question was similar to other answers – multi-faceted, dynamic and flexible. Funding models – as engagement models – must be relevant to the activity and to the stakeholders. Learning and Career Development activities may leverage a variety of funding models ranging from entirely open source contributed courses accessible on MOOCs, to no-fee open webinars, to fee-based workshops and on-site training courses, to formal certification or testing services. Advocacy activities would leverage in kind resources, community grants, crowd-funding, or direct sponsorship.

Research and Development may be funded through grants, research funding awards, and joint sponsored funding. Research may also be supported by in-kind contributions of the members of global expert teams. The model will depend on the nature and intensity of the research. R&D projects that support technology development or evaluation may be sponsored by technology vendors or venture capitalists. Research that has a direct community application may be funded through crowd-sourced or in-kind contributions. The nature of the funding must also take into consideration the intellectual property rights of the products and services. In some cases, established intellectual property provisions will apply. In other cases, creative commons and open source models might be more appropriate.

Another funding model would be pay-for-service. This may be appropriate for Advising activities. Again, there would need to be a progressive pricing strategy to ensure that all members of the community can afford to participate in these activities. The lowest pricing option should be an in-kind contribution or a barter system. In-kind contributions strengthen the Center by increasing its stock of knowledge. Where the Center might support in-kind contributions or contributed services, it would be necessary for stakeholders to have access, and the Center to support the idea of a “knowledge bank”. The idea would be that as stakeholders contribute to the Center, they earn intellectual credit that can be applied to future requests.

Also proposed was a fee-based membership model. The challenge with membership models, though, is that they lock and organization into providing predictable and pre-defined services to members. This typically leads to the need to define generic products and services rather than on-demand or stakeholder-focused activities. We have observed that institutions based on memberships over time can become bogged down in the administrative tasks of supporting members. The membership model might also price many community members out of most engagements. The Participants thought that a membership model should be considered only after all other options had been explored.

In addition, to having a stock set of funding models, the Center would need to have a robust list of funding sources and opportunities. On-going fundraising relevant to current or planned engagements would be one of the Center’s major operations.

Another more revolutionary approach would be to maintain a “knowledge bank” of deposits and withdrawals among Knowledge Sciences Center participants. Such contributions may take the form of in-kind contributions or effort, no- or low-cost advising or simple knowledge sharing. We would expect a healthy Knowledge Sciences Center to generate a high level of activity, not all of which would needed to have a financial basis.

### Issue 5: What Does the Center Look Like?

The Participants were of one mind in recommending both a virtual and a physical preference. The sentiment was that the physical presence should be minimalist and networked to increase visibility.

The physical space should ideally be located on a university or college campus to ensure there is easy access to faculty and students, as well as to research protocol support. However, participants suggested that a remote or satellite campus might be more appropriate to ensure that the Center can establish its own innovation-oriented, dynamic and community-focused organizational culture. The nature of the space should be open, heavily technology-enabled, with spaces for stakeholders to meet and work. The physical space should feel like an open knowledge sharing
environment. As the Center grows, there may be a need for spaces for visiting scholars or short-term team work spaces.

Depending on the nature of the stakeholders, their competencies and environments, the physical Center may need to provide access to the Center’s virtual space. We would also expect “Center franchisees” to provide community-based access to the Center. The Center’s virtual structure includes online collaboration environments, access to social media and cloud-based repositories. The Center is also virtually linked to other similar-Centers. The Center’s virtual presence might leverage cutting edge technologies under development or testing by technology developers or vendors.

The heavy reliance on virtual access would present both challenges and opportunities. In terms of challenges we would expect that many stakeholders would not have affordable high-bandwidth access. We also expect that digital literacy rates might be low for some stakeholders. This presents opportunities, though, for coaching and mentorships particularly where students and community members contribute training time in exchange for other services.

2. The Blueprint

The participants generated a wealth of ideas and options. While a number of support activities might be consistently supported through stable funding sources, it is clear that many will be ‘designer-oriented’. In other words, a stakeholder engagement and funding design model might need to be put in place for each activity. This is not the way that most organizations work. Thus, the participants agreed that an engagement design model would need to be developed for the Center.

The model favored by the participants was an emergent engagement design (Figure 3). The design process would begin with a proposed activity. To ensure that the Center stays true to its goal of facilitating the community or local area’s transition to a knowledge economy, deployment needs to be carefully managed and aligned with demand. The Center would put in place the virtual infrastructure, and engage stakeholders in activities that required low investments but could demonstrate high value. As value is recognized and promoted, stakeholder engagements would expand and build the Center’s reputation.

![Figure 3. Knowledge Center Activities](image-url)

2.1 Observations and Next Steps

The purpose of sharing these ideas is to encourage communities around the world to consider starting a Knowledge Sciences Center. At the time this article is going to press, there are three Knowledge Sciences Centers in design stage. Two of these are on the East Coast, and one is in the Midwest. Each Center will have a different focus and will launch with a different set of engagements. Each is taking an effective approach in reflecting the interests of the local community. The intent of a Knowledge Sciences Center is to serve the local community, and act as a connection point for stakeholders in the community. Some Centers will anchor with an existing research institute, and grow into the community. Others will begin by partnering with local foundations and will develop connections to local universities over time.
It is clear from these recent initiatives that five issues are core to successful implementation of the Center, and to each individual initiative. It is also clear that there is no one-size fits all strategy for building out the Knowledge Sciences Center. A successful Knowledge Sciences Center is interactive, problem-focused, trans-disciplinary, and community-based. Another lesson that has been learned through these young initiatives is the importance of a facilitator or leader with a robust and broad understanding of the field. Finding a transformational leader with the behavioral competencies, dedication and creative spirit to bridge diverse communities is key to its success. The long-term success of the Center is dependent upon the continued engagement of and value to the local community.

It is the intent of the research team to share these ideas, the blueprint, and information on current initiatives to encourage others to consider establishing Knowledge Sciences Centers for their local communities. The research team is open to sharing ideas and knowledge gained with any knowledge management practitioners.

References


