Knowledge management to support innovation in higher education institutions: the case of the Brasil-STHEM Consortium

Adriana Karam-Koleski[1], Gregorio Varvakis[2]

Abstract

This paper presents and discusses the use of knowledge management to support innovation in higher education institutions (HEI). The study was conducted at Brasil-STHEM Consortium - a network of Brazilian higher education institutions that work together in the implementation of innovation in their teaching and learning practices. 29 HEI participated in the study that was designed as an exploratory research and used the Asian Productivity Association (APO) knowledge management maturity level assessment tool as a framework for data collection and analysis.   Results demonstrate that there was openness for knowledge management and that there is technological infrastructure available for this to happen, but found little evidence of the systematic use of knowledge management practices. The study contributes to research and practice in education management by proposing the use of KM theory and tools to understand how knowledge being generated by higher education institutions can be identified, stored, shared, created and applied in order to amplify its impact to educational change and innovation.

Keywords: higher education management; knowledge management; education innovation, educational consortia; Brazil

Introduction

Brasil-STHEM Consortium (BSC) was established in the year of 2014 as a co-operation network of Brazilian higher education institutions (HEI) intended to create synergy and to intensify the process of co-operation and institutional learning about innovation in Education. Since its foundation, the BSC´s activities have been conducted in partnership with LASPAU, a Harvard University affiliate institute which objective is to 'enhance the quality and impact of higher education in the Americas' (LASPAU n.d.).   More than 6000 professors and higher education leaders have participated in the activities held by the BSC over the years (STHEM n.d.).

As of 2021, the BSC has become a learning community spread over the country with 64 participating institutions. It has been working towards helping Brazilian higher educators and leaders to promote transformation in the nature of teaching in higher education. Its knowledge activities comprehend an annual immersive training week on active learning methodologies and innovation in education, online courses on

---

[1] Universidade Federal de Santa Catarina, UFSC, Department of Engineering and Knowledge Management, Brazil. During the time of the research, Adriana was a visiting scholar at Laspau – Harvard University´s Institute that supported the creation of Brasil-STHEM Consortium. We assure this did not bring any conflicts of interest to the research process or to its findings. She is the corresponding author: adriana@opet.com.br

[2] Universidade Federal de Santa Catarina – UFSC, Department of Engineering and Knowledge Management, Brazil.

active learning and education innovation, a forum for the presentation of best practices and the publication of books, articles and journals about innovation in education.   In addition, every institution that takes part in the Consortium is supposed to implement active learning methodologies in its courses and report the results to the Consortium once a year (STHEM, s.d.)

Researches about the impact of the use of such methodologies on students´ learning at the institutions that belong to the Consortium have been conducted and have concluded that their impact is positive (Jerez 2017a) (Jerez 2017b) (Jerez 2017c).   However, there hasn´t been research on the management of the knowledge being generated by the faculty participating in the SLC.   As knowledge is 'flux and not stock' (Neto and Longo 2001, p. 109) it is relevant to study the status of knowledge management (KM) in the SLC.   This article presents the results of a study of KM maturity level in institutions that belong to the BSC. By doing so, it is possible to offer a panorama of how such Brazilian HEI are managing knowledge in order to take advantage of the knowledge being generated by BSC participant faculty.   This article also adds to the discussion of how collaborative innovation initiatives such as the Brazil STHEM Consortium can improve their impact by using the theory and practice of knowledge management.

The paper begins with a review of the literature about innovation in education and the role of networks and consortia in innovation, followed by a subsection about knowledge management, its characteristics and benefits to higher education. Knowledge management assessment tools will be discussed in this section as well. Section 3 describes the methodology used to carry the study, and section 4 presents data collected. In section 5, findings are examined and discussed. Section 6 presents conclusions and areas for future research.

Background

On innovation in education

The need for higher education innovation is an issue that has been around the discussions of educators, policy makers and society for a long time (Christensen and Eyring 2014).   However, promoting innovation in higher education is not a simple task. Higher Education Institutions (HEI) are complex, since they conduct multiple activities and may have a fragmented organizational structure with authority diffusion and with many factors affecting educators' actions, values and behaviors (Kezar and Gehrke 2015; Souza 2009). Innovation results from a series of multilayered coordinated actions due to the systemic nature of HEI (Fairweather 2008). Also, undergoing change and innovation processes is demanding intellectually and emotionally because it means opening up to new ways of thinking and also taking risks (Riordan and Klein 2016).

As a complex endeavor, innovation in education is positively impacted by the use of professional networks as they may be avenues for scaling up change (Fairweather 2008). Researchers have pointed out that networks are primary vehicles for the diffusion of innovation (Davenport and Prusak 1998; Rathi et al. 2014; Rogers 1971). Learning, social capital and risk taking are three outcomes of networks that are important for innovation (Kezar and Gehrke 2015). Networks that are successful in fostering conversation and learning within educational contexts have been reported to have a positive influence on peer

professional development and to the adaptation of innovative strategies that are conducive to change (Daly and Finnigan 2010).

Consortia in higher education institutions

Tadaki and Tremewan (2013) describe consortia as organizational networks that may involve three or hundreds of universities that get together to cooperate, coordinate and collaborate in order to achieve ends that would not be possible for institutions to achieve alone. Consortia may be regional, national or international (Denman 2005) and their purposes and activities are diverse.   They may range from sharing information and resources, promoting student and faculty exchange programs, aligning efforts to influence policy making or conducting collaborative research or professional development programs (Burley et al. 2012; Fadeeva and Mochizuki 2010).

Burley et al (2012) discuss that the contributions of consortia can be more than resource sharing and collaborative programs. Consortia represent an opportunity for collaborative activities to influence organizational practices within individual member institutions what may contribute to their development as learning organizations. Despite the extent to which participating in higher education consortia influence organizational learning is not completely understood, it is the potential of organizational learning that offers significant strategic value (Burley et al. 2012). In this context, KM theory can help in understanding how this contribution may make its way within the HEIs.

Knowledge management

Knowledge has been the driving force of human development all over history and its creation, storage, sharing and application has been a competitive advantage for the development of individuals, societies and nations (Wiig 1997).   The use of knowledge has promoted technological advances and has led to relevant social and economic transformations. From agricultural society to knowledge society it has gained relevance up to a point that knowledge became the production factor itself and an important asset for organizations (Castells 2010; Friedman 2005). Given its importance, knowledge should not be left at its own in organizations and should be managed properly in order to do justice to its potential impact on the results of any endeavor in the knowledge society (Dalkir 2005; Malone 2002; Wiig 1997).

Despite being a continuous effort in the history of mankind, knowledge management has gained push as a research area and as organizational practice only by the end of the 20th century. That is to say, it is not a new concern but something that has been practiced only recently (Davenport and Prusak 1998; Malone 2002; Wiig 1997).   Knowledge management is a systematic and integrative process that helps organizations in the identification, selection, organization, distribution and transference of information and specialized knowledge that make part of the organizational memory and are scattered and non-structured (Cheng 2015; Turban et al. 2004). It aims at transforming intellectual assets and the talent of the organization's members into more productivity, value and competitiveness (Lotti Oliva 2014). Knowledge management contributes in capturing the knowledge of each person in the team and converting it into something that may be useful for the organization, like new routines, new ideas about the clients, new concepts for its products (Davenport and Prusak 1998; Von Krogh et al. 2000). Because leaders should

decide on where to invest the effort and financial resources of the organizations, knowledge management should be closely linked to strategic planning (Cheng 2015; Malone 2002).

Knowledge management (KM) is as important to HEI as they are to any other organization (Rowley 2000). KM can be used for different purposes in different organizations and HEI can benefit from knowledge management to direct and support strategic management and its implementation, to improve quality of structures and administrative procedures, to create a knowledge environment that improves the quality and reach of research, to leverage the use of existing knowledge to create innovation in the education they provide for their students and to create new knowledge that helps the HEI to fulfil its role as a knowledge organization in society (Cheng 2015; Dhamdhere 2015; Rowley 2000; Souza 2009).

The SECI Model for organizational learning

Nonaka and Takeuchi (1995) remember that despite the term 'organizational knowledge' is largely used, it is not created by the organization but by the people that make part of it. It is a personal construction that results from the combination of the experiences, values and context information that are used to generate the individual´s perception about new information and experiences.   (Davenport and Prusak 1998). That is, knowledge is shaped by the person who owns and builds it (Serrat 2008).

There are two basic types of knowledge: tacit and explicit. Explicit knowledge can be expressed by means of words and numbers and can be shared in documents, formulae, manuals, instructions, and so on. Tacit knowledge is inside people's head and is hard to be formalized, communicated and shared with others – insights, intuition are expressions used to refer to tacit knowledge (Nonaka and Konno 1998; Nonaka and Takeuchi 1995; Polanyi 1966).

Despite it is generated by individuals, knowledge can be brought to light and be enlarged by means of social interactions in which tacit knowledge is turned into explicit knowledge (Capra 2002; Souza 2009). Nonaka and Takeuchi´s (1995) model of knowledge creation describe it as a 'spiraling process of interaction between explicit and tacit knowledge'(Nonaka and Konno 1998, p. 42) in which knowledge goes thru processes of socialization, externalization, sharing and internalization.   The model was based on Japanese companies and authors suggest that the success of these companies was a result of their ability to make use of their skills and expertise to create new knowledge to be used in innovation.

Knowledge management maturity assessment tools

Knowledge management (KM) maturity can be understood as a series of dynamic stages to be completed by means of consistent and concentrated efforts. The use of tools to evaluate the maturity of knowledge management is an element that may contribute to KM success since maturity models can be used to identify and implement the necessary steps in the pathway to more elaborate stages (Lin et al. 2011).   There are several tools that may be used to assess KM maturity in practice, which are characterized by their particular way of considering people, technology and process in their structure: the KPMG model, Tiwana's 10-Step KM Roadmap; Kochikar's KMM Model, used in Infosys' KM program; Siemens's Knowledge Management Maturity Model (KMMM); World Bank´s Organizational Knowledge Management (OKA); Assessment Model of the European Forum for KM; Wisdom Source's Knowledge Management Maturity Model (K3M); APQC's Knowledge Management Maturity Model, APQC's Stages of Implementation,

Lotti´s maturity level tool used in Brazilian organizations and the APO KM Assessment Maturity Tool (APO 2009; Batista 2012; Lin et al. 2011; Lotti Oliva 2014; Nair and Prakash 2009).

The APO Model of KM Maturity level assessment.

The Asian Productivity Association (APO) was established in 2007 to share American and European KM practices in Asia. It developed a framework for Knowledge Management with three levels: accelerators, knowledge processes and outcomes, as in figure 1.

Figure 1 APO Knowledge management framework

Source: (APO 2009, p. 82)

The mission and vision of the organization are at the center of the framework and they align the KM program with its strategic direction. The accelerators are four: leadership, technology, people and processes. In the level of knowledge processes there are 5 steps: identify, create, store, share and apply. These processes generate learning and innovation for the organization what, therefore, leads to productivity, quality, profitability and growth. The APO approach presents KM as a means and not an end. By means of an integrated KM approach to create, share and apply knowledge organizations can increase their results and competitiveness (APO 2009; Fraga 2015).

The APO KM assessment tool is a survey designed to help in understanding an organization's readiness for knowledge management. The survey is organized in 7 dimensions, each with 6 questions, with a maximum score of 210, as shown in figure 3. The categories are KM leadership, process, people, technology, knowledge processes, learning and innovation and KM outcomes (APO 2009).
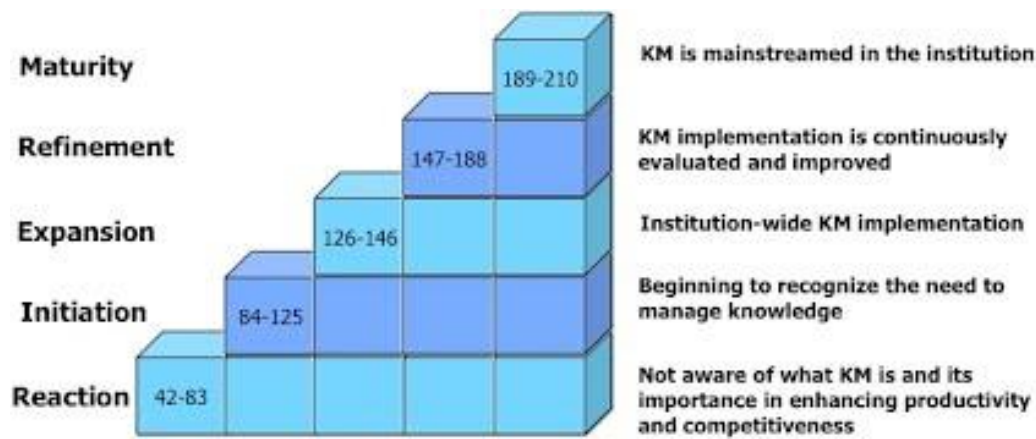
Figure 2 Maturity levels of APO knowledge management maturity level assessment tool

Source: (APO 2009, p. 145)

Methodology

This research was designed as a quantitative study, with an exploratory approach. A version of the APO Assessment tool was sent to the participating institutions at the Brazil Sthem Consortium (BSC) to understand their perception of KM in their institutions. Most of the questions were literally translated and some were slightly modified to fit the context of the research. As the APO tool had been tested for validity and reliability, no additional tests were taken.   The questionnaires were answered by the internal leader of the BSC in the institutions participating in the study and were focused on the knowledge about innovation in educational processes, which is the focus of the BSC.   All questionnaires were filled out online using Microsoft´s survey platform 'Microsoft forms'. All 49 BSC institutions received a letter by email inviting them to answer the survey with a link to the platform. There were 29 answers, making the sample correspond to 60 per cent of the population. A letter of informed consent was signed by all participants.

Each institution had its KM maturity level identified and these results were then compiled to find out the distribution of the institutions´ maturity level. Results were organized by dimension to understand the strengths and opportunities for development of the group of BSC institutions. Each dimension had the results of its questions analyzed, compared and contrasted to the results of other dimensions to test for coherence amongst the answers.

Results

The average Knowledge Management maturity level of the institutions that make part of the Brasil-STHEM Consortium as it is perceived by the local coordinators is level 3 – 'Expansion', with a total of 140 points. as shown in Graph 1. The mean totals in the assessed dimensions are ranked in Table 1.

Graph 1 Maturity Level at BSC by Institution
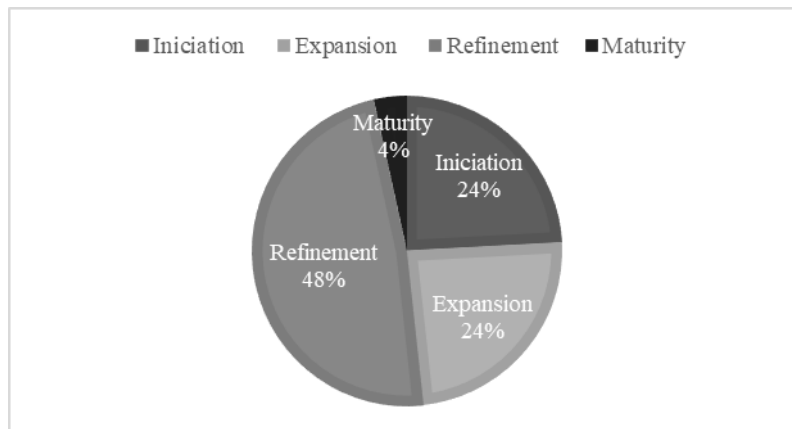
Source: answers of 29 institutions of the APO KM assessment tool

Table 1 Brasil-STHEM Consortium knowledge management maturity level by dimension

Dimension	Mean	Std. Dev.	Mode
Technology	4.3	0.18	5
Learning and Innovation	3.8	0.09	4
Leadership	3.2	0.24	4
Processes	3.1	0.07	3
KM Results	3.1	0.05	4
People	3.0	0.08	4
Knowledge Processes	2.9	0.03	3

Source: APO KM Assessment tool filled by 29 participant institutions.

Table 2 demonstrates the results of each question in the tested dimensions. They will be further demonstrated and discussed in session 5.

Table 2 Brasil-STHEM Consortium level by question and by dimension

	Leadership						Processes					
	Q01	Q02	Q03	Q04	Q05	Q06	Q07	Q08	Q09	Q10	Q11	Q12
Mean	*4,0*	*3,5*	*3,3*	*2,9*	*3,1*	*3,1*	*3,3*	*3,1*	*3,1*	*3,0*	*3,3*	*3,4*
Std. Dev.	1,3	1,4	1,5	1,3	0,8	0,8	0,9	1,1	1,0	0,9	0,9	1,0
Mode	4	4	4	4	3	3	3	3	4	3	3	4

	People						Technology					
	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24
Mean	*3,8*	*3,4*	*2,6*	*2,5*	*3,3*	*3,1*	*4,0*	*3,7*	*4,7*	*4,8*	*4,5*	*4,0*
Std. Dev.	0,9	1,1	1,2	1,1	1,0	1,2	0,8	1,2	0,6	0,6	0,8	1,0

| **Mode** | 4 | 4 | 3 | 2 | 3 | 4 | | 4 | 5 | 5 | 5 | 5 | 5 |

	Knowledge Processes						**Learning and Innovation**					
	Q25	**Q26**	**Q27**	**Q28**	**Q29**	**Q30**	**Q31**	**Q32**	**Q33**	**Q34**	**Q35**	**Q36**
Mean	*2,9*	*2,9*	*2,9*	*2,6*	*3,4*	*3,2*	*3,8*	*3,6*	*3,5*	*3,8*	*4,0*	*4,0*
Std. Dev.	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,0	1,0	0,9	0,8	0,9
Mode	4	2	3	3	3	3	5	3	4	4	4	4

	KM Results					
	Q37	**Q38**	**Q39**	**Q40**	**Q41**	**Q42**
Mean	*2,9*	*2,7*	*3,1*	*3,2*	*3,5*	*3,6*
Std. Dev.	1,1	1,1	1,0	1,0	1,0	1,1
Mode	4	3	4	4	4	3

Source: APO KM Assessment tool filled by 29 participant institutions.

Discussion

Results show that there is a slightly majority of institutions that have already implemented knowledge management and are in the stage of improving it – 52 per cent of the institutions are in levels 4 or 5. Twenty-four percent of them are in level 3, which means that KM has already been implemented and deployed. There are, however, 24 per cent of the institutions in level 2 – the initiation stage. At this stage, the organization has started recognizing the need of knowledge management or has already started some initiatives of KM as pilot projects, but it is necessary to advance in the implementation process in order to have the gains that knowledge management can bring to the organization (APO 2010). These institutions might benefit from the experience of the ones that are in more advanced stages of KM.

The analysis of the results by dimension is important to understand what are the strengths and opportunities for improvement. Technology is the highest score for all the institutions, with a mean of 4,3 out of 5 points and a mode of 5. This is an evidence that there is a good technology scenario available for supporting KM initiatives. The openness to encourage and support systematic learning processes and innovation is another strength with a mean of 3,8. It demonstrates that there is an environment conducive for innovation, team work and knowledge sharing in order to test new methods and tools benefiting risks and mistakes as learning opportunities. It is important to notice that the higher mean of these two dimensions has impacted the overall results of KM maturity at BSC.

The dimensions 'leadership', 'processes' and 'KM results' make a block with a result of 3,2; 3,1 and 3,1 respectively. Leadership comprehends organizational initiatives to align KM to the strategies of the organization, providing the needed resources and support for KM However, leadership is an accelerator for KM implementation and it would be necessary to take it to another level in order to provide the necessary push to improve KM practices. 'Processes' is another accelerator for KM since they promote knowledge

dissemination within an organization (APO 2009). Enhancing this area would benefit the implementation of KM . 'KM results' identifies outcomes in two levels: the improvement of individuals´, teams´ and units´ capabilities; and the improvement of productivity and quality in the services offered, bringing benefits to the institution´s performance and competitiveness. The mean of this dimension will increase as the other ones increase since it is a result of the implementation of KM processes and practices.

The two dimensions with the lowest results are 'people' and 'knowledge processes', with means of 3,0 and 2,9.   An important part of the knowledge base of an institution is in people´s heads (Dalkir 2005) and in educational institutions the service that is delivered to society is done mainly by people. So, a low result is this dimension is something to be addressed since people are users and creators of knowledge at the same time (Nair and Prakash 2009). The results of knowledge processes are the lowest ones what demonstrates that despite there is an openness for learning and innovation and even investment on it, there are few implemented processes to manage knowledge and to get the results that it can bring.

Looking inside and across dimensions

The following section brings of each question in the seven dimensions evaluated. By looking within each dimension, it is possible to understand with more depth the results of each dimension and also to make connections between different dimensions. This will allow a deeper and more systemic understanding of the results of the study.   Each dimension, cited in the order it appears in the APO questionnaire, will begin with a table containing the results of the questions which are followed by their discussion.

Dimension 1: Leadership

The question with the highest result is related to the existence and sharing of a strategy and vision for knowledge and its alignment to the strategic planning of the organization (Table 3).   The biggest challenge in this dimension is making this vision to be implemented by means of systematic processes for knowledge protection (Q4) and by management practices (Q5 and Q6). These challenges are coherent with the low results of 'Knowledge Processes' and 'People' dimension. If they are not addressed by leadership in the planning of the organization's activities, they are probably not implemented.   Data also point that leadership has a vision for knowledge in the organization, there are organizational arrangements for KM to be implemented and some financial investment has been put into knowledge initiatives (Q1, Q2, Q3). It is necessary that vision, structure and resources are turned into management practices for leadership to contribute more to the KM endeavor in the institutions. Another aspect that could be discussed is the need for leaders to be role models of the behavior and knowledge practices that they want to foster in the organization. What leaders actually do is of major importance because, by their actions, they are creating environments, reinforcing norms and setting expectations for their teams (Pfeffer and Sutton 1999).

Table 3 Results by question in the dimension 'KM Leadership'.

Question		Mean
01	The organisation has shared Knowledge, Vision, and Strategy strongly linked to the organisation's vision, mission, and goals.	3,89
02	Organisational arrangements have been undertaken to formalise KM initiatives (i.e., a central coordinating unit for knowledge/information management, Chief Knowledge/Information Officer, ICT team, quality improvement teams/Communities of Practise, knowledge networks).	3,41
03	Financial resources are allocated for KM initiatives.	3,26
04	The organisation has a policy for safeguarding knowledge (i.e., copyrights, patents, KM, and knowledge security).	2,82
05	Managers role-model the values of knowledge sharing and collaborative working. They spend enough more time disseminating information to their staff and facilitating the horizontal flow of information between their staff and with staff of other departments/divisions/units.	3,07
06	Management promotes, recognises, and rewards performance improvement, organisational and employee learning, sharing of knowledge, and knowledge creation and innovation.	3,00

Source: APO KM Assessment tool filled by 29 participant institutions.

Dimension 2: Processes

All the results in this dimension are close to 3 what may allow to assume that that there is place for improvement as processes are regarded (Table 4). Systematic processes that are designed effectively can contribute to better organizational productivity, profitability, quality and growth. They are also a means of communicating organizational knowledge (APO 2009). The major challenge in this dimension has to do with preparation for facing and managing crisis or unforeseen events what would allow the organization to maintain its operations and recover information and knowledge. This result is coherent with Q4 that deals with security of knowledge. Both results (Q4 and Q10) may be an evidence of a limited understanding of the importance of knowledge as an organizational asset and also little risk perception and management regarding not only knowledge but operations in general (Okrent 1998).

Table 4 Results by question in the dimension 'Processes'

Question		Mean
07	The organization determines its core competencies (strategically important capabilities that provide a competitive advantage) and aligns it to their mission and strategic goals	3,21
08	The organization designs its work systems and key processes to create value to customers and achieve performance excellence.	3,00

09	New technology, knowledge shared in the organization, flexibility, efficiency, and effectiveness are factored into the design of processes.	3,04
10	The organization has an organized system for managing crisis situations or unforeseen events that ensures uninterrupted operations, prevention, and recovery.	2,96
11	The organization implements and manages its key work processes to ensure that customer requirements are met and business results are sustained.	3,29
12	The organization continually evaluates and improves its work processes to achieve better performance, to reduce variations, to improve products and services, and to be updated with the latest in business trends, developments, and directions.	3,32

Source: APO KM Assessment tool filled by 29 participant institutions.

Dimension 3: People

This dimension had the second lowest mean. Results on Table 5 indicate that the best evaluated question is the existence of educational, training and career programs. Integration of new members on the team and active practices to promote, encourage and promote knowledge sharing are being treated adequately according to the answers to the questionnaire. However, the results of Q 15 and Q18 are less than 3 and it seems that there are few structured practices to develop situated knowledge (Wenger et al. 2002)   and to use and socialize to solve day to day problems which is an important way of putting the spiral of knowledge conversion into movement (Kimmerle et al. 2010; Nonaka and Takeuchi 1995). Both questions could benefit from the implementation of KM practices – the dimension with the lowest results - just as Q16 could too. Knowledge management practices such as peer assistance, learning reviews, expert locators could help to enhance the results in both dimensions (APO 2010). The low mean of Q16 is also a concern because despite the institutions are making investments in their team learning the resulting knowledge is not being mapped   and thus is not easily located, which may lead to the lack of use of knowledge that is already in the organization or to investing effort and resources to look for it outside the organization (Dalkir 2005). Such locating tools are provided by technology and although the overall mean of this dimension is the highest one which may convey that technology is not being used to support KM.

Table 5 Results by question in the dimension 'People'

Question		Mean
13	The organization's education, training, and career development program builds faculty knowledge, skills, and capabilities, supports achievement of overall objectives, and contributes to high performance.	3,75
14	The organization has a systematic induction process for new faculty that includes familiarity with KM and its benefits, the KM system, and KM tools.	3,25
15	The organization has formal mentoring, coaching, and tutoring processes.	2,57
16	The organization has a database easy of faculty competencies which is easy to access.	2,39

| 17 | Knowledge sharing and collaboration are actively incentivized, rewarded and improved. | 3,14 |
| 18 | Faculty members are organized into small teams/groups (i.e., quality circles, work improvement teams, cross-functional teams, communities of practice) to respond to workplace problems/concerns. | 2,96 |

Source: APO KM Assessment tool filled by 29 participant institutions.

Dimension 4: Technology

Technology is the highest rated dimension by the local coordinators of the BSC. Its mode is 5 which is an evidence that IT resources are available at the institutions (Table 6). Q21 and Q22 show that almost all members have access to a computer and are connected to the web and Q23 demonstrate that there is an effort in delivering updated information in the website or intranet. Though they have high rates, Q19, Q20 and Q24 are the ones more related to the use of technology to support KM and are less rated than the other ones. It might be the case that technology is being used for information management rather than for knowledge management (Fraga 2015). There is an important difference between both. Allowing information to be stored and flow in the organization is part of the contribution technology can bring to KM. The other part is to develop systems that help community members to think together and leverage knowledge which involves the combination of human and information systems (Mcdermott 1999; Rowley 2000).

Contrasting to the high results of the questions in this dimension, the following questions demonstrate that there is place for the advancement of IT´s contribution to KM: Q4 that deals with the use of systems to safeguard knowledge (2,82), Q16 with the data base of competencies (2,39), Q26 that addresses the issue of inventories and virtual places to identify and locate knowledge resources (2,79) and Q38 that presents the need of indicators to evaluate the impact and contributions of knowledge initiatives (2,57). These are issues that explicitly need technology to be set up. Other questions in the questionnaire would also benefit from the use of technology for KM, such as knowledge sharing and co-creation practices.

Table 6 Results by question in the dimension 'Technology'

Question		Mean
19	Management has established an IT infrastructure (i.e., Internet, intranet, and website) and has developed capabilities to facilitate effective KM.	3,86
20	The IT infrastructure is aligned to the organization's KM strategy.	3,61
21	Everyone has access to a computer.	4,71
22	Everyone has access to the Internet/intranet and an email address.	4,82
23	Information delivered in the website/intranet is updated on a regular basis	4,43
24	Intranet (or a similar network) is used as a major source of organization-wide communication to support knowledge transfer or information sharing.	3,86

Source: APO KM Assessment tool filled by 29 participant institutions.

Dimension 5: Knowledge Processes

This is the dimension that had the lowest mean with results shown in Table 7.   The two questions that had means in the adequate range were Q29 and Q30 what demonstrates that there are some initiatives for knowledge sharing and that there is an effort to benchmark experiences and practices to improve organizational performance. However, there is a shortage in the   use of systematic processes to identify, create, store, share and apply knowledge, what may hinder learning and innovation (APO 2009). The little use of inventories of knowledge may lead to a reinvestment as it cannot be easily accessed. If knowledge is not accessed, then it cannot be shared and used by other members of the team, sometimes making the institution look for the knowledge outside when it would be available inside it. In some cases, the institution is not using the available knowledge to enhance its performance and to innovate, what is also unsatisfactory. Q28 demonstrates that critical knowledge of faculty members leaving the organization is not being retained adequately. Knowledge is a valuable asset in every organization and it is even more in educational institutions. Because of that is important to establish routines to retain the knowledge of their senior team or of the people who leave the organization.

Table 7 Results by question in the dimension 'Knowledge Processes'

Question		Mean
25	The organization has systematic processes for identifying, creating, storing, sharing, and applying knowledge.	2,79
26	The organization maintains a knowledge inventory that identifies and locates knowledge assets or resources throughout the organization.	2,79
27	Knowledge accrued from completed tasks or projects is documented and shared.	2,79
28	Critical knowledge from faculty members leaving the institution is retained.	2,54
29	The organization shares best practices and lessons learned across the organization so that there is no constant re-inventing of the wheel or work duplications.	3,25
30	Benchmarking activities are conducted inside and outside the organization, the results of which are used to improve organizational performance and create new knowledge.	3,14

Source: APO KM Assessment tool filled by 29 participant institutions.

Dimension 6: Learning and Innovation

Results of the dimension 'Learning and Innovation' (Table 8) indicate the ability of the institution to encourage and support systematic learning and innovation processes and has the second highest mean.   It demonstrates that there is a favorable environment for learning and innovation in the BSC institutions, with team work and knowledge sharing being stimulated and with an openness to test new approaches and to take risks as learning opportunities. Though Q33 has a mean which demonstrates an adequate use of this cross-functional teams (3,39), Q18 deals with a similar aspect and has lower mean (2,89).   So it is possible that there is space for improving team work practices as a means to foster knowledge creation, sharing and use.

Table 8 Results by question in the dimension 'Learning and Innovation'

Question		Mean
31	The organization articulates and continually reinforces the values of learning and innovation.	3,75
32	The organization regards risk taking or committing mistakes as learning opportunities, so long as they are not performed repeatedly.	3,61
33	Cross-functional teams are organized to tackle problems/concerns that cut across the different units in the organization.	3,39
34	People feel empowered and that their ideas and contributions are generally valued by the organization.	3,71
35	Management is willing to try new tools and methods.	3,93
36	Individuals are given incentives to work together and share information.	3,93

Source: APO KM Assessment tool filled by 29 participant institutions

Dimension 7: KM Results

Knowledge management results are twofold. They identify the improvement of the individuals´, teams´ and units´ capacities and also the increase in productivity and quality of the services offered and their benefits to the performance, recognition and competitiveness of the institution. The best evaluated question is the gain in sustained growth, followed by the improvement of quality of products as a result of applying knowledge (Table 9). This improvement, however, may not be linked to KM since the institutions have few historic data and indicators of KM or other change initiatives and when they exist, there is a limited use of indicators. The implementation of KM demands that its results are measured. So, as other dimensions are treated in a KM implementation project it is important to assess its outcomes.

Table 9 Results by question in the dimension 'KM Results'

Question		Mean
37	The organization has a history (and maintains measures) of successfully implementing KM and other change initiatives.	2,75
38	Measures are in place for assessing the impact of knowledge contributions and initiatives.	2,57
39	The organization has achieved higher productivity through reduced cycle time, bigger cost savings, enhanced effectiveness, more efficient use of resources (including knowledge), improved decision-making, and increased speed of innovation.	3,14
40	The organization has increased its profitability as a result of productivity, quality, and customer satisfaction improvements.	3,18
41	The organization has improved the quality of its products and/or services as a result of applying knowledge to improve business processes or customer relationships.	3,46

| 42 | The organization has sustained its growth as a result of higher productivity, increased profitability, and better quality product and services. | 3,54 |

Source: APO KM Assessment tool filled by 29 participant institutions.

Final considerations

Brasil-STHEM Consortium (BSC) was created to help Brazilian higher educators and leaders to promote transformation in the nature of teaching and to do so it organizes a series of activities to put faculty members in contact with knowledge about innovative teaching practices and provides support for them to implement changes in their own environments. However, as in other inter-institutional collaborative initiatives of the nature of BSC, only few of the faculty members of each institution can participate in the activities provided. Because of that, it is crucial that the knowledge that is being generated by the participant faculty can be shared and become part of the knowledge of these HEI in order to scale the intended innovation.

This study has looked at the knowledge management maturity level in higher education institutions that belong to the BSC based on the APO KM framework (APO 2009).   Seven dimensions were analyzed: leadership, processes, people, technology, knowledge processes, learning and innovation, and knowledge management outcomes.   Results point that there is a good technology base and an environment conducive to learning and innovation in the educational institutions that were studied.   The dimensions of 'leadership' and 'processes' processes need to leveraged to achieve better results regarding KM. Attention to the dimension of 'people' is needed. People are the most important source and conduit of information, knowledge, learning and innovation in the organizations and the results of the study point to low results in important issues regarding this dimension. people. The dimension with the lowest result is the one that has deals with the actual implementation of knowledge management in the institutions i.e. knowledge processes. Looking at KM in a more structured way, developing organizational norms and culture and actually implementing knowledge processes to identify, create, store, share and apply knowledge is important for the institutions at BSC to increase their performance and competitiveness.

The study raises the issue of the importance of KM for higher education institutions and in learning communities like the Brasil-STHEM Consortium. Also, it makes the point for the need to analyze the different aspects evaluated in each dimension of KM to have a better understanding of where to direct efforts of the organization in order to take the best advantage of knowledge and gain performance and competitiveness.

As an exploratory study, this research provides an overview of Knowledge Management at the BSC. Further studies could include interviews with some of the participant institutions to understand their perception of their maturity level of KM and to gain insight on the motivators and barriers to implement KM.   Another study could be done to understand a single knowledge process and how it is put in practice by the institutions. Looking at the BSC itself and how KM practices are being used to improve its impact on the whole body of institutions that make part of it would be another field of research. Studies on the field of comparative education could be done using the same framework of KM analysis in other Consortiums and compare results with the ones of Brazilian institutions.

We believe this study contributes to research by bringing the KM theory and tools to understand how innovation efforts in teaching and learning practices can be addressed in higher education institutions and in Consortiums like the Brasil-STHEM Consortium.

References

APO. (2009). *APO facilitator´s guide*. Tokyo: APO.

APO. (2010). *Knowledge Management Tools and Techniques Manual*. (R. Young, Ed.)*Asian Productivity Organization*. Tokyo: APO. http://www.apo-tokyo.org/publications/files/ind-43-km_tt-2010.pdf. Accessed 17 March 2018

Batista, F. F. (2012). *Modelo de gestão do conhecimento para a administração pública brasileira: como implementar a gestão do conhecimento para produzir resultados em benefício do cidadão*. Brasilia: Ipea. http://btd.egc.ufsc.br/wp-content/uploads/2012/08/livro_modelodegestao_vol01.pdf. Accessed 19 March 2018

Burley, D., Gnam, C., Newman, R., Straker, H., & Babies, T. (2012). Leveraging higher education consortia for institutional advancement. *International Journal of Educational Management*, *26*(3), 274–283. https://doi.org/10.1108/09513541211213345

Capra, F. (2002). *The hidden connections: a science for sustainable living*. New York: Anchor Books.

Castells, M. (2010). *The rise of the network society: the inforation age: economy, society and culture.* West Sussex, UK: Wiley-Blackwell.

Cheng, E. C. K. (2015). *Knowledge Management for School Development*. *Knowledge Management for School Education*. New York: Springer. https://doi.org/10.1007/978-981-287-233-3

Christensen, C. M., & Eyring, H. J. (2014). *A universidade inovadora*. Porto Alegre : Bookman.

Dalkir, K. (2005). *Knowledge Management in Theory and Practice*. Oxford: Elsevier Inc.

Daly, A. J., & Finnigan, K. S. (2010). A bridge between worlds: Understanding network structure to understand change strategy. *Journal of Educational Change*, *11*(2), 111–138. https://doi.org/10.1007/s10833-009-9102-5

Davenport, T. H., & Prusak, L. (1998). *Working knowledge: how organizations manage what they know*. Cambridge, MA: Harvard Business School Press. https://doi.org/10.1145/348772.348775

Denman, B. (2005). Gestalt revisited: spin-offs and assessment in international university cooperation. *Journal of the Programme on Institutional Management in Higher Education*, *16*(1), 65–82. https://doi.org/10.1787/hemp-v17-3-en

Dhamdhere, S. (2015). Importance of knowledge management in the higher educational institutes. *Turkish Online Journal of Distance Education*, *16*(1). https://doi.org/10.17718/tojde.34392

Fadeeva, Z., & Mochizuki, Y. (2010). Higher education for today and tomorrow: University appraisal for diversity, innovation and change towards sustainable development. *Sustainability Science*, *5*(2), 249–256. https://doi.org/10.1007/s11625-010-0106-0

Fairweather, J. (2008). Linking Evidence and Promising Practices in Science, Technology, Engineering, and Mathematics (STEM) Undergraduate Education: A Status Report for The National Academies National Research Council Board of Science Education. *Workshop on Linking Evidence and*

Promising Practices in STEM Undergraduate Education, 1–31.
http://www7.nationalacademies.org/bose/Fairweather_CommissionedPaper.pdf

Fraga, B. D. (2015). *Conhecimento como ativo organizacional: estudo de caso em um programa de pós graduação*. Universidade Federal de Santa Catarina.

Friedman, T. (2005). *The world is flat: a brief history of the twenty first century*. New York: Farrar, Strauss and Giroux.

Jerez, O. y S. (Ed.). (2017a). *Innovando en Educacion Superior: experiencias clave en Latinoamérica y el Caribe 2016-2017 (Volumen 1: gestión curricular y desarrollo de la docencia)*. Santiago, Chile: Facultad de Economia y Negocios, Universidad de Chile.

Jerez, O. y S. (Ed.). (2017b). *Innovando en Educacion Superior: experiencias clave en Latinoamérica y el Caribe 2016-2017 (Volumen 2: metodologias activas de ensenânza y aprendizaje)*. Santiago, Chile: Facultad de Economia y Negocios, Universidad de Chile.

Jerez, O. y S. (Ed.). (2017c). *Innovando en Educacion Superior: experiencias clave en Latinoamérica y el Caribe 2016-2017 (Volumen 3: Integración de TIC´s)*. Santiago, Chile: Facultad de Economia y Negocios, Universidad de Chile.

Kezar, A., & Gehrke, S. (2015). *Communities of transformation and their work scaling STEM reform*. Los Angeles. http://www.uscrossier.org/pullias/wp-content/uploads/2016/01/communities-of-trans.pdf

Kimmerle, J., Cress, U., & Held, C. (2010). The interplay between individual and collective knowledge: technologies for organisational learning and knowledge building. *Knowledge Management Research & Practice*, *8*, 33–44. https://doi.org/10.1057/kmrp.2009.36

LASPAU. (n.d.). LASPAU: mission and vision. https://www.laspau.harvard.edu/mission-and-vision/. Accessed 31 August 2018

Lin, C., Wu, J.-C., & Yen, D. C. (2011). Exploring barriers to knowledge flow at different knowledge management maturity stages. *Information & Management*, *49*, 10–23. https://doi.org/10.1016/j.im.2011.11.001

Lotti Oliva, F. (2014). Knowledge management barriers, practices and maturity model. *Journal of Knowledge Management*, *18*(6), 1053–1074. https://doi.org/10.1108/JKM-03-2014-0080

Malone, D. (2002). Knowledge management: a model for organizational learning. *International Journal of Accounting Information Systems*, *3*(2), 111–123. https://doi.org/10.1016/S1467-0895(02)00039-8

Mcdermott, R. (1999). Why information technology inspired but cannot deliver knowledge management. *California Management Review*, *41*(4), 103–117. https://journals.sagepub.com/doi/pdf/10.2307/41166012. Accessed 2 April 2019

Nair, P., & Prakash, K. (ed). (2009). *Knowledge management: facilitators´guide*. (K. Nair, P.; Prakash, Ed.). Asian Productivity Organization.

Neto, C. D., & Longo, R. M. J. (2001). A gestão do conhecimento e a inovação tecnológica. *Transinformação*, *13*(2), 93–110.

Nonaka, I., & Konno, N. (1998). The concept of " ba ": Building a foundation for knowledge creation. *California Management Review*, *40*(3), 40–54. https://doi.org/10.2307/41165942

Nonaka, I., & Takeuchi, H. (1995). *The knowledge creating company: how japanese companies create*

the dynamics of innovation. New York: Oxford University Press.

Okrent, D. (1998). Risk perception and risk management: on knowledge, resource allocation and equity. *Reliability Engineering and System Safety*, *59*, 17–25.

Pfeffer, J., & Sutton, R. I. (1999). *The knowing doing gap: how smart companies turn knowledge into action*. Boston: Harvard Business School Press.

Polanyi, M. (1966). *The tacit dimension*. New York: Anchor Day Books.

Rathi, D., Given, L. M., & Forcier, E. (2014). Interorganisational partnerships and knowledge sharing: The perspective of non-profit organisations (NPOS). *Journal of Knowledge Management*, *18*(5), 867–885. https://doi.org/10.1108/JKM-06-2014-0256

Riordan, M., & Klein, E. J. (2016). Taking teacher learning to scale: Sharing knowledge and spreading ideas across geographies. *Teachers College Record*, *118*(6), 1–26.

Rogers, E. M. (1971). *Diffusion of innovations* (2nd ed.). New York: The Free Press. https://doi.org/citeulike-article-id:126680

Rowley, J. (2000). Is higher education ready for knowledge management? *International Journal of Educational Management*, *14*(7), 325–333. http://directory.umm.ac.id/Data Elmu/jurnal/I/International Journal of Educational Management/Vol14.Issue7.2000/06014ge2.pdf

Serrat, O. (2008). Notions of knowledge management. *International Publications*, (November). https://doi.org/10.1080/13600860410001674733

Souza, I. M. de. (2009). *Gestão das universidades federais brasileiras: uma abordagem fundamentada na gestão do conhecimento.* Universidade Federal de Santa Catarina.

STHEM. (n.d.). *STHEM em números*.

Tadaki, M., & Tremewan, C. (2013). Reimagining internationalization in higher education: International consortia as a transformative space? *Studies in Higher Education*, *38*(3), 367–387. https://doi.org/10.1080/03075079.2013.773219

Turban, E., McLean, E., & Wetherbe, J. (2004). *Tecnologia da informação para gestão: transformando negócios na economia digital*. Porto Alegre: Bookman.

Von Krogh, G., Ichijo, K., & Nonaka, I. (2000). *Enabling knowledge creation*. Oxford, UK: Osford University Press.

Wenger, E., Mc Dermott, R., & Snyder, W. M. (2002). *Cultivating communities of practice: a guide do managing knowledge*. *Cultivating communities of practice: a guide to managing knowledge*. Boston: Harvard Business School Press. https://doi.org/10.1108/bl.2002.17015bae.001

Wiig, K. M. (1997). Knowledge Management: An Introduction and Perspective. *The Journal of Knolwedge Management*, *1*(1), 6–14.