

Knowledge Management Barriers in the Brazilian Energy Sector

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Abstract

Paper aims: Nowadays, there are happening profoundly changes in the energy sector worldwide. The principal innovations are sustainability, the growing share of renewable energy sources, and energy efficiency. Knowledge Management (KM) is a critical process in energy companies. KM implementation is harmfully affected by factors known as KM barriers. This paper aims to identify those barriers. **Originality:** Knowledge management is fundamental to most organizations' strategy and operations in the energy sector. However, the energy companies need to overcome KM barriers. These issues are rarely addressed in the literature. **Research method:** This empirical, theoretical study is a qualitative approach, descriptive and exploratory. The research adopts the single case study method, having semi-structured interviews and participant observation to identify KM barriers. **Main findings:** Results demonstrate that the lack of incentive from top management, lack of motivation for sharing, staff retention hardship, and focusing merely on operations efficiency was identified as the main barriers to develop KM. **Implications for theory and practice:** These perspectives have not been explored yet and shall open a new approach to knowledge management implementation in energy companies. It offers practical guidance for diffusing and deploying KM initiatives in the energy sector.

KEYWORDS: energy sector, knowledge management, innovation, barriers.

1. Introduction

Sveiby (2001) stated that Knowledge Management (KM) in organizations arose in the 1980s when executives and researchers understood business knowledge's importance. Nonaka and Takeuchi (1995) proposed two types of knowledge: Explicit knowledge is the knowledge type that can be encoded and stored. Tacit knowledge is the knowledge that comes from the experience, internalized by understanding and best practices.

Knowledge Management focuses on connecting people, processes, and technology to leverage corporate knowledge. KM has obtained considerable focus due to its capability to deliver to organizations strategic results related to profitability, competitiveness, and capacity enhancement (Oluikpe, 2012).

Girard & Girard (2015) stated that the KM grounds on creating, sharing, and applying best practices, learning, and information. Further, the company's performance can be improved by corporate education and collaboration with other organizations.

Nowadays, most business organizations are concerned about building knowledge assets for their competitiveness. KM effort is a core necessity for organizations to compete successfully. KM is the systematic collaboration of people, technology, processes, and organizational structure to add value through innovation. This collaboration is achieved by creating, sharing, and applying knowledge as well as through feeding the valuable lessons learned and incorporating the best practices into corporate memory to foster continued organizational learning (Singh et al., 2008)

Competitive advantage has its importance remarked in the electricity sector. According to Ziviani & Ferreira (2017), the Brazilian electricity sector's main technological challenges are related to increased energy efficiency, the search for alternative energy sources, and storage. The intensification of innovation programs in this sector has been the target of attention of the National Electric Energy Agency (ANEEL), which supervises the resources allocated to these projects.

The performance of KM, in this context, is strictly linked to the innovation process. Holmen et al. (2005) point out that the innovation effort depends heavily on the knowledge of the members involved. The authors indicate that coordination, for better use of experience, is essential for advancing the electric energy sector.

The introduction of a KM program can be a significant organizational change, and therefore the involvement of the organization leaders is essential. High-level executives' commitment means a better chance of higher resource allocation. Moreover, it establishes conditions in self-directed learning on the individual level and organizational learning throughout the enterprise. (Anantatmula, 2008)

Intellectual capital, knowledge, and creativity are commonly cited in the literature as necessary conditions of innovation. In the new economy, real-time information access and knowledge sharing are fundamental to gain a competitive advantage. (Fejes, 2015).

There are profound changes in the energy sector worldwide related to sustainable solutions and renewable energy. Schaeffer (2015) has identified factors like global economic crises, geopolitical tensions, climate change, and the decrescent costs of renewable energy technologies as the drivers of changes.

Knowledge management is fundamental to most organizations' strategy and operations in the energy sector. Even at the energy distribution process at the end of the value chain, where competitive advantage might be based only on the resources' availability, there is still a need for scientific and technological knowledge to operate electricity generating plants successfully. (Edwards, 2008)

Knowledge sharing is a critical success factor of the majority of knowledge management processes. Effective knowledge-sharing practices enable individuals to reuse knowledge at the organizational and individual levels. There are two types of barriers. Individual and organizational. Individual barriers include internal resistance, lack of trust, and demotivation. Organizational' barriers consist of bureaucracy, lack of technological infrastructure, rigid organizational structure, lack of incentive from top management, and lack of reward for knowledge sharing. (Chaudhry, 2005)

Despite the growing importance of knowledge sharing practices for gaining competitive advantage and organizations' efficiency improvement, several barriers make it difficult for KM implementation to achieve the goals and deliver positive results. The identification and recognition of knowledge-sharing barriers play an essential role in the success of a KM strategy. (Riege,2005)

KM is a critical process in energy companies. A big challenge for these organizations is how to stimulate knowledge sharing. Companies that can get knowledge and apply it faster will be more successful in the energy sector. KM implementation is harmfully affected by factors known as KM barriers. This paper aims to identify those barriers.

2. Literature Review

2.1 Energy Sector

Nowadays, Energy companies develop their research concentrating on energy generation, distribution and storage, and the safe energy supply (Costa-Campi et al., 2014). The technological development requirement in energy companies focuses on growing energy demand, the necessity of energy efficiency, the utilization of renewables, and the frequent changes in power supply and demand (Alagoz & Kaygusuz, 2016; Chen et al., 2016).

In opposition to the conventional energy sector model related to centralized energy production and distribution, new solutions are coming into focus due to the costs decreasing of renewable energy technologies and changing customer needs. (Adil & Ko, 2016)

There are profound changes in the energy sector related to the increasing importance of renewable energy and sustainable new technologies. Renewable energy is a critical issue for energy companies from regulation aspects and technological marketing (Bollino & Madlener, 2016)

Energy companies have initiated changing their portfolios in terms of sustainability, investing in new technologies to use renewables energy sources at a larger volume and with the best allocation in the energymix. (Ruiz-Abellon et al., 2016)

2.2 KM Barriers in the Energy Sector

Barriers relating to Technology and Environment

The importance of Information and Communication Technology (ICT) can't be neglected. Lack of technological infrastructure is one of the most critical barriers in the implementation of KM. ICT provides a technical platform to KM, enhancing its relevance in an organization by helping and leveraging its knowledge systematically and effectively. There are many tools such as business intelligence, collaboration portals, data mining, and workflow management to support KM activities. The selection of appropriate technology improves the performance of the KM implementation process. (Singh et al., 2008)

Nonaka et al. (2014) point out that new technologies have an important role in exploiting synergies between the information capabilities of ICT tools and human creativity capabilities. In energy companies, a knowledge management system covering the whole company can synthesize all the enterprise data.

According to Bartczak (2002), issues of an economic, political, social, educational nature can be barriers to Knowledge Management implementation. They represent the environment where the organization is located and operates. They are elements outside the company's limits.

Salies (2010) found that the prevalence of traditional technologies prevents innovation and knowledge management, processes related to new businesses, and competitive advantage. The highly concentrated markets and traditional technologies' dominance lead to organizational inertia and dependency. The large company size is a constraint to research and development, mainly because of the prolonged and complex decision-making process that complicated innovation initiatives.

Barriers relating to the organization

Organizations can also create barriers through rigid hierarchies, bureaucracy, and outdated procedures. The creation and use of knowledge are considered by Marques et al. (2019) a challenge. Knowledge and experience are spread through the company and maintained by people or work units. There are countless reports of organizations that have to spend a lot of time, for no apparent reason, to locate such knowledge existing somewhere in the organization. Another difficulty for learning is the difficulty of letting go of your past, questioning your procedures and beliefs, thus rejecting the new existing practices.(Chaudhry, 2005)

Nisar et al. (2016) have examined the energy sector's organizational structure and pointed out characteristics of rigid regulation, inflexible institutional context, and less cooperative systems. The root of this strict institutional environment is that energy has been part of public goods historically; moreover, controlling the energy supply has been a critical activity on the national level.

The top management's responsibility is to communicate the knowledge management program's goals and strategies that will be implemented transparently to all employees to obtain support. However, it is common for these communication and management guidelines to be vague or not very detailed, without

providing clear and objective information. This issue can prevent it from being clear to employees what the organization expects of them concerning KM. (Riege, 2005)

Some studies appointed that organizations and business areas' size influence knowledge-sharing activities in and between business functions. Another organizational barrier could be the lack of formal mechanisms that provide continuous support of sharing knowledge initiatives. (Connelly & Kelloway, 2003; Sveiby & Simons, 2002).

The commitment of the top management is essential, whatever the project implemented in a company is. The encouragement of recruiters and human resources personnel and a clear perspective about knowledge share is critical to the success of KM. (Singh & Kant, 2008)

Barriers relating to people.

Intellectual capital (IC) is one of the company's resources. IC is the set of intangible assets and social relationships that create value for the company, and many studies consider it a source of competitive advantage. Internal knowledge management is related to the power of the company's human and structural capital as a set of values, traditions, and social norms within an organization. The processes and systems to manage internal knowledge are built (Jardon, 2015).

At an individual dimension, knowledge-sharing barriers are frequently related to lack of communication skills, trust, social networks, cultural differences, and the excessive emphasis on hierarchy positions. At an organizational level, barriers tend to be related to lack of accessibility of meeting spaces and physical infrastructure deficiencies. (McDermott & O'Dell, 2001).

Knowledge is a critical factor in human actions. Individuals acquire knowledge. However, organizations build a structure in which individuals can use their knowledge more effectively. The role of managers in sharing knowledge is quite significant (Tan & Wong, 2015).

Evangelou et al. (2006) concluded that motivation management is an essential issue and difficult to realize. They also claimed that motivation is critical for all tasks where goal setting is challenging. It was argued that verbal encouragement from knowledge workers to participate in a sharing system is

essential, but it is often not enough. Reward systems based on the use of technology, for example, can be helpful in such cases.

Choi et al. (2010) claim that communication, as an element of the quality of teamwork, can stimulate associations between members. It positively affects the motivation to collaborate and share knowledge among managers and technicians, mainly when participating in several projects, because it reduces the time consumed and cost.

3. Method

This empirical, theoretical study is a research with a qualitative approach, descriptive and exploratory. The study adopts the single case study method, having semi-structured interviews and participant observation as the primary data collection methods. To this extent, the case study takes dimensions of time and space into account (Yin, 2013).

Considering the purpose of this research, which is to identify the barriers and practices associated with KM in the Brazilian energy sector, it was decided to conduct an essentially qualitative research with the managers of these companies

All the interviews were conducted and recorded with the interviewees' agreement, which allowed the validation of the conceptual model. Due to the covid 19 pandemic, the interviews were carried out remotely, using the Zoom application, a virtual teleconferencing tool. The answers were transcribed and analyzed. The data collected was treated by the categoric content analysis method, triangulating the frequency in which ideas and terms present in the recorded answers occurred in light of the concepts and constructs selected in the literature.

It is essential to highlight this method's limitations, given the subjectivity inherent to interpreting the researchers' accounts during data analysis. The researchers' interpretations, emerging at the data analysis stage, were sent to the interviewees for later corrections to reduce this problem.

The analysis unit is a company in the electric sector of the state of Rio de Janeiro. The selection of individuals for the interview followed the criterion of more significant contribution to the researcher

when understanding the problem and the research question (Creswell, 2010). Interviewees were managers from information technology, human resources, purchasing, administrative, regulatory, financial, accounting, maintenance, operation, and contract management.

4. Results

The energy company studied is relatively new, created just under five years ago, and has shown itself to be of great importance in the Brazilian scenario. It is about to operate the largest natural gas thermoelectric park in Latin America. Using natural gas, this company contributes to its development in a cleaner and more efficient way.

The Brazilian electric sector has more than a century. Naturally, many professionals retire every year, so a lot of knowledge is lost in these turnover processes. One of the main goals of a good KM is to have a knowledge retention plan to avoid this absence. Dattero et al. (2007) remembered how important it is to know what kind of knowledge is used, by whom and for what task, that is, it is necessary to have it mapped and retained as an internal resource of the company, not only in the minds of its employees.

In general, the survey participants stated that there is no evidence of technicians' retention plans in their companies and understand that this is a challenge. It was observed that incentives such as a financial bonus or awards are not currently used.

Unfortunately, no structured retention plan was detected at the interviewed company. Some respondents clarified that they seek to promote a knowledge handover whenever possible when the employee's departure is previously advised. The interviewee mentioned that he tries to adopt a job rotation within his teams to know how to perform the tasks and get to see the process as a whole. Still, it is an action promoted on their own, not by formal guidance from the company.

The participants unanimously informed that the only type of reward they remember to exist in their company and, in the market, in general, is verbal recognition from peers, managers, and sometimes from the human resources area.

Some managers choose to focus only on operations efficiency rise without thinking of KM as an opportunity to gain a competitive advantage. They do not have a vision of the benefits they can obtain with a well-established knowledge management system.

However, it was possible to see that many systems and tools are not necessarily specific for KM but can effectively and are available. The technical and organizational infrastructure did not prove to be an obstacle to the implementation of KM. In general, it exists and is implemented but does not seem to be fully used. Barber et al. (2006) suggest that organizations seek to develop an environment where people are encouraged to learn from each other.

The respondents described that knowledge sharing is in the senior management's minds, and the employees are active and participative. The board and the presidency know that they have a lot of knowledge at home and support this to be amplified, but they do not focus on retention.

Through the culture of sharing, it is possible to prepare the company to solve problems and provide satisfactory answers. The habit of sharing wisdom brings visibility and competitiveness to the company. However, some individuals do not have this procedure as a cultural value. Hong, Suh, and Koo (2011) pointed out that cultural factors are intrinsic inhibitors of knowledge sharing because knowledge is a property of particular groups. The interviews showed that individualist culture could prevent some people from sharing what they know.

In the past, it was widespread for individuals to behave as task performers, and out of fear or uncertainty, they did not share their techniques, processes, and concepts. This fact made them keep the knowledge acquired when solving a problem and facing the setbacks and organizational difficulties, locking the ability they dominate. These actions corroborate what was stated by Kululanga & Mccaffer (2001). Employees who perform tasks routinely and do not contribute to improvements in their processes favor a few knowledge management environments in an organization.

In the interviews conducted, it was possible to see that professionals have extreme knowledge-sharing resistance. However, the expansion of internet access and social networks in the last decades always brings this concept of sharing information. Knowledge retention is fundamental to implement KM. Despite this must be a concern for employees and top management, many participants commented that

they have not seen retention happen in a structured way in any company in the energy sector where they have worked.

The research shows that the significant risk of information loss arises from employees' lack of interest in adequately storing data and documents about their routines and problems solved. For a more innovative and full insertion of knowledge management, the attention of the companies in the electric sector must evolve to a more proactive posture about the storage of information, with a status more as a repository of memories than as a simple file of norms and procedures, offering frequent and continuous actions and not only punctual and passive ones. It would favor the costs and time reduction in solving problems and provide data transformation into useful information, helping develop people and actions.

A knowledge retention plan is essential for companies concerned with maintaining or increasing their competitive advantage. Companies could focus their retention process on a specific department or professional. This person would be in charge of identifying and saving best practices and lessons learned among all employees working in different business areas and enabling the integration of these employees to disseminate tacit knowledge.

A system of rewards to employees who decide to contribute to the leverage of knowledge sharing could also be deployed. This type of action can bring relevant results by positively influencing innovation in the organization and energy sector.

Another critical point is about the value that KM adds to the business. The importance of these actions to support the companies gain a competitive advantage in the electricity sector. Besides, the proper application of KM can be used by managers as a guide to increase value creation in their respective areas.

Based on the answers obtained from the interviews with managers of this Brazilian energy company, the main KM barriers were identified and summarized, as shown in Table 01:

Identified Barriers

Barriers relating to Technology and Environment	Retirement and staff turnover
Barriers relating to the organization	Lack of motivation/reward to share knowledge
	Inefficient communication
	Lack of incentive from top management
Barriers relating to people	Lack of interest from employees

Table 01 – KM barriers

There is a big challenge in the Brazilian energy sector’s current situation to accomplish efficient operations adopting processes innovation and organizational change strategies through an effective KM implementation.

5. Conclusions

Large energy companies need to innovate because of the fast and radical changing external environment, but various factors repress organizational change. These companies need to find the equalize between developments of the traditional technologies and research and development investments focusing on renewable energy sources. Furthermore, energy companies should change their rigid structures to advance knowledge management and innovation.

They need to promote a knowledge management system that supports knowledge-sharing, creating, and taking advantage of the significant volume of data generated by smart grids with data science analyses. Finally, corporate venturing and acquisitions are also possible ways to acquire new technologies and innovations, facilitating environmental change.

Although some KM issues in the energy sector are particular, knowledge sharing is required to organizations in all industries. The drivers for these include challenges related to globalization, climate change, and other environmental problems. There is a need for systemic and integrated approaches to deal with the ever-increasing complexity of energy companies.

Some organizations have earned a reputation as leaders in KM. Others are still entirely incipient. The managers' challenge is to design KM initiatives that fit their own organization's needs. New energy sources will require new processes, not just new technology, and well-trained and educated people. These changes present both threats like loss of experienced staff, old information systems, and opportunities for systematic learning of best practices and technologies.

KM in the energy sector needs to be improved, but despite some organizations have been tackling this effectively, others have not addressed it yet. The key KM issues in the energy sector include maintaining organizational memory and adapting new knowledge-sharing practices into organizations that have not been this culture yet.

Knowledge sharing culture, like most organizational culture changes, starts at the top. The leaders of an organization can reinforce knowledge-sharing initiatives based on the support they give them. If management sets knowledge sharing as a priority, it will be so. High-performing companies empower their employees with knowledge and experience.

Knowledge sharing has been considered an important activity to support innovation management in the energy sector. The findings documented in this research should provide valuable insights into the KM initiatives currently undertaken by other organizations.

It is relevant to remark the losses that can occur, even without being significantly noticed, when knowledge management is not correctly implemented. This research provides subsidies to focus on the challenges to implement a more robust KM process, overcoming barriers that result in a gain of competitive advantage in the energy market in a continental-sized country like Brazil.

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