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The role of knowledge management infrastructure in building learning organizations, case study in Photovoltaic Test Lab Algeria (PVTL)

دور البنية التحتية لإدارة المعرفة في بناء منظمات الأعمال المتعلمة، دراسة حالة مخبر فحص الكهروضوئية الجزائر

Amina Kouadri Boudjelthia [1,*], Achour Mezrig [2],

[1] Hassiba Ben Bouali University Chlef, Laboratory of globalization and its implications on the economies of the countries of North Africa, Algeria.

[2] Hassiba Ben Bouali University Chlef, Laboratory of globalization and its implicatins on the economies of the countries of North Africa, Algeria.

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Abstract

This study aims to know the role of knowledge management infrastructure in building learning organizations, and try to examine the reality of this in Photovoltaic TestLab Algeria. For this we prepared two interviews in which we interviewed 11 members of the laboratory (all researchers). The first interview allowed us to identify the knowledge management infrastructure and the learning organization's dimensions in the laboratory, and through the second we determined the role of the knowledge management infrastructure in building the learning organization in the laboratory. After analyzing the two interviews, we concluded that the laboratory has a good infrastructure that enables it to implement knowledge management as well as transform into a learning organization, which all of its dimensions are available in different proportions. The study also concluded that there is an effective role for knowledge management infrastructure in building a learning organization in the laboratory, especially organizational culture. However, we found some shortcomings that can be remedied through the recommendations presented at the end of the study.

الكلمات المفتاحية:

البنية التحتية لإدارة المعرفة

إدارة المعرفة

التعلم التنظيمي

منظمات الأعمال المتعلمة.

ملخص

تهدف هذه الدراسة إلى معرفة دور البنية التحتية لإدارة المعرفة في بناء منظمات الأعمال المتعلمة، ومحاولة الإطلاع على واقع ذلك في مخبر فحص الكهروضوئية الجزائر. لبلوغ الأهداف النظرية والتطبيقية للدراسة استخدمنا المنهج الاستنباطي بأداتيه الوصف والتحليل. من أجل ذلك قمنا بإعداد مقابلتين استجوبنا من خلالهما أعضاء المخبر البالغ عددهم 11 فردًا (كلهم باحثين)، بحيث تعرفنا من خلال المقابلة الأولى على واقع البنية التحتية لإدارة المعرفة و أبعاد المنظمة المتعلمة في المخبر، والمقابلة الثانية سمحت لنا بتحديد دور البنية التحتية لإدارة المعرفة في بناء منظمة الأعمال المتعلمة في المخبر. بعد تحليل المقابلة الأولى توصلنا إلى أن المخبر يتوفر على بنية تحتية جيدة تمكنها من التطبيق الجيد لإدارة المعرفة وكذا التحول إلى منظمة أعمال متعلمة، والتي توفرت جميع أبعادها بنسب مختلفة، وسمح لنا تحليل المقابلة الثانية بالتأكد من وجود دور فعال للبنية التحتية لإدارة المعرفة في بناء منظمة أعمال متعلمة في المخبر خاصة الثقافة التنظيمية، مع ذلك إلتمسنا بعض النقائص التي يمكن تداركها من خلال التوصيات المقدمة في آخر الدراسة.

* Corresponding author at: Faculty of Economics, Commercial and Management Sciences, Hassiba Ben Bouali University Chlef-Algeria
Email : am.kouadriboudjelthia@univ-chlef.dz

1. introduction

The shift from the resource economy to the knowledge economy has made 'knowledge management' a critical issue in both the public and private sectors, for both organizations and individuals. However, when organizations start to manage the knowledge of their organization, they need to be clear about the factors that will influence knowledge management, which are known as the knowledge management infrastructure. Because infrastructure is the driving force behind knowledge management, it not only generates knowledge in the organization by stimulating knowledge creation, but it also motivates group members to share their knowledge and experiences with each other, thus allowing organizational knowledge to develop simultaneously and systematically. The knowledge management infrastructure is the mechanism by which the organization develops its knowledge and also stimulates the creation of knowledge within the organization and its sharing and protection. They are also the necessary building blocks for improving the effectiveness of knowledge management activities. The knowledge management infrastructure includes organizational culture, organizational structure, and information technology.

The objective of knowledge management is to integrate internal and external knowledge at all times in order to cope with environmental changes both inside and outside the organization, to solve existing problems as well as to innovate for business development. However, to fulfill these functions, the organization must provide a learning environment to maximize its human resources.

On the other hand, the learning organization is defined as an organization capable of creating, acquiring and transferring knowledge, and of changing its behavior to reflect new knowledge and ideas. in this way it learns, consciously gaining knowledge from every experience and from the way it collects, processes and uses the information gained from every interaction with stakeholders. All practices used by knowledge management and the effects of knowledge management influence future learning processes. This shows a close link between the knowledge management infrastructure and the learning organization.

Many studies have shown the relationship between knowledge management and the learning organization or organizational learning. However, these studies have neglected the role played by the knowledge management infrastructure in supporting and enhancing the learning organization. Therefore, the main objective of this study is to examine the role of the knowledge management infrastructure in building a learning organization. And test this role in Photovoltaic Test lab (PVTL).

Based on the foregoing, we presented the following problematic:

What is the role of knowledge management infrastructure in building learning organization in PVTL?

To analyze and answer this problematic, we asked the following sub-questions:

1. What is the reality of knowledge management infrastructure in PVTL?

2. What is the role of organizational culture in building learning organizations in PVTL?

3. Does organizational structure contribute in building learning organizations in PVTL?

4. Does information technology support the building of learning organizations in PVTL?

In order to test the impact of knowledge management infrastructure in building learning organizations, the study is hypothesized as follows:

Main hypothesis: Knowledge management infrastructure has a role in building learning organizations in PVTL.

The first sub-hypothesis: The organizational culture has a role in building learning organizations in PVTL.

The second sub-hypothesis: The organizational structure has a role in building learning organizations in PVTL.

The third sub-hypothesis: The information technology has a role in building learning organizations in PVTL.

This study drives its importance from: The subject of knowledge management and its infrastructure is

one of the modern and important topics in business management; the importance of providing an adequate knowledge management infrastructure for the successful application of knowledge management; the importance of building learning organizations based on the effective application of knowledge management.

This study attempt to highlight the concept of knowledge management infrastructure and learning organizations in its various aspects; understand how knowledge management infrastructure can have a role in building learning organization; and to know at what extent knowledge management infrastructure contributes in building learning organization in PVTL. Moreover, make recommendations that contribute to increase interest in knowledge management infrastructure, and highlighting its crucial role in building learning organization, especially in PVTL.

We used the deductive approach with its tools of description and analysis, so that we reviewed books and scientific articles that talk about the subject of our study, and in order to achieve the objectives of the study, we conducted an applied study at the laboratory level.

2. Knowledge management infrastructure conceptual framework

In today's dynamic business world, it is no longer enough for knowledge to be possessed at the individual level. New technologies and an abundance of competition require that knowledge be shared and utilized at an organizational level if company hopes to survive. Therefore, obvious purpose of most organizations is to manage knowledge so; Knowledge management (KM) is a process of producing knowledge to transport the organization into learning organization **(Mahdi, Al Msafir, & Yao, 2011, p. 9925**) ; this can be achieved through creating, sharing, and applying knowledge as well as through the feeding of valuable lessons learned and best practices into organization's memory **(Aref Hajir, Obeidat, Al Dalahmeh, & Masa'deh, 2015, p. 315)**. The successful implementation of knowledge management requires adequate infrastructure in the organization. The term of KM infrastructure refers as KM enablers by some authors. In an organizational context, KM infrastructure includes three major components: organization culture, organization structure, information technology (Hamidi, Abdaziz, Matzin, & Woods, 2012, p. 310). These dimensions are briefly described in detail in the next sub-section.

2.1. Organizational Culture

Organizational culture is defined as a set of assumptions, rules, standards, systems, and beliefs shared by employees within the organization that affect their thinking and decision-making **(Abualouch, Masa'deh, Bataineh, & Alrowwad, 2018, p. 282**). Thus, Organizational culture affects knowledge management by influencing values of members of the organization and their individual behaviors in dealing with the collective behaviors. According to researcher's findings collaboration, trust and incentives are three major dimensions of Organizational culture **(Ahmadi, Momeni, & Ahmadi, 2013)**. Attributes of an enabling organizational culture include understanding the value of KM practices, management support for KM at all levels, incentives that reward knowledge sharing, and encouragement of interaction for the creation and sharing of knowledge **(Becerra-Frendez & Sabherwal, 2015, p. 44)**.

2.2. Organizational structure

Organizational structure is a formal allocation of work tasks, roles, responsibilities, and authorities that exist within organization including policies, procedures, hierarchic relationships, and sector boundaries **(Abualouch, Masa'deh, Bataineh, & Alrowwad, 2018, p. 282)**. Organizational structure is considered a means of co-ordination and control whereby organizational actors can be directed towards organizational effectiveness. Knowledge management theorists largely conclude that changes in an organization's structure, such as moving from hierarchical to flatter networked forms, are essential for the effective transfer and creation of knowledge in the organization **(Fattahiyan, Hoveida, Siadat, & Talebi, 2013, p. 4).**

2.3. Information Technology.

Webster dictionary define information technology as technology involving the development, maintenance,

and use of computer systems, software, and networks for the processing and distribution of data (Webster). Information technology and knowledge management are closely tied together, because both help the propagation of structured knowledge vertically as well as horizontally within the organization. The information technology plays four different roles in knowledge management: first obtaining knowledge; second define, store, categorize, index, and link knowledge-related digital items; third seek and identify related content; finally flexibly express the content based on the various utilization background. In additionally, informational communication technology has a direct and indirect influence on the motivation of sharing knowledge, because it can execute four different functions to eliminate hindrances, provide channels to obtain information, correct flow processes, and identify the location of knowledge carrier and knowledge seeker **(Yeh, Lai, & Ho, 2006, p. 799)**.

3. Learning Organization: Basic concept

In knowledge economy, the survival of organizations depends on the extent to which they rely on highly effective learning processes. Organizations are open systems and their survival and prosperity depends on their ability to learn and adapt to threats and opportunities presented by dynamic external environments **(Hannah & Lester, 2009, p. 34)**. Both organizations and individuals need the ability to learn in order to remain vital in an environment of strategic change and uncertainty. Organizational learning means the learning achieved by individuals within organizations as is an individual learning. Organizations learn when the knowledge that their members have is explicitly known and codified in the organization. Learning is an oriented activity aimed to acquiring knowledge and developing skills. Organizational learning enhances competitiveness, productivity, and innovativeness in uncertain technological environment **(Wilson & Fiona, 2010, p. 202)**.

3.1. Learning Organization definition

Learning organization (LO) is an organization that assists the learning of its individuals and constantly changes itself. Learning Organization enables organizations to remain or achieve procedures and systems in ways which continuously improve its ability to set and achieve goals, satisfy stakeholders, develop its practice, value and develop its people and achieve its mission with its constituency **(Reynolds, 2005, p. 13)**. Watkins and Marsick provide an integrative model of a learning organization. They originally defined the concept of the learning organization as "one that learns continuously and transforms itself.....Learning is a continuous, strategically used process-integrated with and running parallel to work" **(Watkins & Marsick, 1996, p. 4).**

3.2. Learning Organization dimensions

Watkins and Marsick identified seven distinct but interrelated dimensions of a learning organization at individual, team, and organizational levels. These dimensions and their definitions are described as follows: **(Watkins & Marsick, Demonstrating the value of an organization's learning culture: The dimensions of the learning organization questionnaire, 2003, p. 139**).

• **Create continuous learning opportunities:** Learning is designed into work so that people can learn on the job; opportunities are provided for ongoing education and growth.

• **Promote inquiry and dialogue:** People gain productive reasoning skills to express their views and the capacity to listen and inquire into the views of others; the culture is changed to support questioning, feedback, and experimentation.

• **Encourage collaboration and team learning;** Work is designed to use groups to access different modes of thinking; groups are expected to learn together and work together; collaboration is valued by the culture and rewarded.

• **Create systems to capture and share learning:** Both high- and low-technology systems to share learning are created and integrated with work; access is provided; systems are maintained.

• **Empower people toward a collective vision:** People are involved in setting, owning, and implementing a joint vision; responsibility is distributed close to decision making so that people are motivated to learn

toward what they are held accountable to do.

• **Connect the organization to its environment:** People are helped to see the effect of their work on the entire enterprise; people scan the environment and use information to adjust work practices; the organization is linked to its communities.

• **Provide strategic leadership for learning**: Leaders model, champion, and support learning; leadership uses learning strategically for business results.

4. The role of knowledge management infrastructure in building learning organizations

In the light of the knowledge economy, the inevitability of knowledge management is evident through its characteristics, its ability to continuously provide important knowledge, and the ability to convert it into practical behavior through which the organization achieves its goals efficiently and effectively. As a result of the abundance of knowledge, it is mandatory to transform into a learning organization, which seeks to learn continuously, which allows it to maintain its capabilities and competitive advantage. Many studies confirm the positive relationship between learning organizations and knowledge management, which generated the need to search for infrastructure that ensures the effective application of knowledge management, and then the transition to a learning organization smoothly.

4.1. The role of organizational culture in building learning organizations

The challenge for organizations in this present environment is to create contexts in which members continually learn and create of new ideas and new products, as it is not sufficient for organizations to cope with the pressures of change **(Rijal, 2010, p. 122**). To make the transition to a learning organization, organizations require a culture that supports and facilitates this transformation. If we take into account that organizational culture largely determines the behavior of employees, it is clear that it can have a significant role in catalysis of the very process of learning in the organization **(Djonlagic, Delic, & Kovacevic, 2013, p. 784)**. In addition, organizational culture affects organizational learning (OL) in four ways. First, culture shapes employees' assumptions about whether knowledge is important or not and what knowledge is worth managing. Second, culture allows individual knowledge to become organizational knowledge, it influences the OL process. Third, culture shapes the processes by which new knowledge is created, legitimated and distributed. Finally, culture creates the context for social interaction that ultimately determines how effective an organization can be at creating, sharing and applying knowledge. Consequently, different organizational cultures will have different influences on OL **(Alsabbagh & Al Khalil, 2017, p. 586).**

4.2. The role of organizational structure in building learning organizations

The structure of a learning organization takes into account the common obstacles to learning so it is carefully aligned with strategy, and minimizing unnecessary levels of hierarchy. In decentralized and geographically spread organizations, particular care is taken to use communication to encourage lateral communication. Adequate resources are allocated for learning in terms of time, space, specialist support staff, and budgets for knowledge management and learning infrastructure, formal and informal communities of practice and other value networks (both internal and external), and learning and development programs **(Serrat, 2017, p. 59)**. A less formalized structure can encourage social interactions, creativity and learning processes. Firms purposefully adopt structures and strategies to encourage learning. The structures of an organization define the way the processes interact. Information structures and communication flows facilitate integrative learning **(Namada, 2018, p. 93).**

4.3. The role of information technology in building learning organizations

The role of information technology is to extend human capacity of knowledge creation through the speed, memory extension and communication facilities of technology. Information technology is a key instrument for the creation, codification, storage, communication, analysis, dissemination and systematization of information and knowledge. Furthermore, information technology is widely

used to connect people to reusable and codified knowledge, and it facilitates conversations to create new knowledge **(Ruiz-Mercader, Merono-Cerdan, & Sabater-Sanchez, 2006, p. 18)**. Davenport and Prusak point out that when companies interact with their environment, they absorb information and transform it into knowledge and act on it in combination with their experiences, values and internal rules..

5. The reality of the role of knowledge management infrastructure in building learning organizations in Photovoltaic Test Lab Algeria

5.1. Brief overview of the Laboratory

PVTL is a photovoltaic test laboratory, according to standard IEC 61215 , equipped with test benches for quality control. It allows the testing of photovoltaic modules according to the IEC 61215[(1)] standard (Photovoltaic (PV) modules for terrestrial applications - Design qualification and approval) to validate the reliability and performance of the modules supplied by the manufacturer. The PVTL laboratory, beyond the obligation of the IEC 61215 standard, offers quality control services to support manufacturers, distributors and importers of photovoltaic modules, investors and builders of photovoltaic solar power plants in improving the quality of the modules. PVTL has qualified personnel (11 members, 5 of whom have been trained by the American NREL [(2)] laboratory), having the knowledge and experience required to carry out tests on photovoltaic modules according to the requirements of the international standards. It also has an efficient quality management system, which guarantees the reliability of the results provided. PVTL is equipped with four test benches designed to perform twelve (12) of the 19 tests in the Today standard.

5.2. Sample and data collection

Because of the small population of the study, the study sample included all members of the laboratory (6 research supervisor, 1 research associate, 2 research engineer/ST, 2 research support engineer/ST), and for the same reason we chose the direct interview method to collect data, so we prepared an interview guide that contained direct questions, so that the respondent answered yes or no with an explanation if the answer required that. In order to analyze the interview, we used percentages and graphs, which is the method adopted in the case of direct and closed interviews. We interviewed the lab members in two phases. The first phase we questioned the members about the reality of the knowledge management infrastructure and the dimensions of learning organization in the laboratory, and after making sure of their availability at the laboratory level, we prepared another interview about the role of the knowledge management infrastructure in building learning organization in the lab.

5.3. Result and Discussion

5.3.1. The results of the lab members' answers on the dimensions of knowledge management infrastructure

- Organizational culture

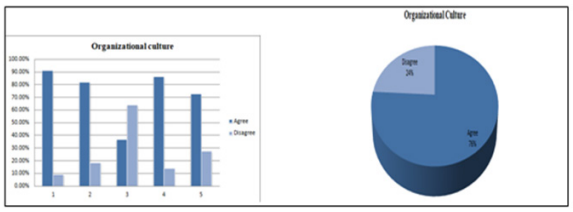
90.9% of the members of the laboratory confirm that there is a high degree of cooperation between them and their colleagues at work and they have mutual confidence in the intentions and behaviors of others, and 81.8% of them accept responsibility for their failures or mistakes and said that they have mutual confidence in the decisions of their colleagues towards organizational interests rather than individual interests, 63.6% They see knowledge management as a pillar of organizational communication and learning, and that there is no system to reward knowledge sharing and this is a fact, despite that 36.4% They see the opposite and justify their answers that they appreciate and recognize the moral incentives provided by the laboratory manager, despite the absence of a formal system that rewards materially Share knowledge. From all of the above it can be said that laboratory members have an organizational culture that supports knowledge sharing and learning, with shortcomings related to a formal incentive system that rewards

(1) The IEC is a leading global organization which develops consensus-based international standards for different electric technologies. It also provides minimum design requirements which assure the safety of the product during normal operation. The IEC 61215 standard contains a total of 19 Module Quality Tests (MQT). https://sinovoltaics.com/iec-61215-certification-testing/

(2) NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy.

knowledge sharing (see Figures N°1).

Figure N°1 : Percentages of laboratory members' responses to organizational culture



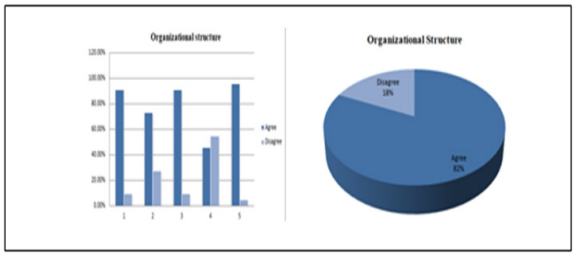
Source: Prepared by researchers based on the answers of the interviewees.

(Questions: 1,2,3,4,5 see appendix 1)

- Organizational structure

90.9% of the respondents assert that the laboratory encourages and supports them to interact with each other, and seeks to promote teamwork. 72.7% of them affirm that the laboratory encourages them to make decisions, and 95.5% believe that the laboratory codifies knowledge. As for the laboratory's endeavor to establish a structure for knowledge management, 54.5% of them deny and justify this because there is no clear practical plan to do so. Despite the shortcomings that can be remedied by the laboratory management, it can be said that the organizational structure supports and encourages knowledge sharing and learning to a large extent (see Figure N°2).

Figure N°2: Percentages of laboratory members' responses to organizational structure.



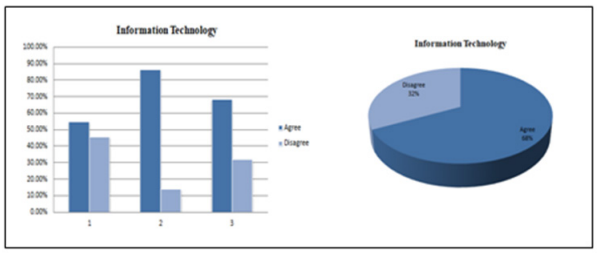
Source: Prepared by researchers based on the answers of the interviewees.

(questions: 1,2,3,4,5 see appendix 1)

- Information technology:

54.5% of the interviewees believe that the laboratory seeks to provide an adequate infrastructure for information technology, and the remaining 45.5% believe otherwise, commenting on their answer that they need more than what is available to perform their work. 86.3% see that the reactive use of information technology exists through the codification of knowledge and the provision of technology that helps research and development. As for the creative use of information technology, 68.2% see that it exists through information technology support for teamwork and communication, And that they belong to informal communities of practice (Messenger group, WhatsApp group) encouraged by the leadership and he is a member, through which they exchange their knowledge and experiences and communicate through them during working hours and outside working hours, although 31.8% of them see the opposite and justify their answer that they often use their own technology to communicate and work with their colleagues, and they do not see communities of practice as highly feasible and prefer the face-to-face exchange of knowledge. From all of the above, we say that the PVTL owns the basic information technology infrastructure for the application of knowledge management and the transformation into a learning organization, although it is not sufficient, but the shortcomings can be corrected (see figure N°3).

Figure N°3: Percentages of laboratory members' responses to information technology



Source: Prepared by researchers based on the answers of the interviewees.

(Questions: 1,2,3, see appendix 1)

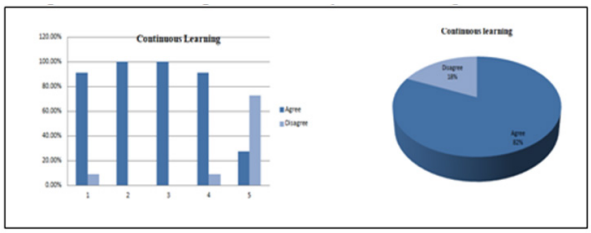
5.3.2. The results of the lab members' answers on the dimensions of the learning organizations

- Continuous Learning:

90.9% members of the laboratory affirm that they learn from their mistakes and help each other, and 100% (all members) confirm that they identify the skills they need for their work tasks and see problems in their work as an opportunity to learn. And 72.7% see that they do not receive a reward for their learning,

while 27.3% of them see the opposite and justify their answer that the rewards are sometimes indirect, because the laboratory's internal system does not have a formal system for incentives for sharing knowledge and learning, so the laboratory manager tries to provide moral incentives, In addition he shares his experience, informs them of the free online training courses and gives them the opportunity to participate in official missions that give them opportunities to develop their skills and obtain a financial return, (see figure N°4).

Figure N°4: Percentages of laboratory members' responses to continuous learning



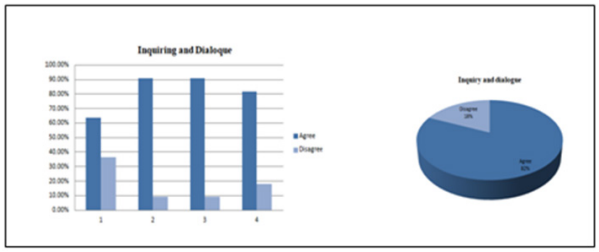
Source: Prepared by researchers based on the answers of the interviewees.

(Questions: 1,2,3,4,5, see the appendix 1)

- Inquiring and dialogue

63.6% of laboratory members assert that they provide honest and candid comments to each other. And 90.9% of them confirm that they listen to each other's opinions and treat each other respectfully, and 81.8% seek to gain each other's trust (see figure N° 5).

Figure N°5: Percentages of laboratory members' responses to inquiring and dialogue



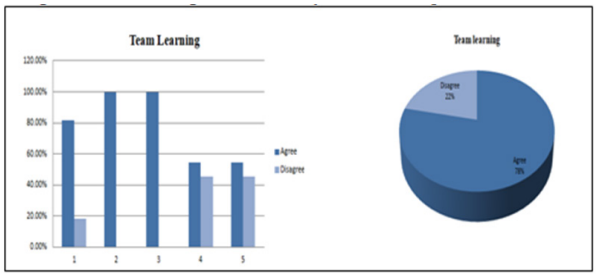
Source: Prepared by researchers based on the answers of the interviewees.

(Questions:1,2,3,4, see the appendix 1)

- Team Learning

100% (all lab members) treat each other equally regardless of their differences, and review their ideas as a result of group discussions or information gathered. 81.8% of them feel that they are free to adapt their goals and 18.2% of the members see that not really seen that they are sometimes limited by very precise tasks to accomplish. While 54.5% of them see that the laboratory takes their recommendations into consideration and that they are rewarded for collective achievements, This is due to the existence of a system that gives a percentage of the profits of the projects completed by the teamwork to the team members, each according to his efficiency at work. They see that this system indirectly rewards learning and development of individual and collective capabilities. As for the work, they a wage every month and what they do is not additional work, while 45.5% who answered no, see it as the wages for the work provided, (see figure N° 6).

Figure N°6: Percentages of laboratory members' responses to team learning.



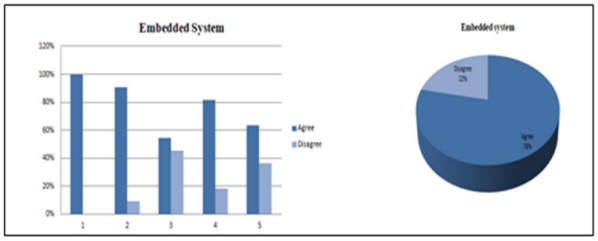
Source: Prepared by researchers based on the answers of the interviewees.

(Questions:1,2,3,4,5, see the appendix 1)

- Embedded system

100% (all lab members) confirm that the laboratory uses formal and informal methods of communication, 90.9% of them confirm that the information reaches it easily and quickly, 81.8% believe that what has been learned in the laboratory is available to everyone, 63.6% believe that training results are measured, and 54.5% see that The laboratory has a system to measure the gaps between current and expected performance, (see figure N° 7).

Figure N°7: Percentages of laboratory members' responses to embedded system.



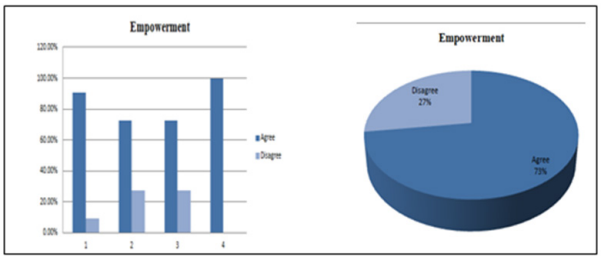
Source: Prepared by researchers based on the answers of the interviewees.

(Questions:1,2,3,4,5, see the appendix 1)

- Empowerment

90.9% of the laboratory members confirm that the laboratory recognizes the members who take the initiative, and 72.7% of them believe that the laboratory invites them to contribute to the development of its vision and that it provides them with all the resources they need to accomplish their tasks. And 100% of them confirm that the laboratory supports members who take calculated risks, (see figure N°8).

Figure N°8: Percentages of laboratory members' responses to empowerment



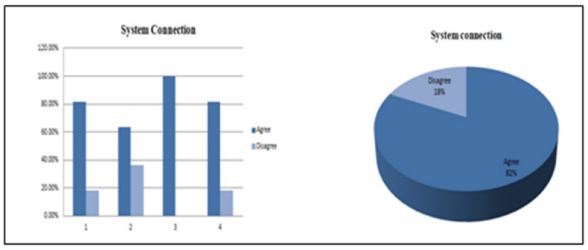
Source: Prepared by researchers based on the answers of the interviewees.

(Questions:1,2,3,4, see the appendix 1)

- System connection

81.8% of the laboratory members confirm that the laboratory encourages them to think from a global perspective, especially as they work with global standards, and facilitates them to obtain the necessary information to solve business problems. 63.6% of them believe that the laboratory encourages them to take customer opinions into consideration in making decisions, and 100% assert that the laboratory works with the external environment to meet mutual needs, (see figure N°9).

Figure N° 9: Percentages of laboratory members' responses to system connection



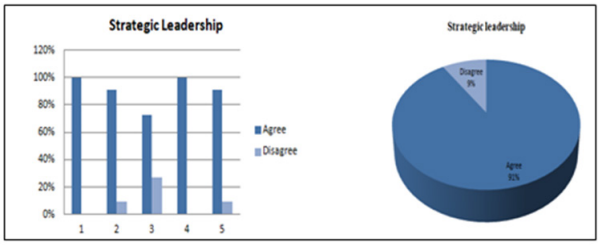
Source: Prepared by researchers based on the answers of the interviewees.

(Questions: 1,2,3,4, see the appendix 1)

- Strategic leadership

100% (all members) assert that the lab leadership supports their requests for learning and training, and engages them in implementing the lab vision, 90.9% of them say the leadership shares the latest information with them and helps them find learning opportunities, and 72.7% see that the leadership always guides and trains them. (see figure N°10).

Figure N°10: Percentages of laboratory members' responses to strategic leadership



Source: Prepared by researchers based on the answers of the interviewees.

(Questions:1,2,3,4,5, see the appendix 1)

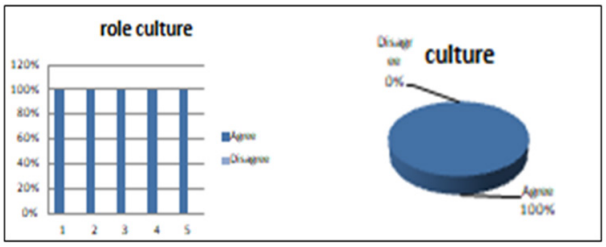
5.3.3. Analyze the role of knowledge management infrastructure in building learning organization in PVTL

- Analyze the role of organizational culture (OC) in building learning organizations (LO) in PVTL.

All laboratory members confirm that the level of trust that exists between them enhances the exchange of their experiences and knowledge with each other, and that this exchange and participation parallels the level of development in their field of work, and that it also contributes to facing work challenges, and that the level of cooperation between them contributes to the

continuity of the learning process in the laboratory. In addition, they confirm that the sharing of knowledge and cooperation among them contributes to the laboratory's provision of high quality services. (see figure N°11).

Figure N°11: Percentages of laboratory members' responses to the role of OC in building LO.



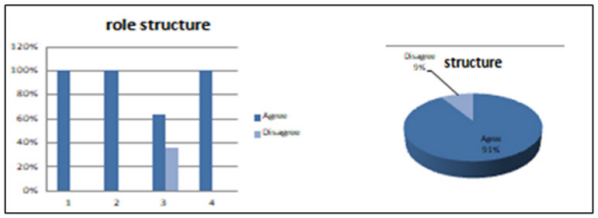
Source: Prepared by researchers based on the answers of the interviewees.

(Questions:1,2,3,4,5, see the appendix 2)

- The role of organizational structure (OS) in building learning organizations (LO) in PVTL.

All laboratory member (100%) confirm that working as a team contributes to the continuity of learning in the laboratory, and that formal and informal communications facilitate their access to important information in a just time, and 63.6% of them believe that the absence of a knowledge management department in the laboratory affects the learning process, while 36.4% see On the contrary, they justify their answer that a small number of them makes it easier for them to determine who has the experience or knowledge necessary for the work, and all of them (100%) see that the lack of a direct system of incentives that rewards knowledge sharing affects the continuity of the learning process. (see figure N°12).

Figure N°12: Percentages of laboratory members' responses to the role of OS in building LO.



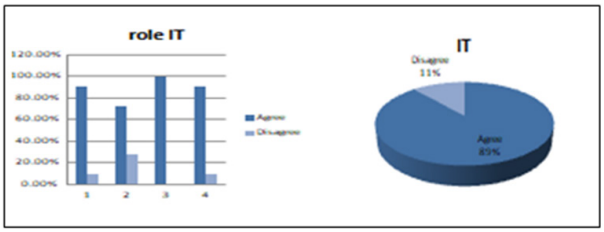
Source: Prepared by researchers based on the answers of the interviewees.

(Questions:1,2,3,4, see the appendix 2)

- The role of information technology (IT) in building learning organizations (LO) in PVTL.

All laboratory members (100%) confirm that information technology at the laboratory level contributes to integrating internal and external knowledge, and that it also contributes to matching knowledge sources with solving work problems, 72.7% of them confirm that the available information technology enables them to realize expectations and developments in the external environment, and 90.9% Some of them believe that the available information technology facilitates the leadership to find opportunities for training and learning. see figure N°13).

Figure N°13: Percentages of laboratory members' responses to the role of IT in building LO



Source: Prepared by researchers based on the answers of the interviewees.

(Questions:1,2,3,4, see the appendix 2)

5.3.4. Discussion

After analyzing the questions of first interview, the results have shown that the laboratory has an infrastructure sufficient to implement knowledge management and contribute to building learning organization, so that As 76% of the interviewees affirmed that there is a culture of cooperation and knowledge exchange, as well as mutual trust between the laboratory members, And 82% of them assert that the organizational structure facilitates communication for them to exchange their experiences and skills, As for information technology, 68 of them confirmed that it is available, but not at the level of the members' aspirations, which requires the laboratory to take it into consideration, and to develop information technology, which contributes to achieving organizational learning for members. Moreover, the results in first interview

revealed that the laboratory possesses all dimensions of the learning organization in varying degrees, so that the percentage of answering yes to the questions related to continuous learning, inquiry and dialogue and system connection was 82%, and those related to team learning and embedded system was 78%, while related to empowerment was 73%, and related to the strategic leadership was 91%. The results, after analyzing the second interview expose that: first, the organizational culture has a role in building learning organization in PVTL. Thus, we accept the first sub-hypothesis. Second, the organizational structure has a role in building learning organization in PVTL. Therefore, we accept the second sub-hypothesis. Finally, the information technology has a role in building learning organization in PVTL. So, we accept the third sub-hypothesis. In short, the results obtained revealed that the knowledge management infrastructure has a critical role in building learning organization in the laboratory. Consequently, we accept the main hypothesis.

6. Conclusion

It is widely accepted that organizations which consciously invest in the creation of new knowledge through research and development activities or through more informal learning processes tend to do a better job than those that rely on knowledge created by others, so the orientation towards a learning organization depends largely on how successful the application of knowledge management is. This highlights the importance of providing adequate infrastructure (An organizational culture based on cooperation and mutual trust between members of the organization, a flexible organizational structure that facilitates communication, and information technology that keeps pace with development) as a key component of the organization's ability to learn and adapt.

7. Recommendations

Through the shortcomings that we observed in the case study that we conducted in the laboratory, we formulate the following recommendations:

1. Establish an administrative unit responsible for the application of knowledge management;

2. Develop the information technology of the laboratory in accordance with the requirements of knowledge management and learning;

3. Adopt a formal incentive system that rewards knowledge sharing;

4. Write down everything that was learned and helped improve performance ;

5. Pay more attention to the physical environment of the laboratory, as it has a direct impact on the level of learning and knowledge sharing.

Conflict of Interest

The authors declare: that they have no conflict of interest

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Appendix 1

I-Knowledge Management Infrastructure:

I-1- Organizational Culture

1- In your organization the members are satisfied by the degree of collaboration.

2- In your organization the members have a willingness to accept responsibility for failure.

3- In your organization there is reward system that encourage sharing knowledge.

4- Trust between members:

- Members have reciprocal faith in other members' intentions and behaviors.

- Members have reciprocal faith in others' decision toward organizational interests than individual interests.

5- Knowledge management is seen as a support for organizational communication.

I-2- Organizational structure

1- Your organization supports and encourages members and organizational entities to interact with others.

2- Your organization encourages members to make their own decisions

3- Your organization seeks to promote team-work.

4- Your organization seeks to create specifics structures for knowledge management throughout the organization.

5- Knowledge codification:

- Your organization typically writes rules and procedures.

- Your organization identifies skills, knowledge, best practices and integrates them into its business processes.

I-3-Information Technology

1- Information technology infrastructure:

- Your organization has a sufficient hardware and computer systems.

- Your organization keeps pace with the development in the field of information technology (IT) (hardware, software).

- Your organization develops technical skills specific to technological infrastructure supporting knowledge management.

2- Reactive use of information technology:

- Your organization provides IT support for searching and accessing necessary information.

- Your organization uses IT to store and codified knowledge in better way.

3- Creative use of information technology:

- Your organization provides IT support for collaborative works at any time and place (e.g.: communities of practice).

- Your organization provides IT support for communication among organization members.

II- Learning Organization Dimension

II-1- Continuous Learning

1- Your organization members openly discuss mistakes in order to learn from them.

2- Your organization members identify the skills they need for their future work.

3- Your organization members view problems in their work as an opportunity to learn.

4- Your organization members help each other to learn.

5- Your organization members are rewarded for Learning.

II-2- Inquiry and Dialogue

1- Your organization members give open and honest feedback to each other.

2- Your organization members listen to the opinions of others before they speak.

3- Your organization members treat each other with respect.

4- Your organization members strive to build trust with each other.

II-3- Team Learning

1- In your organization, team members have the freedom to adapt their goals.

2- In your organization, team members treat each other as equals regardless of the differences between them.

3- In your organization, team members revise their thinking as a result of group discussion or information gathered.

4- In your organization, team members are rewarded for their achievements as a team/group.

5- In your organization, team members are confident that the organization will act on their recommendations.

II-4- Embedded System

1- Your organization uses tow way communication (formal/ informal) on a regular basis.

2- Your organization enables members to get needed information at any time quickly and easy.

3- Your organization creates systems to measure gaps between current and expected performance.

4- Your organization makes its lessons learned available to all employees.

5- Your organization measures the results of training.

II-5- Empowerment

1- Your organization recognizes members for taking initiative.

2- Your organization invites members to contribute to the organization's vision.

3- Your organization gives members control over resources they need to accomplish their work.

4- Your organization supports members who take calculated risks.

II-6- System Connection

1- Your organization encourages members to think from a global perspective.

2- Your organization encourages everyone to bring the customers' views into the decision making process.

3- Your organization works with the outside community to meet mutual needs.

4- Your organization, gives its members access to the information they need to solve problems.

II-7- Strategic Leadership

1- In your organization leaders generally support requests for learning opportunities and training.

2- In your organization leaders share up-to-date information with employees.

3- In your organization, leaders mentor and coach those they lead.

4- In your organization leaders empower others to help carry out the organization's vision.

5- In your organization, leaders continually seek opportunities to learn.

Appendix 2

The role of organizational culture in building learning organizations:

1. Does the level of trust that exists between the members of the laboratory contribute to the exchange of experiences and knowledge?

2. Does the level of knowledge sharing in the laboratory match the level of development in your field?

3. Does the level of exchange of experiences between members of the laboratory contribute to meeting the challenges you face at work?

4. Does the level of cooperation that exists between laboratory members contribute to the continuity of learning?

5. Does the level of knowledge sharing and collaboration that exists among laboratory members contribute to the provision of high quality services?

The role of the organizational structure in building learning organizations:

1. Does teamwork contribute to the laboratory's lifelong learning process?

2. Do formal and informal communications at the laboratory level facilitate rapid access by members to important information?

3. Does the absence of a knowledge management department at the laboratory level affect the learning process?

4. Does the absence of an incentive system that rewards knowledge sharing at the laboratory level affect the learning process?

The role of information technology in building learning organizations:

1. Do the information technologies present at the laboratory level contribute to the integration of internal and external knowledge at all times?

2. Does laboratory information technologies make it possible to listen to the environment in order to perceive and anticipate changes?

3. Do the information technologies available in the laboratory make it easy to combine sources of knowledge with problem solving?

4. Do the information technologies available in the laboratory allow leadership to access learning opportunities?

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