The Use of Information and Communication Technologies in Organizational Learning Practices:

A Research Study in an Innovation-oriented Portuguese Organization

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Abstract—**This study aims at understanding the use of ICT in core Learning and Innovation (L&I) practices and its impact on a company's capability. The analysis of several organizational learning capability proposals and of the Portuguese innovation standard NP4457 allowed the identification of five common practices which were used in the study: idea generation; market and technology surveillance; problem solving; dialogue and knowledge transfer; training and competence development. A mixed method case study has been developed with a large Portuguese company where each L&I practice was assessed, focused on the means promoted by the organization - processes and ICT resources; and its results – perceived impact by the institutional leader and workers. The leaders' perspective was collected through interview and workers' perception through an online questionnaire. This paper provides some findings showing that ICT is proving to promote an effective basis for organizational L&I practices and it is perceived by both leaders and workers as contributing positively to the company's capability.**

Index Terms—**ICT, Innovation, Organizational Learning, company capability**

I. INTRODUCTION

Innovation is becoming a crucial factor to allow organizations to react to a competitive, rapidly changing and global environment by providing a means of constantly develop and implement new or updated products, services or processes [1]. It is an individual and collective learning process that aims to find new ways and creative ideas of solving problems. Organizational learning practices seem to be closely related to innovation promoting the development, distribution and use of new knowledge [2]. Recent developments on information and communication technologies (ICT), especially web 2.0 social tools, allow workers a more participatory attitude and control over their learning and knowledge, enhancing immediate and speed learning, as well as new ways of collaboration between individuals, teams, organizations and networks[3]. Organizations are recognizing that learning is becoming more informal, social and collaborative. Informal and non-formal learning practices supported in ICT favors the continuous development of competencies and skills and an open attitude to the global market which may lead to organizational competitiveness and innovation. It is im-portant that organizations understand how to stimulate informal and non-formal learning and knowledge management practices and how the use new ICT to support them, improving the organizational capability, in particular in industries that constantly seek to create new products and services [4].

II. INNOVATION AND ORGANIZATIONAL LEARNING CAPABILITY

Organizational learning is part of the changing processes of an organization addressing innovation. Organizational learning includes a cognitive dimension, related to the construction and acquisition of new knowledge, and a behavioral dimension, related to the change in attitudes as a result of newly acquired knowledge. Organizational learning is an ongoing process that involves a "creative tension" of what the organization could be and the sense of current reality [5] presenting daily challenges to organizations and its people, especially in innovative oriented contexts, where the demand for novelty is constant.

Organizational learning occurs in three levels, each influencing the others [6]:

- the individual level, learning process of the individual to develop the skills and abilities required to perform the tasks required in a particular function;
- the group level, social and collective processes related to learning, collective decision making, conflict resolution, ongoing feedback, etc.;
- the organizational level, the individual and group processes transcript to the organization in the form of structures, processes, rules and routines.

The way these levels are connected must be taken into consideration when thinking about organizational learning since individual learning does not provide by itself a real benefit for the organization unless this knowledge is shared with the group and institutionalized [6].

Organizational learning results from different activities, some with explicit intention to provide learning and others integrated in daily individual and team working routines that, not being structured with learning purposes, develop important skills. It results from formal, informal and non-formal learning experiences [7, 8]:

- formal learning: occurs in an organized and structured context, is always intentional, i.e. the explicit

aim of the learner is to acquire knowledge and/or skills and typically leads to certification (e.g. formal training course for employees with certification);

- informal learning: results from daily work-related, family or leisure activities, is not organized or structured, has no defined objectives in terms of learning outcomes and is never intentional from the learner's perspective, not leading typically to certification (e.g. informal peer teaching on some subject work related);

- non-formal learning: intermediate concept which runs in parallel to the education and training systems but not necessarily leads to formalized certificates. It is yet embedded in planned activities not explicitly designated as learning, but containing important learning elements. It is intentional from the learner's point of view (e.g. formal workshop for employees without certification).

All formal, informal and non-formal practices contribute to the organizational learning capability. Several researchers propose different dimensions of the organizational learning capability, where formal training activities appear just as one dimension amongst others. Although different naming have been used, it is possible to identify common dimensions such as experimentation and new ideas generation, openness to external behaviors and markets, internal problem solving, analysis of performance gaps, knowledge transfer or continuous learning/training.

TABLE I.
ORGANIZATIONAL LEARNING CAPABILITY DIMENSIONS

Garvin [9]	Experimentation Learning from best practices of others Systematic problem solving Learning from past experiences Knowledge and skills transfer
Nevis, DiBella [10]	Experimentation Promotion new ideas at all organization levels Gathering information on internal and external environment Identifying gaps in performance Continuous education
Yang, Watkins [11]	Continuous learning Inquiry and dialogue Team learning Embedded system Empowerment System connection Provide leadership Financial performance Knowledge performance
Goh [12]	Clarity of mission and vision Leadership commitment and empower Experimentation and reward Effective transfer of knowledge Teamwork and group problem solving
Chiva, Alegre [13]	Experimentation Risk Taking Interaction with the external environment Participative decision making Dialogue
Jerez-Gómez, Céspedes-Lorente [14]	Managerial Commitment Openness and Experimentation Systems Perspective Knowledge Transfer and Integration

III. CHALLENGES OF ORGANIZATIONAL LEARNING AND CONTRIBUTIONS OF INFORMATION AND COMMUNICATION TECHNOLOGIES

Organizational learning is facing challenges regarding new ways of working and learning closely connected to the technological development of the last decade. The evolution of the web to a more participative and social platform has offered new opportunities to organizational learning and knowledge management practices. Web 2.0 tools, such as blogs, wikis, social networks, social bookmarking, among others are producing changes in social behavior, promoting digital participation, information sharing, collaboration and cooperation. New services of the web 3.0, also known as semantic web, are already available based on intelligent agents, recommendation, augmented reality, 3D visualization, intensive use of mobile devices and cloud services [15] offering access to more relevant and contextualized knowledge. Instead of passively selecting and consuming information provided by others, individuals are now more active in information's creation, use, transformation and dissemination, favoring non-planned learning that leads to processes opened to permanent innovation, which formal learning could hardly offer [16].

These technological and social environments are changing the way individuals develop their tasks in the workplace, especially those who deal more directly with knowledge and innovation, the smart workers [17] – curious and autonomous individuals, who aspire to improve their work and performance, seek immediate solutions to problems, share what they know, use personal networks, learn from peers, keep informed about their work field developments. Organizations are recognizing that most of what these workers learn is not through formal learning practices but through informal, social and collaborative interaction.

It is important to understand the potential of the new ICT tools to improve formal and informal learning practices, stimulating individual, group and organizational learning levels. Several organizations are already applying these tools in training, communicative and participative processes [16] but in Portugal this reality still seems to belong to innovation-oriented companies, open to changing processes and early-adopters of technology [3]. This study aims at describing a real case of how one of these companies has been implementing formal and informal learning practices using ICT and web 2.0 tools to support them.

IV. RESEARCH DESIGN

A. Analysis Model

The driving question defining this research is "How are innovation-oriented organizations using Information Technologies and Communication in their learning practices?" To answer this main question, some sub-questions were developed, namely:

- Do innovation-oriented organizations have implemented processes for formal and informal learning?

- Do innovation-oriented organizations enhance those practices with relevant ICT resources?

- What is the employees' perception about the ICT resources provided to those learning practices? Do they autonomously use other ICT resources?
- What is the perception of the institutional leader and employees regarding the impact of learning practices enhanced by ICT both for the organization and for workers as learners?

The first phase of the research design was the development of an analysis model which allows collecting the information needed to answer to the driving questions. The analysis model embraces the concepts, dimensions, components and indicators to be collected [18]. In this research two main concepts were identified: the organization profile and the organizational learning practices supported in ICT tools.

Concept 1 - Organization profile: aims at describing the context were the study is being developed and the participants involved.

- a. Organization Context: Business motivations, Structure of the organization, Innovation profile;
- b. Research participants: leader, employees.

Concept 2 - Organizational learning practices supported in ICT: aims at describing the processes and ICT resources provided by the organization for five learning practices, both formal and informal.

- c. Idea Generation
- d. Market and technology surveillance;
- e. Problem solving;
- f. Dialogue and knowledge transfer;
- g. Training and competence development.

The definition of the learning practices included in the study started from the analysis of the dimensions suggested by different authors of the organizational learning capability (Table I). Considering the focus of the study in innovation-oriented companies, the next step was to identify which of those dimensions were included in the Portuguese innovation management standard NP4457 recommendations [19], which limited the study to the five practices presented.

Idea generation: focuses on motivating workers to identify internal problems to be solved, new organizational methods or customer needs. While promoting innovation opportunities, the idea generation process stimulates creativity, unconventional thought, curiosity, imagination, search for originality and a deliberate focus on problem solving and critical thinking [20]. Sharing ideas with others exposes people to peer judgment, fostering the improvement of the way they express, write and present their thoughts.

Market and technology surveillance: focuses on motivating workers to understand the organization global position, considering its strengths and weaknesses. Involves the monitoring of best practices and the activities of competitors, complementary organizations or others not directly related to the business, contributing to individuals knowledge while helps the organization to simultaneously evolve with its changing environment [2].

Problem solving: focuses on the ability to systematically solve problems through the analysis of past practices, teamwork and participatory decision making. Documenting problems/solutions and post-mortem evaluation improves critical thinking skills, helping to prevent future problems, while team work promotes knowledge transfer, particularly tacit knowledge [21].

Dialogue and knowledge transfer: refers to communication, debate and collaboration between individuals and its teams, aiming at promoting knowledge interaction and transfer. Dialogue is an essential process for building common understanding [22]. It can be internally oriented, e.g. through internal communities of practice, or externally, e.g. regular forums with customers or subject-matter expert collaboration [23].

Training and skills development: formal training programs help workers developing relevant skills to increase their working performance.

Many authors agree that organizational learning can only be measured by organizational performance and results. To assess the use of ICT in the learning practices identified, a model was developed inspired in a performance assessment model - EFQM Excellence Model 2010[a], which is a self-assessment tool that suggests a cause-effect relationship between the results and the means provided by organization, proposing that results can be improved by means and these can be enriched taking into account the results' feedback in terms of learning, creativity and innovation. In this research design this model was adapted in order to assess:

- Means: the learning activities developed by the organization and ICT resources provided to support them;
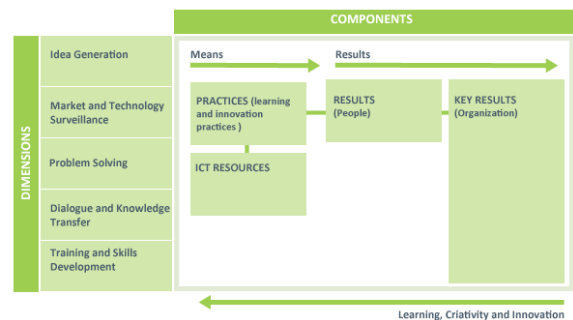- Results: the impacts of those practices both for the organization and for workers.

Figure 1. Assessment Model of the Organizational Learning Practices (adapted from EFQM Excellence Model 2010)

B. Methodology

A mixed methods case study was conducted in a Portuguese organization. The selection of the case was based on two sampling criteria: the certification in the Portuguese innovation standard NP4457, which assures the implementation of processes to foster the learning practices recommended by the standard; and the area of expertise of the company linked to the development of technologies and services for information management, which guarantees high digital skills and positive attitudes towards the use of ICT.

The data collection was done, firstly, with qualitative instruments: documental analysis of the organizational website, quality manual and data provided by the organi-

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[a] More information about this model is available at
http://www.efqm.org/en/

zation; semi-structured interview to the organizational responsible for training and innovation; and direct observation of the use of ICT in learning practices. Afterwards, a quantitative instrument was implemented to collect the employees' perception, through the application of an online questionnaire. [b]

Table II summarizes the analysis model and the instruments used for collecting data.

TABLE II.
ANALYSIS MODEL AND DATA COLLECTION METHODS

Concept	Dimension	Component	Data Collection
Organization Profile	A. Organizational Context	Business Motivations	Documental analysis
		Structure of the Organization	Data provided by organization
		Innovation Profile	Public information
	B. Research participants	Institutional Leader	Interview
		Employees	Questionnaire
Organizational learning practices	C. Idea Generation D. Market and technology surveillance E. Problem Resolution F. Dialogue and knowledge transfer G. Training and skills development	Means (Practices and ICT Resources)	Leader Interview Direct Observation
		Results (for Workers and Organization)	Leader Interview Employees' questionnaire

V. PRELIMINARY FINDINGS

A. Organization profile

1) Organizational Context

Business Motivations: the organization develops telecommunications technology to the market since 1999, through the design and development of innovative solutions for fixed and mobile network, network architectures and next generation services and platforms.

Organizational Structure: the company has more than 600 specialists in telecommunications technologies, organized in 10 departments, both in Portugal, Brazil, Angola and Morocco. It is part of a business Group. Around 79% are male, 66% are less than 40 years old; more than 88% have permanent work contract and hold a higher education degree.

Innovation Profile: Since 2007 the organization is certified in Portuguese innovation management standard NP4457. It regularly presents new products and services to the market, is partner of national and international organizations related to innovation and maintains a strong relationship with universities and R&D centers in national and international programs.

2) Research participants' profile

Institutional Leader: a semi-structured interview was applied to the director of innovation and training who works in the company for about 27 years and took over this function since 2011. This participation was essential to identify the formal and informal learning practices,

activities and ICT resources, as well as the perception of the leadership regarding its results.

Employees: an online questionnaire was delivered to 429 employees. 52 completed answers were collected, representing about 12% of the population. This sampling embraces employees from all departments, age and gender groups, educational degrees and roles (managers and employees). This participation was essential to understand the perception of the employees regarding the learning practices supported in ICT, as well as individual use of other ICT and web 2.0 tools.

B. Organizational learning practices supported in ICT

1) Idea Generation

Means (Practices and ICT Resources)
The organization implements different activities to develop and collect new ideas, internally and externally.

Box of Ideas: aims at collecting ideas from workers to new or improved products or processes. It is based on an internally developed ICT tool, where people share their ideas by describing a set of recommended (not mandatory) fields (e.g. purpose, description, novelty). A committee evaluates them and the best are implemented. The tool doesn't offer social functionalities, so people cannot comment or vote, but new ideas can be created based on previous ones. There is no direct reward for ideas.

Ideas Marketplace: aims at stimulating inter-organizational idea sharing between different companies of the Group. It is based in an internally developed web platform, where a commission inserts monthly challenges, so ideas concentrate in specific themes. Proposals are validated, mashed or filtered before being released to the community and employees can comment and vote (positively or negatively), using a plafond of points. Best-rated proposals are evaluated and implemented. Workers can also rate their peers, as informal recognition.

Crowdsourcing Innovation Portal: this web portal aims at collecting ideas or solutions from external contributors. The organization launches regular challenges to universities, companies or freelancers, and people can submit their proposals and, additionally, map their skills. Submissions are evaluated and the winner gets a prize. This tool allows, simultaneously, identifying potential partners or workers, with exceptional participation. It offers social networking mechanisms and activity feeds.

Results (for Workers and for the Organization)
Leaders' Perspective: Idea generation stimulates workers' involvement in the organization. The use of the ICT platforms allow a better collection of ideas, although many workers still have difficulties in formalizing their thoughts, preferring to share them directly with their leaders and coworkers. Many shared ideas seem to be incomplete and with poor descriptions, which affects its evaluation. As for the Organization the leader perception is that the idea generation processes have great impact in innovation capability and continuous improvement. "*We realize that it has had great impact in the organization, the ideas that appear every day and are implemented; a great number of them.*"

Employee's Perspective: Generally employees consider idea collecting systems extremely important, highlighting aspects such as the ability to engage people with the organization, to promote organizational development and to foster innovation. However they think these systems could

be more useful and claim for more and regular feedback and implementation, although they consider a lot of ideas with low quality.

Regarding the autonomous use of other ICT and web 2.0 in the generation of new ideas, employees identified as the more important tools to be the use of mind mapping tools (Freemind, Xmind and CmapTools), mockup design (Balsamiq, Gliffy, Pencil and Microsoft Visio) and the web search.

In a personal perspective more than 95% consider that the generation of new ideas is helping them to develop new knowledge and more than 80% consider that the use of ICT is facilitating the expression of their ideas and the development of collaborative ideas.

As for the Organization, more than 80% considers that sharing ideas improves team collaboration and internal knowledge transfer. However, more than 30% considers that the organization should help employees to use better the ICT resources available.

2) Market and technology surveillance

Means (Practices and ICT Resources)

This is considered one of the most important internal knowledge factors. Formally there are some groups with the responsibility to keep track on topics like international norms and every 3 years a senior team is focused on evaluating trends and producing a guide of technologies that should be addressed and new paths to explore. However, in a daily basis, there aren't formal processes to address this issue, but each department has the responsibility to make continuous surveillance, which occurs in a very informal way based on individual initiatives of following discussion groups, scientific publications, finding information about competitors and technologies or participating in conferences and webinars. Results are mostly shared in regular team meetings or through e-mail but seem difficult to be formalized. To stimulate the sharing of surveillance results, the organization provides a blog system and a documental repository.

Documental Repository: used for sharing articles, reports or other relevant documents. Everyone can access but only authorized people can submit docs, which are then formally classified and released.

Internal Blog system: used to allow employees to share information about relevant topics, promoting an updated state of art.

Results (for Workers and for the Organization)

Leaders' Perspective: surveillance is considered one of the most important activities to develop internal knowledge and ICT are considered fundamental to allow people to know what is happening in the world. "*All our knowledge and its evolution come from surveillance. People need to know that when anything is to be done out there, we also have to implement it.*" The main difficulty seems to rely not in the performance of surveillance activities, but in its systematization and sharing "A*bove all we fail in internal dissemination. It was important that after people read something important, they share what they've read*".

As for the Organization the leader perception is that this practice contributes to a better understanding of players and organization positioning. "*That is critical for us*".

Employee's Perspective: Employees generally consider the documental repository as extremely important, high-

lighting its potential to centralize information, the efficiency in information management and the ease of sharing. However, it terms of usefulness opinions vary from highly useful (49%), moderately useful (28%), nothing useful (12%) and don't use it (12%). The main negative aspects pointed are linked to the difficulty in finding relevant information (this can result from the fact that document classification is done by a technical and not with folksonomy terms), the lack of functionalities for collaborative document editing and the difficulty to share documents between teams.

Regarding the autonomous use of other ICT and web 2.0 in market surveillance activities, employees identified as the more important tools to be the web search, following expert blogs, to read scientific journals and to watch videos in the internet.

In a personal perspective people generally consider that surveillance activities help them acquire new knowledge which is highly facilitated by the use of ICT. However, more than 20% of respondents feel difficulties to monitor the global developments of their working field and more than 40% have doubts about what are the better activities to do it. Almost 30% are not sure about the best ICT tools they should use and more than 90% considers that the organization should help them with it.

As for the Organization, about 75% consider that sharing surveillance results improves the maintenance of internal knowledge and helps the organization to have a better understanding of market players. However, 45% considers that the organization doesn't stimulate the sharing of surveillance activities.

3) Problem solving

Means (Practices and ICT Resources)

Learning through errors and problem solving is an internal daily concern and different ICT tools are provided to address it, namely operational tools to organize work, sharing of lessons learned and problem reporting systems.

Project Management: a commercial tool is used to ensure the planning of activities, times, sequence of tasks, resource allocation and monitoring of project development. It is used to allow a macro view of the project and complemented with a tool for micro-level.

Wiki: for each existing development project, a Wiki system is created, where the project team has access to technical information, in an informal and simple format, allowing collaborative edition.

Documental repository: complementary to the wiki system, each project has a repository space in SharePoint where all team members can share relevant information. This is only accessible to the team.

Lessons Learned Repository: at the end of each project lessons learned must be compulsory inserted, indicating problems, solutions and impacts. This procedure is being evaluated because at the end of a project often people do not remember exactly what happened.

Problem reporting system to support activities: a reporting system is used to help people ask for help in supporting activities (e.g. regarding hardware). External clients can also report problems through this system. For customers that have a specific reporting system integration is made allowing them report through their own system. Problems are analyzed in order to prevent their repetition.

To improve daily operational performance three systems have been integrated: a product portfolio database, with the identification of all products; a CRM, with all the information of products acquired by clients; and the Project management tool, with all information of the process necessary to develop the product.

Results (for Workers and for the Organization)

Leaders' Perspective: Daily problem solving contributes to the development of internal competencies and knowledge transfer, develops team spirit, improves the performance and helps to reduce the incidence of future problems. The perception of the Leader is that people feel comfortable to discuss and share problems and difficulties, both with coworkers and leaders, easing informal learning and taking advantage on ICT tools. However, the leader considers that "*this has to do with learning from mistake and I think that we still haven't solved the whole problem. I don't know if we reflect enough about the mistakes we make.*" The knowledge captured through lessons learned promotes critical thinking, although people aren't using it very frequently.

Employee's Perspective: Employees generally consider the problem reporting system to support activities has extremely important and useful, highlighting the greater control in the registration of problems and solutions, workflow and communication. Some negative aspects were also pointed, such as the lack of usability of the system, the difficulty in analyzing results or the need to have a knowledge database associated. Regarding the use of the wiki and repository for technical development projects, they seem to be extremely important to support employee's tasks.

Regarding the autonomous use of other ICT and web 2.0 in problem solving, employees identified as the more important tools to be the web search, the use of communication tools, namely instant messaging (Skype), e-mail and video-conferencing tools (Webex and Lync). Other external sources such as external blogs, wiki or communities of practice seem to have very little impact in the individual problem solving processes.

In a personal perspective people generally agree that problem solving is helping them to develop new knowledge. They feel comfortable asking for help to their peers or managers and they consider that the use of ICT helps them to find quicker solutions and to share them amongst their team. Almost 20% though feel unappreciated for finding solutions to daily problems

As for the Organization employees generally consider that problem solving within teams is promoting knowledge transfer and that the organization is providing the adequate ICT resources to support it. However more than 30% considers that the current activities are not yet able to minimize errors occurrence and achieve a better performance. They generally think that the organization should help them use better the available ICT to improve problem solving activities.

4) Dialogue and knowledge transfer

Means (Practices and ICT Resources)

Several strategies are implemented to improve internal and external communication, many involving the use of ICT resources that support formal and informal dialogue.

Internal Communication tools: e-mail, newsletters, corporate television, live broadcasting of internal events, internal repository of photos and videos of events, trimes-tral webcast from the administrator, institutional blog, intranet, Skype and WebEx.

External Communication tools: e-mail, newsletters, corporate website, open innovation portal, publication of an annual journal with paper from employees, Skype and WebEx. More recently the organization is also present in Facebook, LinkedIn and Twitter.

Results (for Workers and for the Organization)

Leaders' Perspective: Communication is facilitated by the flat organizational structure, which is fostering open dialogue between peers and directors and promoting collaboration within and between teams. ICT is facilitating internal communication, especially because the company has a large number of geographically dispersed employees who can be easily reached through these tools. In spite of the different dialogue strategies promoted by the organization "*some people complain that there is too much information shared and they come to a point that they tend to ignore it*". By this reason the organization is now developing a new version of the internal corporate portal, integrating social tools aiming to facilitate the dissemination of information.

As for the Organization the leader perception is that communication improves workers involvement in decisions and helps to consolidate organizational culture. The use of ICT tools also allows the greater involvement of providers, partners and clients. The Leader believes that these initiatives promote knowledge transfer from outside the organization and reinforce a strong image of the organization to the market.

Employee's Perspective: Employees consider the intranet, internal newsletters, internal blog and corporate TV has extremely important, but in terms of usefulness it balances between highly and moderately useful. The main positive aspects pointed were that they allow simple and direct dialogue, contribute to better understanding about the organization (events, workers, training, prizes, etc.). Some negative aspects were also pointed such as the amount and frequency of information being disseminated contributes to some deconcentration, lack of collaborative social tools and personalization possibilities.

Regarding the autonomous use of other ICT and web 2.0 in internal and external dialogue activities, employees identified as the more important tools to be the e-mail, communities of practice (LinkedIn), instant messaging tools (Skype), collaborative tools (Google Docs), internal repositories (SharePoint) and internal wiki system.

In a personal perspective people consider that internal dialogue is the greater source of knowledge transfer, much more than the dialogue with any external actor and that the use of ICT tools facilitates this dialogue.

As for the Organization, 20% of respondents consider that internal communication instruments are not contributing to a complete understanding of organization decisions. They consider that ICT tools improve the way they communicate both internal and externally but about 30% doesn't see a greater involvement of clients, providers or partners due to the use of ICT resources. More than 50% also think that the leaders are not stimulating by their example the development of dialogue dynamics supported in ICT and almost 100% consider that the organization should help people to use better the ICT resources to maintain internal and external dialogue.

5) Training and skills development

Means (Practices and ICT Resources)

A large investment is done to develop workers knowledge and skills, including skill gaps analysis, career plan, training needs analysis, face-to-face and e-learning training development, pedagogical content development and training assessment. Although face-to-face training is still the most important training method, e-learning self-administered is assuming greater relevance in formal training and blended-learning has almost no expression. Supporting the skills developments practices, different ICT resources are being used.

Skills Management system: this tool defines the map of skills of each person of the organization and is used to make an analysis of the important skills to be developed. It helps to identify training gaps and needs.

Learning Management System (LMS): a self-developed tool is used to manage blended-learning and e-learning training, both for internal workers, as for certification programs for clients and partners. Most training actions are e-learning, self-administered without tutor.

Training Management System: a self-developed tool is used to manage face-to-face training in aspects like class-rooms, administrative documentation, etc.

Interactive contents and serious games: e-learning interactive contents scorm compliant are internally developed for specific technical and behavioral subjects. A serious game was developed to welcome new employees, explaining daily routines and processes of the organization through challenges.

Results (for Workers and for the Organization)

Leaders' Perspective: Training, especially e-learning courses are allowing workers a better control on their learning with more flexibility and autonomy. The organization invests a lot in training and skills development activities, but sometimes gets the perception that these efforts are not improving performance as expected "*we spend too much money on training, sometimes with little impact on the organizations' life*." ICT resources are considered very important to training and there is a very relevant investment in e-learning, both in infra-structure, content development and supporting team. The organization relates e-learning benefits with efficiency of the training process because allows a growing portfolio, is quickly available to more people at once and it avoids loss of travel time and transportation costs.

Employee's Perspective: Employees generally consider e-learning and the LMS tool as extremely important and useful, allowing them to reconcile training with professional activities and the better management of their time. The main critics are related to the fact that the courses are too generic with little connection to daily technical needs and sometimes use time-consuming animations that make the courses slow and tiring. Employees consider that the e-learning platform could be used more intensively, in particular through the provision of short duration courses that could be performed autonomously without prior authorization of managers.

Regarding the autonomous use of other ICT and web 2.0 in self learning, employees identified as the more important tools to be web search, external e-learning services (including MOOCs), e-books and digital articles, communities of practice, written and video tutorials as well as online presentations (such as slideshare presenta-

tions). Less relevant seem to be the participation in webinars and listening to podcast.

In a personal perspective more than 80% considers that the use of ICT in training gives them more flexibility and control over their learning path, but more than 30% considers that it is not offering a more motivating, significant or collaborative learning. Also more than 30% considers that their training plan is not aligned with their personal needs.

In what concerns to organizational results, more than 75% of respondents consider that the training provided is improving workers' skills and performance. However 90% consider that the organization should help internal trainers and workers to better use ICT in learning.

VI. DISCUSSION

The case studied illustrates how an organization oriented to innovation is promoting formal and informal dynamics that foster knowledge acquisition, development, use and transfer. Even if some of these processes may not have been develop with the specific purpose of learning, they are creating informal learning opportunities and helping employees and groups to develop autonomous learning, peer learning and speed learning.

It is evident the importance that ICT tools assume in all these practices, in the ability to collect, organize and manage knowledge, as well as in the promotion of greater participation and involvement of workers in the company's life and in the creation of social dynamics.

The working environment seem to play an important role observed in aspects such as: workers' freedom of expression; workers' involvement in changing processes; teamwork promotion; entrepreneurship and networking appreciation; formal and informal learning valorization; positive attitude towards the use of ICT and web 2.0 tools.

Based on the collected results, the initial research questions are now answered.

Do innovation-oriented organizations have implemented processes for formal and informal learning? Do they enhance those practices with relevant ICT resources?

The case studied show that this innovation-oriented organization is strongly developing formal and informal learning practices and is very sensitive to the potential of ICT in its support, particularly the Web 2.0 social tools. The use of ICT seems to play a central role in all studied learning practices, both in gathering and managing knowledge, as well as in its creation and sharing through social dynamics favorable to knowledge transfer.

In spite of the great efforts being made by the organization in technologies to support learning practices, results show that the availability of ICT and the high digital literacy of the employees, by itself, are not enough to promote participation, especially in informal learning practices that don't result in certification recognition. More than a technological challenge, this is a cultural and social challenge. Formalizing tacit knowledge into explicit still seems to be difficult, which was visible in the poor involvement in idea sharing and description, in sharing technology and market surveillance or in reporting solutions to problems. The organization is aware of this difficulty and after mandatory experiences to foster participation, more informal practices are being prepared to promote more natural

participation, namely through the integration of social and personalization tools in the corporate intranet, which may allow the integration of learning outcomes in more informal, less structured and time consuming social dynamics as well as promotes ongoing feedback, either from leaders and peers.

What is the employees' perception about the ICT resources provided to those learning practices? Do they autonomously use other ICT resources?

Results show that employees consider the resources provided by the organization as extremely important, but unfortunately less useful. At the same time, the leaders' perception is that employees participate less in the available ICT resources than it was expected. If in some cases this may be due to difficulties related with poor usability, technical difficulties and lack of use of more natural language (e.g. in classification of repository documents), in other cases it seems related to the reduced perception of employees about the benefits of this use. Generally employees demonstrate the will to better understand how to use the available ICT resources to better develop and participate in the learning practices.

What is the perception of the institutional leader and employees regarding the impact of learning practices enhanced by ICT?

Although there are some differences between the leader and employees' perceptions, it is possible to see some consensus in the assessment presented by both parts, which allow concluding that the formal and informal learning practices are promoting the development of new knowledge and skills of: individuals (improvements in task performance and decision making, as well as maintenance of future employability), groups (improvements in knowledge transfer within and between teams and promotion of peer teaching and learning) and the organization (improvements in knowledge management and organizational performance).

By promoting regular learning practices and an engaging environment with the support of ICT, this company seems to be continuously improving its performance, while fostering its innovation capability.

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