

Facilitadores del aprendizaje informal en el lugar de trabajo: el caso de dos cooperativas del sector máquina-herramienta¹

Maite Aurrekoetxea-Casaus² y Fernando Díez³

Recibido: 26 de julio de 2019 / Aceptado: 7 de octubre de 2019 / Publicado: 2 de junio de 2020

Resumen. En los últimos años se han intensificado el interés por el aprendizaje informal en el lugar de trabajo, siendo la preocupación por parte de las organizaciones conocer cómo los trabajadores aprenden en su lugar de trabajo más allá de los conocimientos adquiridos en el aprendizaje formal. Cada día en su lugar de trabajo se producen una serie de aprendizajes fruto de la interacción entre los compañeros, pero también otra serie de elementos que ejercen una función catalizadora de ese aprendizaje que de manera latente actúan sobre el aprendizaje y el conocimiento de los trabajadores. Para este estudio se seleccionó una aproximación cualitativa. Se realizaron 16 entrevistas en profundidad a empleados de diferentes áreas organizacionales y con diferentes responsabilidades. Emergieron diferentes resultados que fueron describiendo cómo se produce el aprendizaje en el lugar de trabajo y cómo los empleados perciben diferentes elementos que actúan de catalizadores de su aprendizaje. Si bien se reflejan una serie de elementos propios del puesto de trabajo que ocupan los empleados, el aprendizaje en el lugar de trabajo responde a un modelo basado en 3 pilares: un trabajador flexible con habilidades para enfrentarse a tareas que exigen una adaptación constante para responder a eventos inesperados y resolución de problemas; una organización que posibilita espacios de interacción como las reuniones de equipo donde poder afrontar las dificultades y; por último; un entorno competitivo marcado por la innovación tecnológica y la exigencia de un cliente que estimula al aprendizaje.

Palabras clave: Aprendizaje; Información y conocimiento; Formación; Cooperativas; Cultura corporativa.

Claves Econlit: J24; M53; O33; O35; P13.

[en] Facilitators of informal learning in the workplace: the case of two cooperatives in the machine tool sector

Abstract. In recent years, interest in informal learning in the workplace has intensified, with organizations being concerned about ways through which workers learn in the workplace beyond the knowledge acquired through formal learning. Every day at the workplace, a series of lessons can be learnt through colleague interaction, in addition to another series of elements that act as a catalyst to enhance workers' learning and knowledge. A qualitative approximation method was selected for this study. Furthermore, 16 in-depth interviews were conducted with employees with different responsibilities and from different organizational areas. The study results describe the manner in which learning occurs in the workplace and employees' perception of different elements that act as catalysts to enhance their learning. While numerous elements specific to the job position held by employees are indicated, learning in the workplace responds to a model based on three pillars: a flexible worker with skills to perform tasks requiring constant adaptation to respond to unexpected events and problem solving; an organization that provides spaces for interaction, such as team meetings, to address difficulties; and a competitive environment marked by technological innovation and customer demand that fosters learning.

Keywords: Learning; Information and knowledge; Training; Cooperatives; Corporate culture.

Summary. 1. Introduction, 2. Methodology, 3. Result analysis, 4. Discussion, 5. Conclusions, limitations, and future research lines. 6. References.

How to cite: Aurrekoetxea-Casaus, M.; Díez, F. (2020) Facilitators of informal learning in the workplace: the case of two cooperatives in the machine tool sector. *REVESCO. Revista de Estudios Cooperativos*, vol. 134, e69166. <https://dx.doi.org/10.5209/REVE.69166>.

¹ This article is part of an ENLIVEN research project (acronym for Encouraging Lifelong Learning for an Inclusive and Vibrant Europe), financed by the European Union Programme Horizon 2020 (ID: YOUNG-3-2015). This project aims to present an innovative model and instrument to support policy debate and training policies as well as assess the lifelong learning policy, focusing on young employees' current needs and integrating theoretical and empirical perspectives from social and computer sciences (for more information, see: <https://h2020enliven.org/>).

² Universidad de Deusto, España
Dirección de correo electrónico: maurreko@deusto.es.

³ Universidad de Deusto, España
Dirección de correo electrónico: fdiez@deusto.es.

1. Introduction

The way in which organizations impart knowledge through the organization's learning processes has become a "core variable" to build competitive advantages in a global market subject to demanding changes for companies and their teams. As such, there has been increasing interest in studying the sources of workplace learning as a field of research (Ashton & Sung, 2002; Billett, 2011; Ellstrom, 2011), and cooperative businesses in the machine tool sector under the pressure of a highly competitive market are no exception.

From companies' perspective, researchers since the early nineties have highlighted the significance of a workplace as a vital learning space (Illeris, 2018) that provides unique and extensive learning not available in formal education. Accordingly, workplaces may offer unique learning opportunities to different employees, and the workplace can limit or enrich people's learning (Marsick & Watkins, 2015).

Numerous researchers (Boud & Middleton, 2003; Billet, 2004; Matthews, 1999; 2003) have emphasized the significance of informal learning in the workplace. Specifically, Matthews (2003) noted that learning in the workplace can take on different forms or definitions, causing some confusion regarding the term "workplace learning."

Varied concepts appear in academic literature when referring to the type of learning in the workplace. Workplace learning occurs through a combination of formal and informal learning, which are inextricably interrelated (Malcom, Hodkinson & Colley, 2003). Lombardo & Eichinger (1996) stated that informal learning constitutes 90% of workplace learning and that formal learning contributes only 10%. However, other sources such as the Center for Workforce Development (1998) and Jay Cross (2006) set the proportion of informal learning in the workplace between 60% and 80%. The recent 70/20/10 Model for Learning and Development argues that 70% of learning occurs through work experiences, tasks, and problem solving; 20% occurs through feedback and examples (good and bad); and 10% occurs through courses and reading.

An IZA report (2015) stated that compared with formal education, workplace learning is far more crucial for the development of workers' human capital. Workplace learning is defined as "the acquisition of skills by doing tasks and observing other workers, following instructions, and receiving supervision and feedback from supervisors or colleagues" (p. 2). This definition reveals that when referring to workplace learning, there exists a learning that "is planned and provided by the organization in an effort to improve the effectiveness of its employees" (Le Clus, 2011: 359), which is known as formal learning. However, in daily workplace tasks, numerous activities emerge from people's relationships and their contexts in diverse environments (Coombs, 1985) that are spontaneous, unstructured, and unintentional, which are referred to as informal learning.

According to certain authors (Cross, 2006; Watkins & Marsick, 1992), informal learning is characterized by being experiential and by integrating into the organizational context. It is action-oriented learning, guided by non-routine conditions that arise in daily activities. It is a part of the day-to-day activities (Cardwell & Danaher, 2009; Eraut, 2004; Schwartz, 2019) and enables the accumulation of experiences that simultaneously become knowledge.

However, several unforeseen events occur at the workplace (which "occur(s) as a by-product or another activity"), referred to as informal and incidental learning (Mc Ferrin, 1999; Watkins & Marsick, 1992). Other authors such as Coetzer, Kock & Wallo (2017) referred to it as innovative learning based on what has already been described by Fenwick (2003). It requires a more active problem-solving process through experimentation, risk-taking, and search for variations and refers to a type of learning in new or unknown situations for which no previous experience is available. Thus innovative learning stimulates "transformational change and generates pioneering solutions that challenge existing practices" (Ellström, 2001; Fenwick, 2003).

Whether referred to as innovative or incidental, this learning (Kerka, 2000) derives from observation, repetition, social interaction, and problem solving, in addition to observing or talking with colleagues, superiors, etc. This type of learning can "result in an improvement of competences, a change of attitudes and an increase of interpersonal, self-confidence and self-awareness skills" (Kerka, 2000:2).

The concept of informal learning has ultimately evolved to the term "real learning" (Cross, 2016), implying learning wherein professionals are helped to learn what they do and what surrounds them. In short, this term implies learning that motivates professionals to share and co-create. This concept moves away from the idea that workplace learning is applying theoretical and practical knowledge acquired in vocational training centers and universities. This evolution of the informal learning concept (Manutti, Pastore, Scardigno, Giancaspro & Morciano, 2015) is understood by the different changes undergone by the labor market in recent decades. Largely, this concept is realized by the significance of the learning process in an individual's career plan and can be categorized as employee learning in different forms and meanings (Jacobs & Parks, 2009).

Literature review

Regardless of the definition of formal, informal, incidental (Kerka, 2000; Watkins & Marsick, 1992), “discretionary” (Holm & Lorenz, 2015), and “real learning” (Cross, 2016) terms or the manner in which these are acquired, discovering the characteristics of, conditions of, and opportunities for learning in the workplace is important.

However, discerning the formal and informal elements of workplace learning is difficult. As described by Manuti, Pastire, Scardigno, Giancaspro & Morciano (2015), traditional learning models no longer work in understanding ways to continuously implement and empower employees in ever-changing situations in highly competitive markets. These traditional learning models either focus on the structural opportunities offered by the organization or on employees’ ability to learn.

Evans (2017), Goller & Paloniemi (2017), and Vähäsantanen, Paloniemi, Hökkä & Eteläpelto (2017) stated that structural opportunities alone are inadequate for workplace learning to occur. Learning requires individual participation, in which individuals open themselves up to or close themselves off from new experiences (Billett, 2002), making their own experience and subjectivity a cornerstone for any workplace learning. Individually and in groups, employees make sense of the learning opportunities available, thereby building the nature of their workplaces.

As indicated by Schwartz (2019), the learning capacity of employees in the workplace is determined by certain facilitators, levers, or stimulators of informal learning. In addition to a person’s qualities, abilities, and skills, a series of specific organizational factors of the company exist as the most expansive or restrictive characteristics of workplaces (Füller and Unwin, 2004). However, including the lived and perceived experiences of employees themselves is necessary (Billett, 2002); through subjectivity in the performance of their tasks, employees shape the nature of their workplace.

In recent years, researchers have discussed workplace learning as the space in which individual aspects regarding the employee and the organization are combined (Evans, 2017; Evans, Unwin, Hodkinson & Rainbird, 2007; Hefler & Markowitsch, 2012, 2013; Illeris, 2004), introducing interesting elements such as the person’s lifecycle, employees’ involvement in their task, and employees’ motivation or commitment to the company.

Other researchers have focused on elements based on interactions between people who perform different tasks at the workplace. As such, informal interactions with colleagues or the influence of different people in the organization are other sources of informal learning in the workplace (Awan & Tahir, 2015). Evans (2017) and Vähäsantanen, Paloniemi, Hökkä & Eteläpelto (2017) referred to this compendium of elements as the intersection of the individual career and the opportunities that the organization provides for such learning.

The interest in understanding and gathering this knowledge has led to the examination of the facilitating elements that influence this learning or ways in which this learning can be promoted or constrained, either from an organization’s or individual’s perspective. In particular, this research aimed to describe the manner in which learning occurs in the workplace and employees’ perception of different elements that act as catalysts to enhance their learning.

Considering that workplace learning can be acquired through a combination of individual, contextual, and social factors, this research identifies the elements positively facilitating workplace learning. To achieve this objective, a theoretical framework was used. This framework combined the holistic model established by Matthews (1999) with facilitators’ perspective described by Watkins & Marsick (1992). Ellinger & Cesh (2007) applied facilitators’ perspective in their research on contextual factors for learning through daily experiences. With this adaptation of perspectives, exploring a dimension of informal workplace learning, employees’ perspective, rarely analyzed, is proposed as an objective for this research; specifically, this study examines employees’ perception of workplace learning. This will help explore the contextual factors perceived as facilitating workplace learning.

Matthews’ (1999) model is based on an organization committed to the development of a positive learning environment in the workplace. In formulating his model and in reference to Rylatt (1994), he described workplace learning as a systematic and interactive process wherein a wide variety of influences have to be considered. He referred to factors specific to the organization, in addition to certain external factors (the economic context, market competitiveness in which the organization operates, etc.) and employees’ “critical skills.”

This same context makes workplace learning surpass the limits of a workplace as a space. Learning informally occurs within the workplace through team work, problem solving, and colleague interaction (Awan & Tahir, 2015), in addition to the context outside the organization (Mutia & Sikalieh (2014). For Manutti et al. (2015), clients and suppliers are considered to be a source of informal learning.

In general, models that have studied facilitators of informal learning in the workplace have highlighted five important elements in the organization as learning stimulators. These elements include the more specific organizational aspects such as structure, systems, and technology as well as the more difficult (intangible) elements to understand such as people, organizational culture (Appelbaum & Gallagher, 2000), or “organizational subcultures” (Schwartz, 2019). The organizational culture or subculture is crucial to understand the manner in which learning occurs in the workplace. If there is no commitment from the organization to train its employees, it is impossible to determine the initial condition for learning to flow, known as the first link in the learning chain. Leslie, Aring & Brand (1998) called this the “teaching firm,” i.e., the company becomes an organization that “teaches” its employees.

For Matthews (1999), people are particularly important in any type of learning. Attitudes, commitment, and motivation are the key elements. Most importantly, “people will only adopt new ideas, knowledge or skills if they are interested in learning or finding some benefit for themselves” in doing their job (p.25).

While Matthews (1999) provided a framework for understanding the factors that influence the workplace, Ellinger & Cesh (2007) helped incorporate more workplace-specific elements by adapting Marsick & Watkins’ (1997, 2001) model of incidental and informal learning in line with the objectives set out in this research. The authors’ contribution to the central role played by certain “facilitators” in the workplace learning process provided inspiration for a frame of reference to help interpret what was happening in the two organizations analyzed (see Figure 1).

1.1. Contextual framework: facilitator of workplace learning in the machine tool sector

Matthews (1999) suggested that several elements condition an organization when it comes to promoting or restricting workplace learning. Focusing on market competitiveness in which the organization operates, type of product, and technological development driven by an organization becomes essential if the organization has a contextual framework that facilitates learning in the workplace.

Companies in the machine tool sector move in a panorama of uncertainty. Businesses must adapt and define strategies that encourage innovation and technological development to enable maximum competitiveness and integrate into the global market with a digital transformation of the sector toward an industry 4.0 state (Bakaikoa, Begiristain, Errasti, & Goikoetxea, 2004; Gavilanes-Trapote, Rio-Belver, Carrasco, Andara, Maria Rio-Belver, Cilleruelo Carrasco, & Rodriguez Andara, 2018).

In terms of internationalization, the extensive export experience of the Spanish machine tool sector has enabled it to sell more than 40% of its production in other countries for more than 35 years, with a current foreign sales quota of more than 80% (AFM, 2017). In the race for internationalization, the diversity of markets should be highlighted as a key factor, as Asia constitutes more than 30% of sales, with sales undertaken in five continents and practically in every industrialized country. Regarding the machine tool sector, internationalization has a broader connotation: that is, it implies the ability to sell, produce, make purchases, and train personnel wherever necessary to offer the best solution to the customer. This results in building a robust presence to provide quick and quality service and assistance to the customer.

Given the competitive pressure of low wages in the machine tool sector, companies in this industry need to innovate and move up on the value chain to remain competitive. The machine tool sector, like all high added value sectors, has made a commitment to innovation as a particularly important subject (Nonaka & Takeuchi, 1995; Lorenz & Lundvall, 2006), laying the foundations for the study of workplace learning (Ashton, 2002; Billett, 2011; Ellstrom, 2011).

With regard to technological innovation, the machine tool sector is prominent for having its own technology based on companies’ continuous effort toward research and development and innovation (R&D&I), as well as on an ongoing collaboration with numerous technology centers located within their geographical environment. The companies studied allocate an average of 6% of their total billing to R&D&I activities.

The machine tool sector is a strategic sector (González de la Fe & López, 2011; Copani, 2014), as machine tools are considered to be a capital good that can be used to build other machines. The peculiarity of capital goods is that they comprise investments for refurbishment or replacement made at the end of the useful life of a machine to continue the production work.

Most products have a deliberately short lifespan, called planned obsolescence (Brown, Lu & Wolfson, 1964). This planned obsolescence affects most machines, especially electronics. However, there is one exception to which obsolescence cannot set an expiry date, and that is the machine tool sector. The useful life of a machine tool is extended through retrofitting (Hardy, 1967), which comprises updating or improving the machine at a lower cost than that required for a new acquisition. With this reform or update, which comprises adding new technologies or functionalities to an already obsolete system, the useful life of the

machine is extended. Industrial equipment are products designed without planned obsolescence, intended to last decades, and their processes have been evolving in a linear manner. However, the new challenge of industry 4.0 (Benešová & Tupa, 2017) forces the reconsideration of how to interact with the industrial environment, the great challenge of the future.

The sector is characterized by the specialization of specific pieces and processes, making product innovation and process innovation essential. This sector relies on knowledge and provides solutions for other sectors to manufacture in more competitive conditions (Stark, 2015). The activity is based on people: accordingly, it is necessary to attract, prepare, and retain the best professionals, in addition to making the sector attractive to young people, who, after all, have to carry out these improvement and innovation processes in the not too distant future.

The impact of science and technology development causes the knowledge and experience in an area to change from one year to the next. Therefore, an urgent need to generate innovation exists, but basically, it is applied research with a specific time horizon and impact. The sector does not suffer from obsolescence of the machinery; however, it faces the obsolescence of knowledge, i.e., with respect to workers (González-Prida & Zamora, 2019). Concepts such as tacit and explicit knowledge, innovation, talent attraction, chameleon organization, etc., have begun to form part of the organizational management (Nonaka and Takeuchi, 1995; Lorenz and Lundvall, 2006). In fact, Stewart (1998) already established that the strength of an organization resides in knowing what it does best, indirectly emphasizing that such knowledge resides in its human teams.

1.2. Organizational context: peculiarities of cooperatives in the machine tool sector

Following Matthews' (1999) model, which distinguishes between tangible and intangible elements, with an emphasis on the latter, organizational culture can be singled out as a facilitator of workplace learning. The companies studied have a culture characterized by their cooperative nature, which differs from those of other companies in the machine tool sector.

Cooperative businesses share a similar business culture, uniquely differentiated by their products, markets, and environments, which determine their individual strategies. The business culture of these machine tool companies emphasizes customer satisfaction, internationalization, innovation, profitability, development, and social involvement (Bakaikoa et al., 2004; Bretos & Errasti, 2018). Cooperatives are a different type of business model, in which the objective is not the entrepreneur's wealth but sustainable growth, collaboration, and mutual aid among its associates, in addition to the creation of shared equity that may not be distributed (Martínez, 2009).

The existing culture of cooperation and solidarity makes its positioning for solving problems and taking advantage of opportunities a clear competitive advantage, in which social capital is an important component of the regional innovation system (Landabaso, Mouton & Miedzinski, 2003). The decision-making process of cooperatives is performed with participation from all their associates, which means that the decisions made are accepted and undertaken by their staffs, which favors their motivation, involvement, and collaboration.

The workers who become associates do so for life, so the cooperative member has a long-term vision of their professional career. Everyone has a conscious commitment to cooperate and progress together (Williams, 2007), leaving the company better off than before. Being a cooperative associate is a responsibility toward colleagues and society (Kasmir, 1999). The process begins with a period of adaptation for the company, in which there is a rotation through different positions and managers prepare a report concerning the employees. Thereafter, it is decided if a specific employee is offered the opportunity to be a cooperative associate. This is essentially for life, passing through different positions and acquiring different responsibilities depending on the person's interests and value. When someone is made an associate, they are retained, until retirement. To achieve this position, they need to be sufficiently attractive for companies. Its innovative process is based on training people in talent management (Bakaikoa et al., 2004).

The work between the cooperatives in a group is a working network, in which they share resources, reduce risks, and carry out joint projects, maintaining their competitive advantages. During crisis, the corporation employs other companies experiencing difficulties from the group (Gallastegui & Markaida, 1998; Kasmir, 1999). There may also be a shift of employees to respond to different workloads within the company or between companies in the group, providing them with a great deal of flexibility. On some occasions, a company may cease to operate, and its staff members are incorporated into other companies in the group. If the company expects profits at the end of the year, they make a monthly advance payment; if they expect losses, employees' salaries are reduced, which is an example of awareness and adaptation to the competitive environment in which they operate.

The contextual framework and the organisational context described in the machine tool sector cooperatives make it possible to understand the peculiarities of the sector, but do not show which elements make learning possible in the workplace and which reside in the workers. This is the challenge faced by this study: to show which elements, according to the perception of employees, enable non-explicit learning, latent learning, implicit and hidden in the tasks they perform.

2. Methodology

In the last two decades marked by the intensification of globalization, many cooperatives have been forced to grow internationally to survive in their markets (Novkovic and Sena, 2007; Flecha and Ngai, 2014; Siebel, 2016). As indicated by Flecha & Ngai (2014), cooperatives in highly competitive and globalized sectors are at crossroads. On the one hand, they are being forced to set up operations abroad to remain competitive. On the other hand, they are expected to maintain their cooperative practices and values and transfer them to their international subsidiaries so that they can respond to the economic, social, and democratic needs of the countries where they are established. The Mondragon Group is particularly suitable to study these issues.

Established more than half a century ago in the Basque Country as a local organization, the corporation began by acquiring manufacturing licenses, which generated knowledge not based on the product but rather on the process (Ormaetxea, 2003:252). Many of these licenses limited them in international markets, making them a necessity for the corporation; thus, they gradually abandoned the licenses, opting for R&D&I and the commitment to having their own research centers that would enable them to create their own technologies and position themselves in international markets (Igartua & Errasti, 2007; Whyte & Whyte, 1991). The continuous search for new markets and the quality of its products have marked its competitive advantage, in which they are prominent for the incorporation of added value to their products (advanced technology) and service improvement as elements of differentiation (Forcadell, 2005).

Currently, it has approximately 25 cooperatives belonging to the industrial division, which are multinational companies that control 141 foreign production subsidiaries and employ more than 14,400 people (Estrategia Empresarial, 2019). As of 2018, the group had 81,837 employees, of which 38,722 were in the corporate group. Its activity comprises three groups: industrial, financial, and distribution. It had 98 cooperatives in the group, and its sales invoices totaled 11,581 million euros in 2018. Its 15 R&D centers employed more than 2,018 researchers, yielding 496 patents as of 2018. The group has its own university and a wide range of training centers that educate qualified personnel for its companies and technology centers.

When selecting the two entities to be analyzed, it was decided to select businesses with strong internationalization indicators, high technology, formal and informal learning mechanisms, in addition to meeting other requirements such as not having labor conflicts or appearing in the press for this reason. The two companies selected for this study are cooperatives belonging to the Mondragon Group. The companies analyzed in the Basque Country are leading cooperatives that design and sell “turnkey” products, with 93% of their customers outside the country. The selected entities are producers in international markets and occupy different positions in the transnational value chain.

Company 1 (SP1) has more than 400 employees. It is dedicated to lathes, grinding machines, laser cutting machines, automatic punching and bending machines, as well as composite material automation integrators. It ranks first in machinery manufacturing for the metallurgical industry, sector CNAE 2849 (The Economist, 2019), with invoicing in excess of €100 million and an average R&D&I investment of over 6%.

Company 2 (SP2) has more than 200 employees. It specializes in the design and manufacturing of high-performance milling machines, boring milling machines, and milling and turning centers with advanced technology. Innovation is at the forefront of what it does and in many of its technologies. It ranks second in manufacturing metalworking machine tools, sector CNAE 2841 (The Economist, 2019), with invoicing at more than €50 million and an average R&D&I investment of more than 4% per year.

2.1. Procedure

This study describes the elements that characterize informal workplace learning based on the analysis of two entities in the machine tool sector. Given the complex and multidimensional nature of this type of study, a qualitative methodological design was chosen, specifically a single-subject research design. The case study methodology is especially useful for exploring situations in which there are certain limitations in understanding its phenomena, and it is necessary, as indicated by Gerring (2007), to discover initial research patterns that enable the development of innovative theoretical ideas.

After the selection of entities, a data collection procedure was designed. First, access was gained to several types of information relating to operating results, reports, material available on the web, and Mondragon Group's internal journals. Initial contact was made with the entities through which the objectives and methodological needs of the study were shared. After obtaining approval to participate in the study, in September 2017, two guided tours of the work centers were conducted to contextualize all the technical and specialized language surrounding the machine tool sector and visualize in situ some of the elements included in the documentary analysis. However, the study was primarily based on interviews with the actors involved in the two entities.

2.2. Sample and selection of informative participants

A total of 16 in-depth face-to-face interviews that lasted an average of 90 minutes were conducted from October 2017 to October 2018. Interviews were conducted among cooperative members, new non-associate employees, managers, and members of the board of directors. For anonymity and confidentiality, the positions held by some of the interviewees were withheld. Even though for the contextualization of the results it is necessary to have detailed knowledge of the sample's composition, the researchers decided to prioritize the anonymity of the informants. Of the set of interviews, eight were conducted at the SP1 plant and eight at the SP2 plant.

The sample distribution essentially composed of two types of key organizational actors: managers and employees. The different hierarchical positions resulted in the need to address different issues depending on the organizational group, leading to different interview scripts. Specifically, the interviews with managers addressed general aspects of work systems and work organization, in addition to their perception of lifelong learning. In the case of employees, special focus was placed on their vital experience of informal learning in the cooperative.

All the interviews were conducted at the entities' headquarters during their working hours, which facilitated the temporal development of the study thanks to the organization's willingness to carry out the interviews. All interviewees were informed in a timely manner regarding the study's objectives, and the informed consent procedure was followed with every interviewee. All interviews were recorded, and detailed notes were taken during the course of the interviews that complement the content analyses of the subsequent interviews.

2.3. Codification phases

To interpret the textual data, subjects were identified and converted into a "code book" relating to the dimensions and categories listed in the following table:

Table. 1. List of Dimensions, Categories of Analysis, and Code Numbers on Organizational Learning

Dimensions	Categories of Analysis	Code No.
Workplace learning	Informal learning	227
Workplace characteristics	Work organization and workplace (job)design	272
Work system characteristics	Work systems & organizational structures	59

Note: Prepared by the author.

In the first coding phase, the codes derived from the main dimensions previously established were applied, which directly enabled the emergence of new categories of data obtained that were incorporated into the analysis. Specifically, the content analysis began with the coding process in which the initial codes were assigned to text extracts, which were then grouped with the emerging subjects.

The results of the interview analysis were contrasted with the interviewees in a second wave of face-to-face interviews in November 2018. After establishing this contrast, a subsequent analysis was performed, with all the nuances provided in the second wave of interviews. New interview scripts, recordings, and transcripts were employed in the second set of interviews. This procedure is known as "respondent triangulation," and its purpose is simply to increase methodological rigor.

3. Result analysis

The value of intangible knowledge in a company has become increasingly important as a competitive advantage for highly valuable technology companies, as is the case for the two entities analyzed in the machine tool sector.

Following the theoretical framework presented, the data analysis resulted in the analysis presented below based on two subjects: 1. the facilitating elements of the workplace and 2. the organizational facilitators.

First finding: employees' perception and learning through incidental learning

First, this study identified the workplace as a space in which the organization's and employees' individual trajectories converge, which demonstrates that learning occurs through the interaction between the organization's resources and limitations and employees' own abilities. Therefore, authors such as Billet (2004) considered the workplace as an environment with a complex negotiation between knowledge and the roles played by different agents, processes, and the organization.

However, this study's focus led to an initial attempt to identify the characteristics that describe informal learning in the two entities analyzed to discover the distinctive elements of this type of learning. Watkins & Marsick (1992) stated the difficulties in observing this type of learning because it does not happen immediately and is difficult to recognize.

The review of authors previously carried out revealed some common characteristics that are reflected in the analysis of the two entities. Table 2 presents the weight attached to several categories, i.e., the elements and characteristics that describe informal learning in the workplace. The first relevant element was recognized by Eraut (2000: 114) and refers to learning based on an employee's own capacity to respond to tasks (28 codes), followed by learning for problem solving (26 codes) and learning through incidents (25 codes). The results are in line with those of Kerka (2000), who established these as the main elements of informal learning, which characterize incidental learning for some and innovative learning for others.

Table 2. Main Codes of Informal Workplace Learning

<i>Main Codes</i>	<i>SP2</i>	<i>SP1</i>	<i>TOTAL</i>
<i>Learning from applying oneself in the process of work</i>	11	17	28
<i>Learning from problem solving</i>	4	22	26
<i>Learning example incidental experiences</i>	12	13	25
<i>Learning from colleagues</i>	9	14	23
<i>Learning from responding to unexpected events</i>	8	13	21
<i>Learning as a part a team from teamwork</i>	4	17	21

Note: Prepared by the author.

Despite that the resulting rationale presents the weight of the codes, it is important to note that employees' perception could materialize in such a way that the need to respond to unexpected events forces them to respond and apply their knowledge and skills.

“But in the end, things happen that may be malfunctions that have occurred before. They can also be malfunctions that you don't know where they come from, and you have to really focus to try to figure out why they're happening. (...) and it's an important point because we have the idea that learning means not making mistakes, you know, but it's quite the opposite; in order to learn you have to make mistakes.” SP2-p8

“I have seen this a bit, you have to search for clues and try to figure it out, and in the end, you are more involved. I think trying to figure it out yourself is similar to how my bosses have been able to develop themselves with their skillsets.” SP2-p8

In trying to understand what may be some of the reasons that led interviewees to bring up unexpected events and problem solving as characteristic features of informal workplace learning, the nature of the entities analyzed should be considered. In these companies, the work performed is subject to pressure because each product is designed for a specific client, resulting in two different products. When faced with challenges arising from each product, the team’s role (21 codes) always came up in the testimonials.

“Depending on the problem, whether big or small, some can take several days to resolve while other minor problems can be resolved quickly in a few hours. We joined the rod assembly team, the office team, and the manager and evaluated possible solutions, what we can do, and what needs to be done in order for future (machines) to be produced or assembled properly.” SP2-p9

Second finding: perception of organizational characteristics as facilitating learning elements such as being a team member/part of meetings

Following the description of the elements of informal workplace learning in Table 2, peer learning (23 codes) and being part of a team (21 codes) are characteristics that reflect what Marsick, Watkins, Scully-Russ & Nicolaidis (2017) described. This learning comprises acquiring knowledge through experiences and interaction with others, which links learning with the job.

Spaan, Dekker, Van der Velden & De Groot (2016) highlighted the role of two “learning facilitators,” which were well represented by the interviewees’ testimonies in this study. The authors referred to a) the role of supervisors who perform contrast and reflection exercises and b) the role of formal meetings and more or less informal gatherings, in which a short amount of time is spent to review a process or resolve a problem.

If learning occurs through interaction with other employees, it is stimulated by other colleagues who have a role as learning facilitators. Ellinger & Cesh (2007) indicated that these facilitators or “occasional trainers” are colleagues and/or team members whose “expertise” gives them added value. Colleagues with more experience (senior-level) are seen as a source of learning for employees who have worked for the company for fewer years. These experienced colleagues or team members play a significant role in informal learning (Smith, Smith & Selby, 2010) and are mostly employees who are highly committed to informal learning (Berg and Chyung, 2008). In some cases, this takes on the shape of *mentoring*, which Matthews (2003) described as a relevant characteristic for workplace learning.

“You often bother the assembler more than help, but I feel that it is something that needs to happen because it helps you learn about the machine, it helps you become familiar with its different characteristics, and the truth is, I have memories of being really grateful and retaining the knowledge.” (SP1-p1)

The significance of these results is helpful in understanding why Lungreen, Bang, Justice, Marsick, Poell & Yorks (2017) proposed the idea that individual reflection is less important than learning and producing knowledge, which is a collaborative experience through actions that take on a greater role in workplace learning.

In the companies studied, there is a general agreement between study participants on the role that leaders or supervisors play in solving problems that arise in different activities and tasks performed by the employees.

“Yes, skills play a big role in (my supervisor’s) job. He is also very good at teaching and knows how to delegate so that you can learn, but he doesn’t throw you into something that you can’t handle either. He gives you a little bit more at a time so you can pick it up. Also, he’s always there to give you a hand, if you have a problem he asks you how you are doing, this and that. He follows-up, the only problem is that he is also overworked.” (SP1-p13)

“Many people come here when they have to make a decision, to ask him what he thinks or what he would do. There are people who are used to writing contracts with clients, but they always come to ask for his opinion.” (Sp1-p1)

“For me, my boss is a role model. I don’t know how many years ago he started, but he started working on assembling heads, and whenever you ask him a question, he has an answer. It’s really his years of experience, eagerness to learn, engage, everything.” (SP2-p9)

“Well, there are people who lead because they have more experience, our team may be running well, it was him who formed it. However, with more complex machines with robots, that is, with a much higher level of complexity, the managers are responsible for directing us, for identifying problems that we probably don’t see, for teaching us, the guru always arrives, right? (...) He always has to be there, the manager as well. The technical manager is very, very good. I don’t know how many years he’s been working, he’s young, he’s been working here for a few years and is very good technically speaking and always has to be here to provide us technical support, you know.” (SP2-p14)

“What the veteran workers always tell me is that there are going to be negative changes to plans, with pieces and deadlines. After modifying parts of the machine, setting it up, you learn. Once the sets are modified, they give you the designs for small pieces, then you grow and make a machine design. When you design a machine, you present it to the client, and you know, what they require is what is included, and they speak German, English, or Mandarin.” (SP1-p3)

At the same time, there is a perception that one of the organizational instruments most suited to solve problems are team meetings in the cooperatives analyzed. Meetings are considered as gatherings with a high added value, in which ideas are compared between different employees, with more and less experience, involved in a process. Sometimes, there are established weekly formal meetings and informal meetings at other times called to address unexpected occurrences that arise in projects.

“In these meetings, we develop the process with the plant director and receive feedback from the team, which is requested from those who have more experience, such as the mechanic and machine technician. The aim is to learn their needs and reasons behind them, as well as the weakest points in the process, and to ask for help.” (SP2-p6)

“We are a company in which meetings to get on the same page are encouraged, which can help us to make decisions; that is, for example, all the supply departments meet once a week; me with mine, others with theirs, we have meetings.” (sp1-p15).

This represents Baert and Govaerts’ (2012) “agora learning pattern” idea, which is a valuable metaphor to explain the role played by meetings as a Roman space where ideas, solutions, and difficulties are exchanged.

Notably, all the elements described above present in informal workplace learning are connected to the type of organization (Poell, Yorks & Marsick, 2009). In the case of the study subject, it can be affirmed that learning is linked to a culture of strong learning encouraged by the company. This culture is reflected in the organization’s immersion in a talent management project as a self-improvement strategy:

“We have a defined human resource management model that has two pillars. We operate in strategic cycles, and the 2017–2020 cycle basically has a defined model with two pillars; the first is talent management, which is one of our greatest challenges at the group level, and the other corresponds to the cooperative’s culture and values.” SP2-p11

Third finding: organizational context - cooperative = job rotation as a learning method

It is important to highlight that the two companies analyzed are, from an organizational perspective, cooperative systems with a different administration and organizational model than those of a traditional business that operates in a market as competitive as the machine tool sector. In this sense, establishing a series of elements that characterize these types of cooperative organizations is necessary.

According to the classical scheme of Clarke (1984), at the organizational level, cooperative enterprises are characterized by being labor-intensive, unlike traditional enterprises that are capital-intensive, and by division of labor based on rotating jobs and tasks. These different elements become learning sources for employees in the entities analyzed. The two organizations are businesses with a high technological level, which requires human capital with a certain degree of commitment toward learning.

The interviewees recognize an informal learning mechanism established by the organization that is applied to all employees. Given the circumstances and the lack of a job description given to them when they formalize their contract for the simple reason that the organization cannot foresee what they will end up

doing, the organization makes job and task rotation mandatory, which becomes a differentiating element in the organizations analyzed (Arando, Gago, Jones & Kato, 2015; Clarke, 1984).

This requires employees to have a certain level of flexibility and adaptability to the requirements of the job position that they hold (Hetzner, Heid & Gruber, 2015). It can be referred to as a worker's versatility to adapt to different projects and tasks. Their job function is not fixed but rather flexible: today, they work in re boring in the aeronautical sector, and tomorrow, they are designing a new machine for a company (even during the period of incorporation to the company, it is necessary to rotate through two or three different job functions to carry out different tasks).

“Yes, and you see it in different businesses, different types of clients, and different machines.” SP1-p1

“Regardless of the position for which you were hired, you spend maybe a month and a half or two months, minimum, in assembly. That is, if you are responsible for production or have a technical/electrical office position, whatever, you work two months in assembly. I think it's interesting because, of course, you start designing something or working on something that you don't know well, unless you've worked moderately for ten or fifteen, whatever. Through that, you learn what it's all about, but in my case, it wasn't like that, at least then, because they familiarize you with a part, a base, how the elements are leveled, what kind of validations are made, it's really quite an interesting story.” SP2-p8

“The fact that you've been in different positions, doing different tasks (...) you learn while you work, I was trained through working.” SP1-p4

Every employee, before becoming a definite member of the company, rotates through several positions in a manner in which they can be evaluated by several managers who determine if they are a good candidate for the company. Simultaneously, the rotation enables the candidate to learn several jobs performed at the company and different functions in a reciprocal manner. Once they decide to become a permanent member, the worker will enjoy job stability for life as a “cooperative member,” unless they choose not to.

This rotation enables the organization to assess skills that require flexibility and a certain level of autonomy on the part of the employees in different situations and organizational tasks.

“What they want to know is if you're competent in that position. They also want to see if you are competitive or competent in a position at the same company but in a different department. You are also evaluated by another manager. Your manager gives you the go-ahead to see if another leader has the same opinion or not.” (SP1-p5)

“You learn a little by seeing all the parameters of the machine itself, its different aspects, which is pretty basic. Then through your work, you learn a lot more, like what it's made of, how many cables it might have, hydraulic hoses of all kinds, there are some machines with (.....) You go from something that is very large in dimension to something that is small, such as heads, compared to the machines I was telling you about, and you are aware of the jump in precision. That is, with heads, a head at the end of the process is made up of gears, bodies, bearings; the precision that these types of elements require becomes clear...” SP2-p8

Fourth finding: workplace learning is stimulated by an element: product change = forces closely working with the client

The customer proximity strategy that requires guidance for “turnkey” products becomes a learning source for employees who have to be constantly adapting to customers' needs and requirements. This characterizes the entity as a “human capital intensive” organization. Both organizations tie their production capacity to the work performed by their employees, employee knowledge, and their relationships with clients and suppliers. This has forced both entities to search for learning opportunities offered by their clients and suppliers, which was expressed by one of the interviewees.

“They give us a lot, they are very demanding, and when they arrive we have to be very close to them because they give you a vision that you may lose sight of, (...) and when making decisions it is important to have the client's point of view in mind.” (SP2-p7)

Project leaders design the machine by working hand in hand with the client. They visit the country where the factory is located, working in collaboration with their team. When the machine is being prepared, it is assembled in the Basque Country; the client and the quality manager go through a checklist throughout the process, ensuring that the machine meets all the requirements established in the order. Thereafter, the

machine is taken apart, and the pieces are separately shipped to the country where the client is located. Then, the assembly and checklist processes are repeated, ensuring the machine's optimum performance.

They serve customers with uniquely designed products and cannot act in a manner characteristic to the general sale of products, which was reflected in one of interviewees' testimonies.

“There was a client who ordered a machine from me, but it had to be with a numeric control. When that occurred, I had to train a person to work for four or five months to learn how this type of numeric control works and develop a software capable of making it work for that machine. So, from that moment, we are product manufacturers and link services to the specific product.” (SP1-p2)

However, this type of learning cannot be generalized for all employees. As can be seen from the interviews carried out at the entities analyzed, there is no detailed division of work, but there is a difference in employees' functions. Following the model of Marsick and Watkins (1997; 2001; 2015), two types of employees are observed: those who perform more routine work with more direct contact with machinery and employees with more undefined tasks. As described by one of the interviewees, functions differ between those who have direct contact with the machinery and those who perform tasks related to service, management, marketing, etc., called indirect work. There is a clear parallel between direct jobs (routine work) and indirect jobs (linked to workloads that are more difficult to manage and with more responsibilities for work teams).

“It depends on each person's position. There are tasks that we call direct labor, which are very clear, like machine assembly. There are studies on load capacity, and we know the number of hours required to assemble a machine. The necessary resources are allocated to be able to meet the delivery deadline according to the hours we need and these jobs are organized in a manner (...) Then there are the jobs, which we call indirect, in which the load capacity is more difficult to manage. Responsibilities are distributed between work teams but without a quantitative distribution because it is more difficult to measure. We always try to assign responsibility in place of tasks at all levels. For us, this is one of the key elements, which is why we precisely avoid job descriptions as they have always been understood.” (SP2-p211).

4. Discussion

In view of the findings, interviewees consider unanticipated events as a source of workplace learning in line with what Marsick & Watkins (1997, 2001, 2017) called informal and incidental learning. Unexpected events require the capacity to address problems caused by the incident itself. Workers have to find a solution that requires taking risks in decision making as well as seeking alternatives or solutions to the problem at the workplace (Coetzer, Kock & Wallo, 2017). Addressing these types of problems requires a series of knowledge that sometimes is inadequate. Prior experience is an important element in addressing several problems, but when faced with a distinct problem, experience may not be sufficient to solve that particular problem.

Learning that results from incidents or events is unique and has a cumulative effect. Such learning results from a combination of elements such as observing colleagues, repeating specific tasks that have been successful, or interacting with other team members or people not in one's team who can provide a different perspective on the problem to be solved, according to what was established by Cardwell & Danaher (2009), Eraut (2004), and Schwartz (2019). The combination of all these factors produces innovative learning, as coined by Kerka (2000), instilling trust in oneself and, ultimately, improving the employees' skills and abilities.

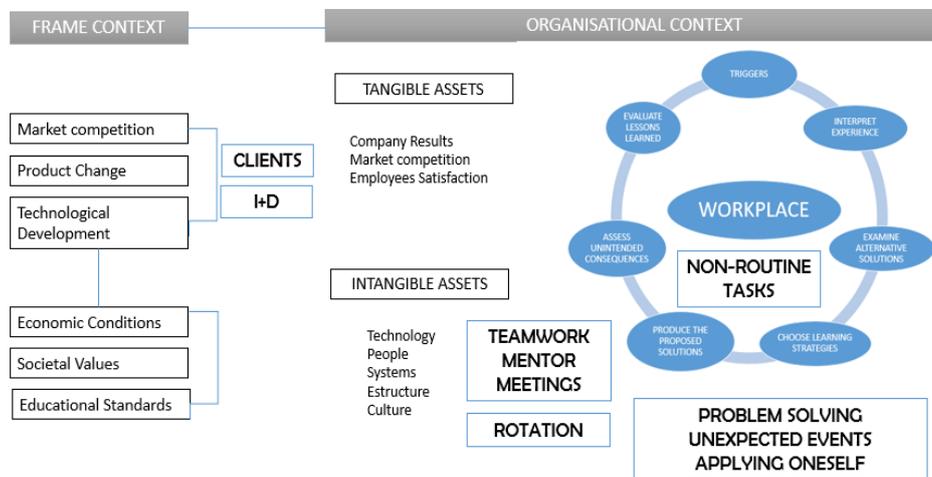
In short, a certain degree of responsibility is given in project management so that leaders learn as quickly as possible to face real problems. In increasingly challenging work contexts, workers are assigned responsibilities, not tasks, which require them to develop their role by contributing their judgment and way of doing things. In this study, this concept has been called “personalization in problem solving.”

In the case of the cooperatives analyzed, workers who become associate members of the company are assigned increasingly complex projects. The objective is that workers acquire autonomy and awareness of their skills (Kerka, 2000). The organization's aim is to apply theoretical and practical knowledge as soon as possible so that workers acquire the autonomy and capacity to adapt to products and processes that require handling uncertain situations. The innovative aspect is not talking about tasks since the challenge posed forces workers to address a challenging situation in the form of a process in which they may be accompanied or be alone. This autonomy also helps identify conformist workers with learning concerns.

For the companies analyzed, employees' technical knowledge as well as their attitude and motivation to work are essential. Organizational commitment is a decisive factor when considering an employee for an associate member position (Evans, 2017; Evans, Unwin, Hodgkinson & Rainbird, 2007; Hefler & Markowitsch, 2012, 2013; Illeris, 2004), which will enable their promotion in the company. In the words of one of the technicians interviewed, "there are no limits to your professional development."

Following the discussion on the perceived facilitators in an organizational context, Schwartz (2019) established a series of facilitators or organization levers, which Ellinger and Cesh (2007) placed in an organizational context as shown in the diagram below (see Figure 1). Differentiation in employees' functions according to the tasks they perform appears among these facilitators. Routine and non-routine tasks are differentiated because in the former, a repetitive task is performed in consultation with a supervisor in problematic situations. However, with regard to the latter, the supervisor can decide to take on the responsibility from the worker. The cooperatives analyzed no longer speak of routine and non-routine tasks (Marsick, Watkins, Scully & Nicolaidis, 2017) by introducing the element of responsibility and autonomy, the language used to refer to what the authors call routine and non-routine, which is identified by direct jobs (machine assembly) and indirect jobs, to refer to the responsibilities of work teams.

Figure. 1. Workplace learning model in cooperatives in the machine tool industry



Source: Adapted from Matthew's Holistic Model (2003) and Ellinger & Cesh's (2007) perspective.

With respect to the organization, job rotation is a mechanism typical of the cooperative nature of organizations, which according to an interviewee's perception is an element that facilitates informal learning (Arando, Gago, Jones & Kato, 2015; Clarke, 1984). Job rotation has two functions: on the one hand, employees learn different skills and enrich their knowledge. On the other hand, the organization is able to identify workers' abilities to perform distinct tasks with different supervisors, providing the most complete picture possible of a worker.

As indicated by the findings of the analysis, the role of two workplace learning facilitators was noted. Spaan, Dekker, Van der Velden, & De Groot (2016) identified these in their research as a) the role of formal meetings and more or less informal gatherings, in which a short amount of time is spent to review a process or resolve a problem, and b) the role of supervisors who perform contrast and reflection exercises.

Formal or informal meetings constitute another source of informal learning, as verified from the analysis performed. The organization has a set of periodic meetings established with different objectives. As such, there are meetings to follow-up on processes in which the aim is to verify that they are on schedule, the phases that have been completed, project milestones, etc. The project's progress is analyzed, and benchmarks are readjusted to the client's expectations or established beforehand. Furthermore, there are other meetings, more sporadic, called "critical process" meetings. Such meetings are called when a machine fails to determine what caused the problem. They are specific meetings to address a concrete problem.

However, there is another series of informal meetings, in which other team members and/or project leaders/supervisors interact, which are valuable for the interviewees. In these meetings, the entire team's knowledge is shared, which is invaluable; however, it is difficult to find a mechanism for the "appropriation" of this knowledge by the organization.

Special mention should be made regarding the support provided by certain colleagues whose experience is recognized as valuable in solving day-to-day problems. This has already been recognized by Smith, Smith & Selby (2010), although in the case of the entities analyzed, this person has certain specific characteristics such as a high level of commitment and corporate culture values (Berg & Chyung, 2008). In this context, it is important to note a figure that emerges powerfully: a person who is free to realize their tasks and is recognized by their colleagues and the organization. This is a point person in the development area and is adept in providing “training” on certain job tasks. This person is entrusted with the responsibility of transmitting their knowledge through talks and preparing manuals, procedures, etc. This person shares certain similarities to a mentor, as indicated by MacLennan (2017) and Matthews (2003).

Among the findings of this study that should be highlighted is one of the contextual elements linked to the machine tool sector, specifically the “product type” of the organizations analyzed; “turnkey products” act as a stimulus for workplace learning. The common thread among the product, workplace, and employee learning is the client. Along these lines, authors such as Manutti et al. (2015) indicated that customer proximity is a stimulus or a facilitator for employees to be constantly adapting to customer requirements, with the goal of achieving maximum satisfaction and product quality.

Having to constantly adapt to client’s requirements made for “ad hoc” machines results in work teams having to face a new challenge every time that a client establishes a new requirement. The workplace becomes a setting with constant challenges, which demands certain skills and abilities from the teams that go beyond theoretical knowledge. In this sense, communication skills emerge in different settings, even in unusual languages, since machine delivery and final assembly occur in the client’s country of origin, to which different team members have to travel.

5. Conclusions, limitations, and future lines of research

Organizations in the machine tool sector subject to the “technology imperative” must navigate through uncertainty and provide differentiated and immediate responses from the workplace. Therefore, the elements and characteristics of the workplace learning concept are not easily defined. Despite conceptual difficulties, this study revealed numerous contextual factors for informal workplace learning from the perspective of employees.

A workplace is more than a space in which employees perform tasks, as demonstrated by the findings of this study; it entails interactions among team members, clients, and suppliers, in addition to the skills and abilities to resolve problems and uncertainties. This requires commitment, motivation, and the need to familiarize with the organization’s tasks and cooperative values. The employee profile formed on the basis of the study results includes an element that has been overlooked till date, called “the personalization of problem solving” that goes beyond the subjectivity or individual characteristics of employees.

This “personalization” combines learning from mistakes, unexpected events, and each employee’s own skills and abilities and has become one of the main study findings for defining the elements that stimulate workplace learning. However, the importance of other factors must also be considered to understand their role.

From the employees’ perspective, with respect to the importance of organizational factors for workplace learning, the spaces in both formal and informal meetings are crucial to transfer knowledge. Albeit, there are certain important people in these meetings, such as the team leaders who are trusted for their *expertise* in the area being addressed as well as to meet the needs to respond to day-to-day problems.

However, all this would not be possible without an organization that is clearly focused on facilitating learning spaces and ensuring thorough professional and personal development of its employees. The organization itself establishes all the structures aimed at constant learning so that employees can respond to customer requirements in a highly competitive market. It has evolved from a learning organization model (Senge, 2004; Serrat, 2017) to a sophisticated organizational model that teaches and adapts to respond to the challenges it faces on a daily basis. In this manner, they are able to be competitive, providing a complete solution to the client that goes beyond the delivery of a specific product.

The limitations of this study should be noted. The main limitation is the result of its qualitative nature. The findings are clearly in line with those from other studies on workplace learning; however, these cannot be extrapolated to other companies in the machine tool sector. Simultaneously, the cooperative nature of the businesses studied makes the findings specific. This calls for extending research to other companies in the machine tool sector or high-tech sectors to contrast whether workplace learning facilitators reflect the same elements as those found in this study.

Finally, it is necessary to highlight that the results of this study contribute to shed light on the scarcity of research around workplace learning in the machine-tool sector, showing that technological innovation, customer service, etc. do not become learning catalyzers if human teams do not learn, capture and transfer knowledge generated in the workplace.

6. References

- AFM-Advanced Manufacturing Technologies (2017) *Economic report. Machine-Tools and Manufacturing Technologies*. Retrieved from <https://www.afm.es/gestor/recursos/uploads/archivos/sector-maquina-herramienta/INFORME%20ECON%20C3%93MICO%20AFM.pdf>.
- Appelbaum, S.H & Gallagher, J (2000) The competitive advantage of organizational learning. *Journal of Workplace Learning*, Vol. 12, Nº 2, pp. 40-56. <https://doi.org/10.1108/13665620010316000>.
- Arando, S.; Gago, M.; Jones, D. C. & Kato, T. (2015) Efficiency in employee-owned enterprises: An econometric case study of Mondragon. *ILR Review*, Vol. 68, Nº 2, pp. 398-425. <https://doi.org/10.1177/0019793914564966>.
- Ashton, D.N & Sung, J (2002) *Supporting Workplace learning for high performance working*. Geneva: International Labour Office. ISSN:0020-7780.
- Awan, A.G & Tahir, M.T (2015) Impact of working environment on employee's productivity: A case study of Banks and Insurance Companies in Pakistan. *European Journal of Business and Management*. Vol. 7, Nº 1, pp.329-346. ISSN 2222-1905.
- Baert, H. & Govaerts, N. (2012) Learning patterns of teams at the workplace. *Journal of Workplace Learning*, Vol. 24, Nº 7/8, pp. 538-550. <https://doi.org/10.1108/1366562121126102>.
- Bakaikoa, B.; Begiristain, A.; Errasti, A. & Goikoetxea, G. (2004) Redes e innovación cooperativa. *CIRIEC-España, revista de economía pública, social y cooperativa*, Nº 49, pp. 263-294. ISSN: 0213-8093
- Berg A S. & Youn S. Chyung, Y. S. (2008) Factors that influence informal learning in the workplace. *Journal of Workplace Learning*, Vol. 20, Nº 4, pp. 229-244. <https://doi.org/10.1108/13665620810871097>.
- Benešová, A. & Tupa, J. (2017) Requirements for education and qualification of people in Industry 4.0. *Procedia Manufacturing*, Nº 11, pp. 2195-2202. <https://doi.org/10.1016/j.promfg.2017.07.366>.
- Billett, S. (2002) Toward a workplace pedagogy: Guidance, participation, and engagement. *Adult education quarterly*, Vol. 53, Nº 1, pp. 27-43. <https://doi.org/10.1177/074171302237202>.
- Billett, S. (2004) Workplace participatory practices: Conceptualising workplaces as learning environments. *Journal of Workplace Learning*, Vol. 16, Nº 6, pp. 312-324. <https://doi.org/10.1108/13665620410550295>.
- Billett, S. (2011) Subjectivity, self and personal agency in learning through and for work. *The SAGE handbook of workplace learning*, pp. 60-72. <https://doi.org/10.4135/9781446200940>.
- Bretos, I. & Errasti, A. (2018) La transmisión de los valores y prácticas organizacionales cooperativas en las filiales extranjeras: El caso de la cooperativa multinacional Fagor Ederlan. *REVESCO. Revista de Estudios Cooperativos. Primer Cuatrimestre*, Nº 127, pp. 45-69. <https://doi.org/10.5209/REVE.58395>.
- Brown, G. W.; Lu, J. Y. & Wolfson, R. J. (1964) Dynamic modeling of inventories subject to obsolescence. *Management Science*, Vol. 11, Nº 1, pp. 51-63. <https://doi.org/10.1287/mnsc.11.1.51>.
- Boud, D. & Middleton, H (2003) Learning from others at work: communities of practice and informal learning. *Journal of Workplace Learning*, Vol. 15, Nº 5, pp.194-202. <https://doi.org/10.1108/13665620310483895>.
- Center for Workforce Development (Education Development Center) (1998) *The Teaching Firm: Where Productive Work and Learning Converge: Report on Research Findings and Implications*. Center for Workforce Development, Education Development Center.
- Copani, G. (2014) Machine Tool Industry: Beyond Tradition? In *Servitization in industry*, pp. 109-130. Springer, Cham. <https://doi.org/10.1007/978-3-319-06935-7>.
- Ellström, P. E. (2011) Informal learning at work: Conditions, processes and logics. *The Sage handbook of workplace learning*, pp. 105-119. <https://doi.org/10.4135/9781446200940>.
- Cardwell, K. & Danaher, P. A. (2009) Workplace learning: principles and practice, 81-83. Taylor & Francis Group. <https://doi.org/10.1080/01580370902742090>.
- Coetzer, A.; Kock, H. & Wallo, A. (2017) Distinctive Characteristics of small businesses as Sites for Informal Learning. *Human Resource Development Review*. April 21. <https://doi.org/10.1177%2F1534484317704291>.
- Coombs, P.H. (1980) *The World Crisis in Education: The View from the Eighties*. New York: Oxford University Press. DOI: 10.1525/aa.1986.88.4.02a00270.
- Cross, J. (2006) *Informal learning: Rediscovering the natural pathways that inspire innovation and performance*. John Wiley & Sons. ISBN: 978-0-787-98169-3.
- Cross, J. (2016) *Real Learning*. Internet Time Press.
- González-Prida, V.; Zamora, J.P. (2019) *Handbook of Research on Industrial Advancement in Scientific Knowledge*. Hershey, United States: IGI Global.
- El Economista (2019) *Ranking de Empresas del sector Fabricación de otras máquinas herramienta*. Consultado el 25 de junio de 2019. <https://ranking-empresas.eleconomista.es/sector-2849.html>.
- Ellinger, A.D. & Cseh, M. (2007) Contextual factors influencing the facilitation of others' learning through everyday work experiences. *Journal of Workplace Learning*, Vol. 19, Nº 7, pp. 435-452, <https://doi.org/10.1108/13665620710819384>.

- Ellström, P. E. (2001) Integrating learning and work: Problems and prospects. *Human Resource Development Quarterly*, Nº 12, pp. 421-435.
- Eraut, M. (2004) Informal learning in the workplace. *Studies in continuing education*, Vol. 26, Nº 2, pp. 247-273. <https://doi.org/10.1080/158037042000225245>.
- Eraut, M. (2011) Informal learning in the workplace: evidence on the real value of work-based learning (WBL). *Development and Learning in Organizations: An International Journal*, Vol. 25, Nº 5, pp. 8-12, <https://doi.org/10.1108/147772811111593>.
- Estrategia Empresarial (21 de junio de 2019) *El área industrial de Mondragón generó más de 1.700 empleos en 2018*. Estrategia Empresarial. Retrieved from <http://www.estrategia.net/estrategia/UltimaHora/tabid/615/ItemID/10764/Default.aspx>.
- Evans, K (2007) Concepts of bounded agency in education, work, and the personal lives of young adults. *International Journal of Psychology*, Vol. 42, Nº 2, pp. 85-93. <https://doi.org/10.1080/00207590600991237>.
- Evans, K. (2017) Bounded agency in professional lives. En M. Goller & S. Paloniemi (Eds.), *Agency at work. Agentic perspective on professional learning and development*, pp. 17–36. Cham: Springer. https://doi.org/10.1007/978-3-319-60943-0_2.
- Evans, K.; Hodkinson, P.; Rainbird, H. & Hunwin, L. (2006) *Improving workplace learning*. Routledge. New York
- Evans, K.; Unwin, L.; Hodkinson, P. & Rainbird, H. (2007) *Improving workplace learning*. Routledge. <https://doi.org/10.1108/00197850710762007>.
- Fenwick, T. (2003) Innovation: Examining workplace learning in new enterprises. *Journal of Workplace Learning*, Nº 15, pp. 123-132.
- Fenwick, T. (2008) Workplace Learning: Emerging Trends and New Perspectives. *New Directions for Adult and Continuing Education*, Nº 119, pp. 17–26. <https://doi.org/10.1002/ace.v2008:119>.
- Flecha, R. & Ngai, P. (2014) The challenge for Mondragón: Searching for the cooperative values in times of internationalization. *Organization*, Vol. 21, Nº 5, pp. 666-682. <https://doi.org/10.1177/1350508414537625>.
- Forcadell, F. J. (2005) Democracy, cooperation and business success: the case of Mondragón Corporación Cooperativa. *Journal of Business Ethics*, Vol. 56, Nº 3, pp. 255-274. <https://doi.org/10.1007/s10551-004-5094-5>.
- Fuller, A. & Unwin, L. (2004) Expansive learning environments: integrating organizational and personal development. *Workplace learning in context*, pp. 126-144. <https://doi.org/10.4324/9780203571644>.
- Gallastegui, E. A. & Markaida, I. B. (1998) Flexibilidad laboral y generación de empleo en tiempos de crisis. El caso de Mondragón Corporación Cooperativa. *Revista Europea de Dirección y Economía de la Empresa*, Vol. 7, Nº 3, pp. 83-98. ISSN: 1019-6838.
- Gavilanes-Trapote, J.; Rio-Belver, R.; Carrasco, E.; Andara, A.; Maria Rio-Belver, J.; Cilleruelo Carrasco, R. & Rodríguez Andara, E. (2018) *Visualization of the digital transformation of the machine tool sector. Towards an industry 4.0. Dyna*, Vol. 93, Nº 6.
- Gerring, J (2007) *Case study Research. Principles and practices*. Cambridge University Press.
- Goller M., Paloniemi S. (2017) Agency at Work, Learning and Professional Development: An Introduction. In: *Goller M., Paloniemi S. (eds) Agency at Work. Professional and Practice-based Learning*, Vol 20. Springer, Cham. https://doi.org/10.1007/978-3-319-60943-0_1.
- González de la Fe, T. & López, A. (2011) *Innovación, Conocimiento Científico y Cambio Social*. Madrid: CIS. ISBN: 9788474765533, 8474765536.
- Hardy, J. (1967) *Retrofitting Machine Tools: Converting Conventional Machine Tools to Numerical Control*. Industrial Development Division, Institute of Science and Technology, University of Michigan
- Hefler, G. & Markowitsch, J. (2012) Bridging Institutional Divides: Linking Education, careers and work in organizational space dominated employment systems. In: *Brooks, R; Fuller, A & Waters, J (Eds): Changing Spaces of Education-New perspectives on the natures of Learning*. London: Routledge, pp.160-181. <https://doi.org/10.1007/s11159-017-9611-z>.
- Hefler, G. & Markowitsch, J. (2013) Seven types of formal adult education and their organisational fields. Towards a comparative framework. *Lifelong learning in Europe: national patterns and challenges*. Cheltenham: Edward Elgar, pp. 82-113. <https://doi.org/10.4337/9780857937360.00011>.
- Hetzner, S.; Heid, H. & Gruber, H. (2015) Using workplace changes as learning opportunities: Antecedents to reflection in professional work. *Journal of Workplace learning*, Vol. 27, Nº 1, pp. 34-50. <https://doi.org/10.1108/JWL-12-2013-0108>.
- Holm, J.R. & Lorenz, E (2015) Has “Discretionary Learning” declining during the Lisbon Agenda? A cross-sectional and longitudinal study of work organization in European nations. *Industrial and Corporate Change*, Vol. 24, Nº 6, pp. 1179-1214. <https://doi.org/10.1093/icc/dtv005>.
- Igartua, J. I. & Errasti, A. (2007) La Innovación en una Corporación Industrial: el caso de MCC. In *XI Congreso de Ingeniería de Organización*, pp. 1127-1136.
- Illeris, K (2004) A model for learning in working life. *Journal of Workplace Learning*, Vol. 16, Nº 7/8, pp. 431-441. <https://doi.org/10.1108/13665620410566405>.
- Illeris, K. (Ed.) (2018) *Contemporary theories of learning: learning theorists... in their own words*. Routledge. <https://doi.org/10.1080/0158037X.2011.577173>.
- IZA World of Labor (2015) *The importance of informal learning at work*. Deutsche Post Foundation. Author: Andries de Grip. Retrieved from: <https://wol.iza.org/uploads/articles/162/pdfs/importance-of-informal-learning-at-work.pdf>.

- Jacobs, R. & Parks, Y. (2009) A proposed conceptual framework of workplace learning: implications for theory development and research in human resource development. *Human Resource Development Review*, Vol. 8, Nº 2, pp. 133-50. <https://doi.org/10.1177/1534484309334269>.
- Kasmir, S. (1999) *El mito de Mondragón*. Nafarroa: Txalaparta.
- Kerka, S (2000) Incidental Learning. *Trends and Issues Alert*. Nº 18. <https://files.eric.ed.gov/fulltext/ED446234.pdf>.
- Landabaso, M.; Mouton, B. & Miedzinski, M. (2003) Regional innovation strategies; a tool to improve social capital and institutional efficiency? Lessons from the European Regional Development Fund innovative actions. *Regional Studies Association conference -Reinventing regions in a global economy- held at Pisa, Italy, from*, Vol. 12.
- Le Clus, M (2011) Informal learning in the workplace: A review of the literature. *Australian Journal of Adult Learning*. Vol. 51, Nº 2, pp. 356-376.
- Leslie, B.; Aring, M. K. & Brand, B. (1998) Informal learning: The new frontier of employee & organizational development. *Economic Development Review*, Vol. 15, Nº 4, p. 12.
- Lombardo, M. M. & Eichinger, R. W. (1996) *The Career Architect Development Planner*. Minneapolis: Lominger. p. iv.
- Lorenz, E. & Lundvall, B. Å. (Eds.) (2006) *How Europe's economies learn: coordinating competing models*. Oxford University Press.
- Lundgren, H.; Bang, A.; Justice, S. B.; Marsick, V. J.; Poell, R. F.; Yorks, L.; Clark, L. & Sung, S. (2017) Conceptualizing reflection in experience-based workplace learning. *Human Resource Development International*, Vol. 20, Nº 4, pp. 305-326. <https://doi.org/10.1080/13678868.2017.1308717>.
- Malcolm, J.; Hodgkinson, P. & Colley, H. (2003) The interrelationships between informal and formal learning. *Journal of workplace learning*, Vol. 15, Nº 7/8, pp. 313-318. <https://doi.org/10.1108/13665620310504783>.
- Manuti, A.; Pastore, S.; Scardigno, A. F.; Giancaspro, M. L. & Morciano, D. (2015) Formal and informal learning in the workplace: a research review. *International journal of training and development*, Vol. 19, Nº 1, pp. 1-17. <https://doi.org/10.1111/ijtd.12044>.
- Marsick, V. J. & Watkins, K. E. (1997) Lessons from informal and incidental learning. *Management learning: Integrating perspectives in theory and practice*, pp. 295-311.
- Marsick, V. J. & Watkins, K. E. (2001) Informal and incidental learning. *New directions for adult and continuing education*, Nº 89, pp. 25-34.
- Marsick, V. J. & Watkins, K. (2015) *Informal and Incidental Learning in the Workplace* (Routledge Revivals). London: Routledge. <https://doi.org/10.4324/9781315715926>.
- Marsick, V. J.; Watkins, K. E.; Scully-Russ, E. & Nicolaides, A. (2017) Rethinking informal and incidental learning in terms of complexity and the social context. *Journal of Adult Learning, Knowledge and Innovation*, Vol. 1, Nº 1, pp. 27-34. <https://doi.org/10.1002/ace.20285>.
- Martínez, A. (2009) Innovación y Cooperativas. *Boletín de la Asociación Internacional de Derecho Cooperativo*, Nº 43, pp. 135-157. ISSN: 1134 - 993X. <https://es.scribd.com/document/379368822/Dialnet-InnovacionYCooperativasUniversidadDeDeusto-3074494>.
- Matthews, P (1999) Workplace learning: developing a holistic model. *The Learning Organization*, Vol. 6, Nº 1, pp. 18-29. <https://doi.org/10.1108/09696479910255684>.
- Matthews, P (2003) Workplace learning and learning theory. *Journal of Workplace Learning*, Vol. 15, Nº 4, pp. 167-178. <https://doi.org/10.1108/13665620310474615>.
- MacLennan, N. (2017) *Coaching and mentoring*. Routledge.
- Mc Ferrin, K.M. (1999) Incidental Learning in a Higher Education Asynchronous Online Distance Education Course” In *SITE 99: Society for Information Technology & Teacher Education International Conference Proceedings*, edited by J.D Price et al Charlottesville, Va: Association for the Advancement of Computing in Education, 1999 (ED 432 288).
- Mutia, P. M. & Sikalieh, D. (2014) Work Environment and its Influence on Productivity Levels among Extension Officers in the Ministry of Agriculture in Kenya. *International Journal of Innovation Education and Research*, Vol. 2, Nº 12, pp. 82-93. <https://doi.org/10.31686>.
- Nonaka, I. & Takeuchi, H. (1995) *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. USA: Harvard Business Review Classics Series.
- Novkovic, S. & Sena, V. (Eds.) (2007) *Cooperative Firms in Global Markets*. Emerald Group Publishing Limited.
- Ormaetxea, J.M. (2003) *Didáctica de una experiencia empresarial. El cooperativismo de Mondragón*. Gipuzkoa: JM Ormaetxea ed.
- Paloniemi, S. & Goller, M. (2017) The multifaceted nature of agency and professional learning. En *M. Goller & S. Paloniemi (Eds.), Agency at work: An agentic perspective on professional learning and development*, pp. 465-478. Springer, Cham. https://doi.org/10.1007/978-3-319-60943-0_23.
- Roure-Niubó, J. & Boudjaoui, M. (2016) Estrategias de profesionalización para la implementación de la formación en alternancia en educación superior en España: El caso del Instituto Máquina Herramienta (IMH) de Elgoibar (País Vasco). *Educación*, Vol. 52, Nº 2, pp. 315-336. <https://doi.org/10.5565/rev/educar.748>.
- Schwartz, G.J. (2019) An Examination of Key Factors that Influence Employee Learning in the workplace In *Vanessa Hammler Kenon & Sunay Vasant Palsole, The Wiley Handbook of Global Workplace Learning*. John Wiley and Sons. Online ISBN: 9781119227793.

- Senge, P. M. (2004) The leader's new work: Building learning organizations. *How Organizations Learn: Managing the search for knowledge*, pp. 462-486.
- Serrat, O. (2017) Building a learning organization. In *Knowledge solutions*, pp. 57-67. Springer, Singapore. DOI 10.1007/978-981-10-0983-9_11.
- Siebel, S. (2016) *Cooperative economies in a global age*. Tesis doctoral, RMIT University, Melbourne, Australia.
- Smith, E.; Smith, A. & Smith, C.S. (2010) Old dogs, new tricks: training mature-aged manufacturing workers. *Journal of Workplace Learning*, Vol. 22, N° 5, pp. 277-291. <https://doi.org/10.1108/13665621011053190>.
- Spaan, N. R.; Dekker, A. R.; van der Velden, A. W. & de Groot, E. (2016) Informal and formal learning of general practitioners. *Journal of Workplace Learning*, Vol. 28, N° 6, pp. 378-391. <https://doi.org/10.1108/JWL-12-2015-0090>.
- SPRI y AFM-Asociación Española de Fabricantes de Máquina-Herramienta (2017) *El sector Vasco de Fabricantes de Máquina-Herramienta*. Retrieved from: http://www.basquecountry.eus/contenidos/noticia/maquina_herramienta_08/es_ma_he/adjuntos/maquinaherramienta_es.pdf.
- Stark, J. (2015) Product lifecycle management. In *Product lifecycle management*, Vol. 1, pp. 1-29. Springer, Cham. https://doi.org/10.1007/978-3-319-17440-2_1.
- Stewart, T. A. (1998) *La nueva riqueza de las organizaciones: el capital intelectual*. Ediciones Granica SA.
- Vähäsantanen, K.; Paloniemi, S.; Hökkä, P. & Eteläpelto, A. (2017) An agency-promoting learning arena for developing shared work practices. En *M. Goller & S. Paloniemi (Eds.), Agency at work: An agentic perspective on professional learning and development*, pp. 351–371. Springer: Cham. doi:10.1007/978-3-319-60943-0_18.
- Yoshida, T. & Higashikawa, K. (1981) *U.S. Patent No. 4,288,849*. Washington, DC: U.S. Patent and Trademark Office.
- Watkins, K. E. & Marsick, V. J. (1992) Towards a theory of informal and incidental learning in organizations. *International journal of lifelong education*, Vol. 11, N° 4, pp. 287-300. <https://doi.org/10.1080/0260137920110403>.
- Whyte, W. F. & Whyte, K. K. (1991) *Making Mondragon: The growth and dynamics of the worker cooperative complex*, N° 14. Cornell University Press.
- Williams, R. C. (2007) *The cooperative movement. Globalization from below*. Aldershot: Ashgate.
- Xu, X. W. & Newman, S. T. (2006) Making CNC machine tools more open, interoperable and intelligent—a review of the technologies. *Computers in Industry*, Vol. 57, N° 2, pp. 141-152. <https://doi.org/10.1016/j.compind.2005.06.002>.