30TH INTERNATIONAL CONFERENCE OF THE INTERNATIONAL ASSOCIATION FOR MANAGEMENT OF TECHNOLOGY | IAMOT 2021

VIRTUAL CONFERENCE

19 – 23 September 2021
Nile University
Cairo, Egypt

INTERNATIONAL ASSOCIATION FOR MANAGEMENT OF TECHNOLOGY
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MOT FOR THE WORLD OF THE FUTURE

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KNOWLEDGE DOMAIN CAPABILITIES AS A BUSINESS MINDSET IN THE CONTEXT OF DIGITAL TRANSFORMATION

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ABSTRACT

The digital revolution, characterized by a high dynamism of technological change and a great demand for knowledge, is generating important and inevitable changes in the traditional ways in which innovation management was carried out, specifically with regard to management of skills and traditional knowledge. Also, it is demanding at a global level, a specific type of human capacities (competences) that allow innovation actors and market agents to operate in the context of the supply-demand of knowledge. This means that a type of knowledge and skills are required that present a particular duality: breadth and specialization. This duality had not been as remarkable as it is now, since the first industrial revolution occurred. On the new competencies that are required in the digital transformation in general, there is no disagreement, in fact, there are different groups of competencies that have already been defined in the sectors that make up the digital transformation. However, the theoretical basis and composition of this set of competences has not been sufficiently studied. It is not enough to know a set of skills, abilities or competencies in workers, it is necessary to identify them related and typical of the digital transformation, with which companies can generate innovation and permanently readapt to maintain their competitiveness. On this, there is not enough theoretical foundation and consequently there is a gap in the strategic foundation in the actors of innovation. In these conditions, it is not easy to respond to the new demand for knowledge generated by digital transformation. This paper tries to answer the question about which theoretical variables related to labor competencies in the artificial intelligence sector can be useful to achieve a conceptual approximation of the set of competencies necessary in this sector. With this contribution, the management of innovation and digitization of companies would be strengthened, by recognizing and then strengthening strategies that allow the creation and development of a set of specific competencies that can be developed in the context of duality of specialization and breadth. One of the most important results obtained in this work is a conceptual approximation of these competences through the “knowledge domain capacities”. In addition, these findings present a potential that could transform innovation management into a digitalization management of labor competencies. The methodology used to arrive at these results is fundamentally qualitative and interpretive. The identification, characterization and operationalization of variables was developed through the MAGG theoretical contrast method.

Key words: Strategic issues, competitiveness, quality & productivity in developing countries, digital transformation.

1. INTRODUCTION

Artificial Intelligence (AI) represents one of the main drivers of Digital Transformation (DT) (Montes et al., 2021; OECD, 2019c). Corporations and research centers are creating numerous startups that foster an ecosystem of artificial intelligence and that are modifying the economy worldwide (Montes et al., 2021). According to Santos & Massó (2016), companies must transform the way things are done, towards a transversal, collaborative, intuitive, democratic and highly technological and intelligent way. For Micheli (2018) the TD emphasizes the importance of the skills of workers as a determining factor to reduce the digital divide and to increase the innovation capacity of companies.

The demand for current skills is being affected faster than in previous times by technological change MIT (2020). The COVID-19 pandemic has resulted in the evolution of current common jobs towards non-routine tasks that are demanding a high level of qualification and creativity (Stanford University, 2021). It has also been reported that there has been an accelerated use of Artificial Intelligence (AI) during the pandemic, due to the increase in people who participated collaboratively in investigations and were forced to carry them out in virtual formats. This dynamism that AI develops is typical of technological change (Parayil, 1991; Estevadeordal & Robot-lución, 2017). AI behaves in this way given its cumulative, evolutionary and dizzying technological force that increases the ability of society to solve social, economic and daily problems. As part of technological change, AI is a driver of the economy (Zeppini, 2011).

This changing context in which DT exerts a particular and very accelerated dynamism influences organizations (Bauer et al., 2015, as it happened before with industrial revolutions. In such a way that, also the abilities and capacities of the workers have been affected. According to Gehrke et al. (2015), each industrial revolution has brought a set of abilities and job capacities that are different and more developed than the previous ones. The particular characteristic that these skills and abilities exercise in the context of DT is that they are condensed and expanded at the level of competencies (Gehrke et al., 2015). Additionally, the difference of these competencies with respect to the previous ones is that they are positioned in the space of duality: breadth and specialization. They do not contradict each other, rather they complement each other (Gehrke et al., 2015).

Therefore, it is relevant to formulate the following research question: what theoretical variables related to labor competencies in the artificial intelligence sector can be useful to achieve a conceptual approximation of the set of competencies necessary in this sector? The objective of this work is to generate theoretical inputs to expand studies in the field of innovation management, regarding strategies and actions that allow strengthening the skills of workers and thus expand the possibilities of companies in stay and innovate in highly dynamic and competitive markets (Hanusch & Pyka, 2006; Dosi, 1982; Coccia, 2018; Cantner & Vannuccini, 2018). To achieve this objective, the work is based on the qualitative-interpretive analysis of Orlikowski & Baroudi (1991), with which it is possible to initially address theoretical elements that form the basis for understanding the value of competencies in the current global economic structure.

Subsequently, the MAGG methodology (Marquina, Álvarez, Guevara & Guevara (2013) is used to contrast theories that have been produced chronologically and that have made it possible to identify and characterize a set of variables. This methodology has already been used in studies related to innovation management and TD (Escott, 2020; Palacios et al., 2021). It is a methodology that allows

systematizing and simplifying variables in the context of innovation and that can finally be used to know the state of the art of the phenomenon under study, which, in this case, would be the identification of a set of variables to achieve an approximation to the definition of knowledge domain capabilities in the AI sector. Although the selection of a specific innovation management model for the analysis of workers' competencies is not the objective of this work, it is important to note that the method of theoretical contrast (MAGG) has the particularity of being able to be used with any selected innovation approach. This means that we can consider approaches that take the perspective of innovation management from the perspective of organizations and knowledge transfer (Escorsa & Valls, 2005; Hannan & Freeman, 1984; Kogut & Zander, 1992; Geiger, 2005; Cantner & Vannuccini, 2018) to current approaches like total innovation (Xu et al., 2007; Rudskaia & Rodionov, 2018).

Initially, 80 variables were identified and they were simplified with the MAGG method and additional techniques to 28 variables. In this way, a first conceptual approximation of these competences is achieved, it is about the characterization of the knowledge domain capacities. In this work, the knowledge domain capacities are not defined, what is achieved is to give it a theoretical foundation and open space for an approximate construction of its theoretical composition through the identification of a set of variables related to the competences in the context of the DT and artificial intelligence. Finally, at work job competencies are delimited with respect to knowledge domain capabilities. The competencies correspond to the actions of innovation management (Rychen & Salganik, 2003) and these actions in practice describe and characterize the innovation capacities of companies (Cantner, 2018).

2. REFERENCE CONTEXT AND THEORETICAL BACKGROUND

For Schumpeter (1942), technological change is a dynamic process and is made up of waves of innovations that are endogenously originated by industrial transformation. This is what makes capitalism not stationary, but rather prevails over time (Schumpeter, 1978). Technological change is considered as the starting point to understand different approaches and technological innovation paradigms, but also in a way of exploring the dynamics of dominant technological patterns such as DT (Escott et al., 2020).

The concept of techno-economic paradigm developed in depth by Freeman & Pérez (1988) highlights that the technological transformations that entail a change in the dominant paradigm impact on different productive activities and generate structural crises, require changes in the institutional and social systems (Pérez, 2002; Dutrénit et al., 2008). In this way, it is also that business practices are generated, acquisition of new skills of workers, new products, infrastructure, entrepreneurs who spread the new pattern towards the system, as well as the trend of a new pattern of consumption (Freeman & Pérez, 1988).

Historically, five waves have been identified that have involved transformations in the global economic structure. Each of them has its own characteristics in terms of production patterns, resources used, knowledge production, organization of production and types of skills required in very specific production sectors (See table 1).

Table 1. Technological revolutions and their characteristics

Technological revolution	Core country (s) / period in which it takes place	Bing Bang that starts the revolution	Key Resources	Knowledge production	Organization of production	Type of skills required
First: Industrial Revolution	England 1770/1780 - 1830/1840	Cotton spinning	Cotton, iron, machinery, textile materials, chemistry	Learning by doing and technology transfer	Individual entrepreneurs and micro enterprises	abilities (physical and manual tasks)
Second: Era of steam and railways	England, Europe 1830/1840 - 1880/1890	Test of the steam engine called "Rocket"	Coal, transportation, steam engines, steel, gas, electricity	Learning by doing and the institutionalization of knowledge	Micro companies and the emergence of big companies	Capabilities and abilities (division of dangerous physical and manual tasks)
Third: Age of Steel, Electricity and Heavy Engineering	USA, Germany 1880/1890 - 1930/1940	Pennsylvania steel mill opening	Steel,electrical machinery	Institutionalization of knowledge through internal R&D departments and recruitment of scientists	Business expansion and expansion of monopolies and oligopolies	Capabilities and abilities (division of highly dangerous physical and manual tasks)
Fourth: Age of oil, automobile and mass production	USA, Europe 1930/1940 – 1970/1980	Ford Model-R in Michigan	Petroleum, automobiles, synthetic materials	R&D department expansion, technology transfer	Oligopolistic competition, multinationals and foreign direct investment	Capabilities, abilities and competences (negotiation, physical and manual tasks guided by the global economic dynamics.
Fifth: Age of Information Technology and Telecommunications	USA, Europe, Asia	Microprocessor advertisement	Microelectronics, ICTs, digital technologies, robotics,	Horizontal integration of R&D, design and production	Networks of companies, systems and production platforms	Capabilities, abilities and competences (R&D, analysis, evaluation, planning,

Technological revolution	Core country (s) / period in which it takes place	Bing Bang that starts the revolution	Key Resources	Knowledge production	Organization of production	Type of skills required
	1970/1980 to the present		biotechnology			negotiation, coordination, technology transfer)

Source: Own elaboration based on Freeman & Pérez (1988); Pérez (2002); Roitter (2019)

According to the table, it can be inferred that technological change has been progressive in the transformation of the economic structure, but also in the development of abilities, capabilities and knowledge competencies. The latter has been the dynamizing element of technological change, the more knowledge there is, the greater the potential for the dynamism of technological change and also of the existing production and technological patterns (Escott et al. 2020; Escott, 2020).

According to the Schwab (2016) reports, the current technological change is driven by technologies such as Big Data, Renewable Energy, IoT, Crowdsourcing, Robotics and AI, these technologies have particular characteristics that characterize them: a) value of knowledge as a fundamental productive factor (Boscherini & Poma, 2000) b) permanent innovation as differentiating and advantageous in the market (Antonelli, 2009) and c) innovation as an accelerator of technological change

To this are added three additional aspects, the first refers to the fact that digital technologies enable the speed of communication, coordination, control, integration and collaboration, production and distribution of goods and / or services (Mariotti, 2000), and second that the innovation process has been developed fundamentally on this framework of technologies capable of linking production sectors in a transversal way (Schwab, 2016; Tapia, 2019; Garcia & Mirón, 2013). The third deals with the value and importance of network structures for both production and knowledge, since it is from here that clusters, innovative productive platforms, productive ecosystems, among others, can be created (Huggins, 2008).

The foregoing allows two observations to be made regarding the current techno-economic paradigm:

i. Unlike previous techno-economic paradigms, where physical human work has been replaced by other abilities and capabilities, in DT the cognitive and organizational processes of companies are replaced very quickly in parallel with the development of new technologies (Escott et al. 2020; Palacios & Escott, 2021). However, it is important to mention that this process generates natural imbalances typical of any transition, such as the reduction of the labor market (Mariotti, 2000).

ii. The current techno-economic paradigm is dominated by digital technologies that together and combined make up a technological pattern that dominates the global economy (Escott et al. 2020). The dominant character attribute refers to the force that DT exerts to dominate the global economic structure through a permanent process of recombination of digital technologies (Escott, 2020). Along with the recombination of technologies are other attributes that give DT the dominant character (See figure 1)

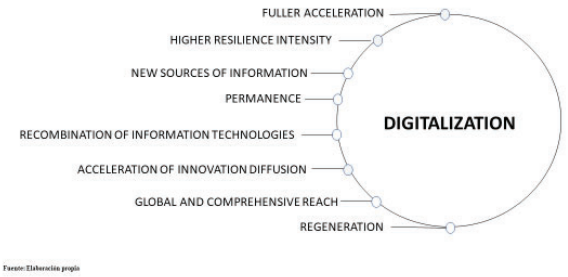

Figure 1. Approximate premises on digitization as a technological pattern dominant. Source: Escott, 2020

This characterization of DT as a dominant technological pattern allows lower than that they generate effects in organizations, in innovation management and in the development of abilities, capabilities and competences of the workers (Escott, 2020). The following figure shows both the dynamism that digitization has achieved in the global economy as well as its influence on innovation management and strategies (Dimension Meso and Dimension Micro) (Palacios & Escott, 2021).

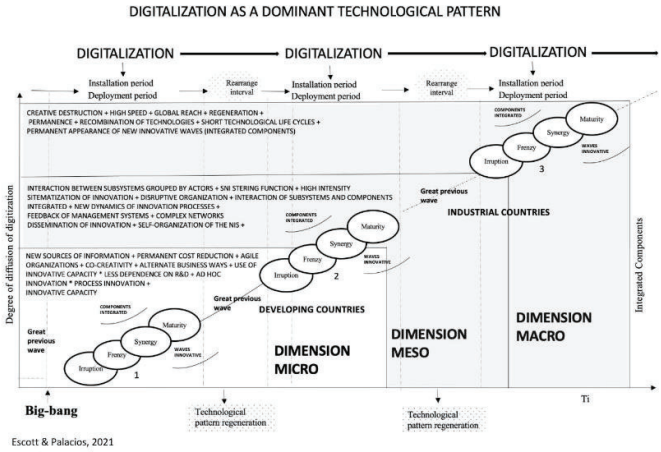

Figure 2. Digitization as the dominant technological pattern. Source: Escott, 2020

The contributions of Palacios & Escott (2021) on the characterization of digitization as the dominant technological pattern allow us to observe changes in the evolution of the technological paradigm according to the contributions made by Pérez (2004) when referring to the behavior of technological revolutions, the financial capital and the dynamics of big financial bubbles and boom times. XXI century. The changes are fundamentally observed in the fact that the maturity period of the technology when it runs out it is recombined with new digital technologies that give greater strength to the dominant technological pattern. This means that the technological pattern is not exhausted (Palacios & Escott, 2021).

For the purposes of this work, what these findings indicate is that the development of new labor competencies is most likely the product of the behavior and dynamism of the dominant technological pattern. According to Santos & Massó (2016), companies must modify the way in which things are

done, towards a transversal, collaborative, intuitive and democratic way. DT is promoting these changes and forces innovation actors to also transform their thinking models in technology management.

Some other effects are visualized on this dynamism of the technological pattern. For Micheli (2018) the DT emphasizes the importance of the competences of workers as a determining factor both to reduce the digital divide and to increase the capacity for innovation.

Another element is that global value chains are increasingly complex (OECD, 2017), so it is of utmost importance to build evaluation and anticipation systems that work and allow countries to react to the demand for labor skills changing. Other reports such as those by PricewaterhouseCoopers (2015) mention that megatrends such as globalization, digitization, migration, aging of the population and environmental pollution and COVID-19, will result in the evolution of current common jobs towards tasks non-routine that will require a high level of skills and creativity.

Based on all this context, an accelerated use of Artificial Intelligence (AI) is observed, driven by the need of global society to interact in a virtual way (Pedreño et al., 2018; Albrieu et al., 2018; Lee, 2016). Therefore, AI represents one of the main drivers of DT (Montes et al., 2021; OECD, 2019c). According to Rao & Verweij (2017), AI is generating a massive disruption in the consumer, since all those involved are driving innovation and new commercial developments.

Some other elements of AI are relevant to envision the dynamism that they have acquired and will continue to acquire labor competencies. According to Paris et al. (2017), the following characteristics of the current development of AI are identified: a) It is a sector that is already in a constant process of digitization, b) investment in human talent is high, c) There is high specialization in digital technologies at the same time that it is combined with other skills related to the development of innovation strategies as a source of productivity and performance and d) executive leadership models innovation management. Additionally, Rao & Verweij (2017) argue that the pioneers in AI have the advantage of advance knowledge of the client. This requires the capability to take advantage of consumer preferences and adapt production to those preferences and demands.

Finally, it is noteworthy according to the reports by Rao & Verweij (2017) that labor productivity will represent more than 55% of all GDP gains in AI during the 2017-2030 period. This would mean that the impact of AI on productivity could have a transformative competitive effect, where organizations that do not adapt or adopt these technologies could be quickly undermined.

In this context, it is essential to envision from the innovation management what is the strategic orientation so that workers can constantly generate knowledge and also develop and use them within the systemic structure in which innovation occurs in the context DT and artificial intelligence (Escott, 2020; Palacios & Escott, 2021).

In this work, the concept of "competencies" is adopted as the set of knowledge that allows evaluation, criticism, the emergence of a transforming element with high quality (innovation), the sustainability of products and the company in the Market, but also the application of a set of specialized knowledge (Spencer & Spencer (1993); González & Wagenaar, 2003; Rychen & Salganik, 2003; Gallardo et. al, 2015)

Unlike the capabilities that are characterized by the abilities, cognitive conditions and aptitudes of people to learn and develop a task (Davenport, 2020), the competences have a high degree of probability that the tasks generate new knowledge (Spencer & Spencer, 1993). The capabilities are a type of resource embedded in the company or in the individual, they are not transferable and their objective is productivity (Makadok, 2001).

However, capabilities are expressed in the practical aspect through competencies, so there is a close relationship between them. On the other hand, abilities, which are a set of skills that allow an activity to be carried out efficiently and effectively (Spencer & Spencer, 1993), differ from competencies because they integrate knowledge about understanding the situation, evaluation, critical, responsibility coupled with high quality performance. For Iglesias et. al (2008) the ability refers to the capability acquired by an individual that allows him to use his knowledge and habits in a theoretical or practical activity.

In the words of Rychen & Salganik (2003), competences go far beyond knowledge. Competencies include the ability and dexterity to cope with complex demands making use of their psychosocial resources (knowledge, abilities and attitudes) in a particular context. They are also the combination of attributes such as knowledge, application, aptitude, ability and responsibility performed by an individual with a high level of proficiency (González & Wagenaar, 2003). Thus, competencies can be seen as a standard of effectiveness of innovation management (Spencer & Spencer, 1993).

3. METHOD

Nowadays, competencies have been studied by different authors, from various disciplines (Spencer & Spencer, 1993; Prahalad & Hamel (1997); Lévy-Leboyec (2003); Rychen & Salganik, 2003, Schkolnik et al., 2005; Mertens, 1996). In this context, the present research has aimed at chronologically analyzing the publications of different authors regarding the concept of competences in the context of artificial intelligence. For this, the MAGG methodology has been selected as the methodology, a name derived from the authors' initials: Marquina, Álvarez, Guevara & Guevara (2013). Some recent studies have used this method to combine and contrast theories related to technological change and DT (Escott, 2020; Escott et al., 2020). The MAGG methodology is developed fundamentally in four stages: (1) Literature search, (2) Literature exploration, (3) Argument development and (4) Literature criticism. Table 2 describes the way in which the methodology has been applied.

Table 2. Application of the Marquina, Álvarez, Guevara & Guevara (MAGG) methodology

Phase	Literature search	Literature exploration	Argument development	Literature criticism
application	- The object of study is established: Identification of the components related to knowledge domain capabilities. - Chronological selection of authors based on the main theories and main theoretical exponents. - Selection of scientific reports - the selected reading is read gradually, starting with a general reading to a deep and specific reading. - Identification of the main arguments of each author.	- Analysis of the evolution of the topic over time. - Identification of related variables that affect the concept of competences.	- Classification of the literature based on the approaches given by each author on the concept of competences. - Orderly identification of the authors' arguments. - Systematization of information (Elaboration of table) where the author, definition and variables used regarding the theoretical approaches and visions about the competences are identified. - Build up of classifiers for each variable, to be unified with other variables.	- Analysis of the first table, to comparatively observe the arguments of each author. - Identification of the similarities and differences related to the theoretical approaches to competences. - Systematization of new information (Preparation of a second table) for theoretical contrast, comparing the key concepts of each author from different approaches.

Source: Own elaboration based on Marquina, Álvarez, Guevara & Guevara (2013)

3.1 Approach to the identification of variables and results

Theoretical contrast is the product of comparing the authors' key concepts about competencies in the context of DT and artificial intelligence. A set of variables (80) were chosen and defined chronologically using three types of approaches: (a) Competences focused on the individual[1], (b) Competences focused on tasks[2], (c) Relational competences[3]. The use of these approaches has allowed competencies to be considered as a holistic element that has an impact on different levels of innovation management, the development of knowledge originates in the individual and is developed with a combination of tasks associated with other individuals and organizations to the development of innovations (Llopart, 1997; Guerrero, 1999; Drake & Germe, 1994). (See table 3)

[1] whose definition of competence does not consider the context
[2] the definition aims to complete tasks associated with the individual's behaviour
[3] where the context is relevant and complex combinations of attitudes, abilities, values, skills and knowledge of the individual are made, resulting in complex solutions

Table 3. Chronology of the Type of Competences Required in the Context of DT and Artificial Intelligence

Variables	Year	General Definitions of Competition According to Variables	Autor	**Approach**
-Motivation -Traits -Self concept -Knowledge -Skill	1993	-Underlying characteristic of an individual that is causally related to effective and / or superior performance in a job or situation referred to critical criteria	Spencer & Spencer (1993)	Individual
-Knowledge bases - Training -Experience training -Innovation capabilities -Knowledge of the market -Expert programs -Organizational motivational systems -Intangible images Enduring alliances	1996	- It demands higher quality in the products and services offered by the companies, focusing on the needs of the client, without neglecting the low price and as a result the cost.	Mertens, L. (1996)	Relational
-Technological and non-technological strategies -Market -Technological activities -Strategic units -Basic skills	1996	-Result of the deployment and integration of resources over time and through characteristics. Different types of competencies are presented here: a) nuclear, which are strategically important to the successful performance of a company and b) superior, which are superior to its competitors. Both are based on the protection of the technological interests of business units	Coombs (1996)	Relational
-Business' units -Competence -Market -Strategic architecture -Distinguishing competences -Capabilities -Resources	1997	-Provides potential access to a broad market. -Significant contribution of the benefits received from the product by the end customer. -Difficult to imitate by competitors. -Medular for its position in the market and its strategy towards the future. -The knowledge that is not used vanishes.	Prahalad & Hamel (1997)	Relational
-Knowledge -Actions -Ability to relate -Search for solutions -Creation and innovation	1998	-Converge in knowledge competencies (combination and problem solving)	Nadine, J. (1998)	Individual

Variables	Year	General Definitions of Competition According to Variables	Autor	**Approach**
-Mobilization of resources -Practice-action -Capital of flexibility and adaptability	1999	-Functions, tasks and roles of a professional to adequately develop their job, as a result of a training and qualification process. -It is about technical, methodological, social and participatory skills.	Tejada, J. (1999)	Task
-Internal mechanisms -Learning rules -Productivity -Resources -Capabilities	2000	-Technological competence defining it as the technological domain that implies knowing how to conceive, produce, sell the products derived from it under advantageous and profitable conditions. It originates from the use and minority or exclusive control of some process. -It is the result of the exclusive exploitation of information acquired outside the company, but enriched within it. The knowledge gained could create a "technology monopoly".	Morcillo et al. (2000)	Individual
-Individual characteristics -Qualities -Aptitudes -Personality traits -Acquired knowledge	2003	-Repertory or set of behaviors that are dominated better by some people than by others, which in a given situation makes them effective. -The skills are directly related to the individual, while the competences are linked to professional activities and the inventory of what is essential to meet the objectives of these activities.	Lévy-Leboyec (2003)	Relational
-Demand -Knowledge -Cognitive abilities -Practical skills -Attitudes -Emotions -Values -Ethics -Motivation	2003	- It involves the ability to satisfy complex demands, drawing on and mobilizing resources (including skills and attitudes) in a particular context.	Rychen & Salganik (2003)	Individual
-Knowledge -Ambit -Skills -Learning capacity Independent	2003	-Generic competences, which are independent of other areas; several common points of all disciplines converge, without losing sight of diversity, freedom and autonomy	González & Wagenaar (2003)	Individual

Variables	Year	General Definitions of Competition According to Variables	Autor	**Approach**
		-Specific competences of the different areas, refers to the learning results within a certain area.		
-Creativity -Initiative -Versatility -Previous specialization -Employability -Productivity -Offer	2005	-Set of knowledge, skills, abilities, attitudes and behaviors that people perform effectively in organizations or work contexts. It classifies in basic, transversal or generic and specific or technical competences. -Defines the temporal, thematic and methodological dimension	Schkolnik et al. (2005)	Individual
-Knowledge -Attitude -Skill -Ethics	2010	-Demonstrated capability in daily professional and social life, includes the set of personality traits, attitudes, knowledge and skills that enable the performance of activities in a recognizable way. -They integrate the concept of digital competence as the confident and critical use of information technologies, regardless of their use.	Gallego-Arrufat (2007)	Individual
-Knowledge -Abilities -Character -Meta-Layer	2012	- Set of knowledge, abilities and skills that can be acquired and that allow people to carry out an activity in an adequate and systematic way, and that can be obtained and expanded through learning. Defines cognitive, technical, and socio-emotional competencies.	OECD (2012)	Individual
-Personal characteristics -Attitudes -Knowledge -Innate general and specific abilities	2014	-Individual work performance that includes personal characteristics, attitudes, knowledge and innate or acquired skills that perform with high quality. -It is distinguished between general and specific labor competencies according to their applicability in the labor market: a) General Competences: such as those that apply to any job or task, regardless of where they were acquired for the first time. It is identified: Foreign languages and ICT skills, corresponding to hard skills, and analytical and logical thinking, cooperation and team, work, communication and presentation, creativity, customer orientation, efficiency and achievement orientation, flexibility,	Balcar et al. (2014)	Individual

Variables	Year	General Definitions of Competition According to Variables	Autor	**Approach**
		independence, lifelong learning and self-control, loyalty, organization , planning and leadership, proactive approach and problem solving, responsibility, reliability and diligence, Sales and negotiation, strategic thinking, resistance to stress, work motivation, corresponding to soft skills and b) Specific Competences that are applicable only in the environment for which were built and are not applicable to other companies or jobs.		
-Execution of tasks -Emotional regulation -Collaboration -Open mentality -Relationship with others	2018	Socio-emotional skills that are individual characteristics that originate a reciprocal interaction between biological predispositions and environmental factors. They are manifested in consistent patterns, feelings, and behaviors.	OECD (2018)	Individual

Source: Own elaboration based on Autors analyzed

As a second step in the theoretical contrast, we proceeded to define theoretical categories such as: (1) Attitudes (2) Capacity (3) Underlying Characteristic (4) Knowledge (5) Beliefs and Values (6) Entrepreneurship and Innovation (7) Standards (8) Strategy (9) Experience (10) Abilities. Based on this categorization, it is possible to develop a process of simplification of variables from 80 to 28. The latter are presented in a structured and coherent way that represent not only the theoretical approaches of the different authors, but also, based on them It could be deepened on the characterization of a particular type of knowledge capacities linked to innovation management in DT and artificial intelligence (see table 4).

Thus, the theoretical categories are generators of "common elements" that allow the development of the "simplification of variables" (Marquina, Álvarez, Guevara & Guevara, 2013). But in addition, with this categorization, similarities of variables were identified between authors and conceptual redundancies were reduced (Marquina, Álvarez, Guevara & Guevara, 2013).

Table 4. Approach to Knowledge Domain Capabilities in the Context of DT and Artificial Intelligence

Theoretical Categories	**Common and Simplified Variables + Definition**
Attitudes	Trait: Habitual patterns or behaviors.
Capabilities	Capability: Professional equipment and resources necessary to carry out an activity.
	Qualification: Potential capacity that a person has to carry out a certain task.
Underlying Characteristics	Individual characteristics: aptitudes, personality traits. Individual representation

Theoretical Categories	Common and Simplified Variables + Definition
Knowledge	Knowledge: What a person knows about a particular area.
	Key competences: Knowledge bases, education, training
	Theoretical skills: Knowledge acquired
	Learning: Accumulation, memorization, recreation to result in knowledge, absorptive capacity.
	Cognitive competence: Knowing.
Beliefs and Values	Values / Social Roles: What the person attributes as important.
	Social exchange: Transparency, internalization of business objectives, clarity, personal awareness
	Know how to be: Values, how to live in a context and how others are perceived
	Ethical competence: Development of the concept "knowing how to be"
Entrepreneurship and Innovation	Distinctive competencies: They provide potential, contribute to the consumer's perception of benefits towards the final product, are difficult to imitate.
	Innovation capabilities: competitive advantage and difficult to reproduce, the result of contact networks
	Knowledge skills: Combination of theory, practice and social skills, combining elements to coordinate actions, seek new solutions, provide innovations and creativity.
Standards	Standard of effectiveness: Carrying out an activity effectively
Strategy	Strategic architecture: Identifies and commits to technically and productively unify the strategic business units to generate competitive advantage
Experience	Occupation trajectories: Formal and informal work as an entrepreneur, company or hybrid. Stable and / or temporary work.
	Basic competencies: bodies of technological product and process experience and organizational capacity to deploy the experience effectively.
	Tacit knowledge: related to skills, not formally collected, personal and not organized.
	Situated learning: It is built with reality, knowledge and experience of values and competences
Abilities	Skills: What the individual knows how to do well.
	Qualifications: Academic, personal development and teamwork skills

Theoretical Categories	Common and Simplified Variables + Definition
	Practical competence: Operational actions
	Functional competence: "Knowing how to do"
	Skill: Ability to execute a task in a certain context
	Ability: Be capable, be dexterous, able to do something with ease

Source: Own elaboration based on Autors analyzed

4. DISCUSSION

The effort of wanting to expand the studies related to the theory of innovation requires a sufficiently legitimate foundation that demonstrates the implications that a particular study phenomenon has on the global economy and society. This is the case of DT and artificial intelligence (Montes et al., 2021; Bauer et al., 2015; Carroll & Helfert, 2015; Hanusch, 2006; Coccia, 2018, Cantner, 2018, Escott, 2020, Escott et al. 2020, Palacios & Escott, 2021; Freeman & Pérez, 1988; Roitter, 2019; Boscherini & Poma 2000; Antonelli, 2009). Not only has it been possible in this work to describe the characterization and dynamics of both, but also, it is established here, according to the recent findings of Escott & Palacios (Escott, 2020; Palacios & Escott, 2021) that we are in the presence of a dominant technological pattern in constant dynamism and evolution; which also transfers this dynamic to organizations and innovation actors. This means that innovation management is also in constant transformation (Estrada, et al., 2016), and it also means that the actions and strategies to adapt to DT by these actors are highly dynamic but also highly complex (Estrada, et al., 2016). Therefore, it is inferred that the strategies and actions aimed at increasing the innovation capacity of companies, as it has always been conceived, rest on the agility of innovation management of having workers with a high level of competences (Rychen & Salganik, 2003; González & Wagenaar, 2003; Paris et al., 2017). The characterization of the competences according to the MAGG theoretical contrasting method used (Marquina, Álvarez, Guevara & Guevara (2013) allows us to observe that they are developed in a dual duality process: a) specialization and b) breadth. The first is a characteristic that the dominant technological pattern (Digital Transformation) gives to the competencies of workers and that refers to the fact that these require more and more specialized knowledge in the field of digital technologies, as is the case of artificial intelligence (Rao & Verweij (2017). For its part, the breadth of competencies is stimulated by the systemic nature of innovation (Estrada, et al., 2016) in which workers increasingly require holistic knowledge to develop their tasks (Rychen & Salganik, 2003; González & Wagenaar, 2003; Spencer & Spencer, 1993; Lévy-Leboyec, 2003). For this reason, the simplification of the set of variables identified on competencies in DT and artificial intelligence was carried out under three competency approaches (individual, relational, and tasks) (Spencer & Spencer, 1993). A conceptual approach on the type of capabilities that must be developed from innovation management should consider the variables finally simplified through the MAGG method. Traits, capacity, qualification, individual characteristics, knowledge, competences, learning, cognitive competence, values, social exchange, "knowing how to be", ethical competence, distinctive competences, innovation capacities, effectiveness standards, strategic architecture, occupational trajectories, basic competences, tacit knowledge, situated learning, qualifications, practical competence, functional competence and ability). If we start from the premise that both DT and artificial intelligence as a whole is a highly

dynamic and complex dominant technological pattern (Escott et. Al, 2020, Palacios & Escott, 2021), but also if this complexity and dynamism is observable in the number of variables identified related to competences, it could be positioned in the current theoretical discussion of innovation, that the development of competencies is conditioned to the development of a specific set of knowledge domain capabilities that should be generated from the innovation management itself. Here it must be differentiated and delimited that the development of labor competencies corresponds to the actions of innovation management and these actions describe and characterize the innovation capacities of companies. One of the elements of discussion that is also generated from this work is that with the complexity that the development of competencies from innovation management means, it could be overwhelmed by its operating principles and strategic positioning within the company to develop strategies in the context of DT and artificial intelligence. This could mean that part of the current actions developed by innovation management could be transferred to the specific management of digitization, where the management of labor competencies could be controlled (Raabe, et al., 2020).

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