Plataforma web para el desarrollo de la inteligencia colectiva en logística para PYME Latinoamericanas: el caso de SmartLogistiX3.com

Web platform to develop collective intelligence in logistics for Latin American SMEs: the case of SmartLogistiX3.com

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Resumen

A pesar de que el desarrollo tecnológico se está incrementando rápidamente en las cadenas de suministro, el desempeño logístico en cualquier tipo de organización se mantiene fuertemente relacionada con un conjunto de capacidades y competencias humanas. El objetivo del presente artículo es presentar el proceso de diseño e implementación de una plataforma web para desarrollar la inteligencia colectiva en logística en pequeñas y medianas empresas (PYME) de América Latina. Con base en el método del caso de estudio, se expone la estructura y procesos utilizados para la programación de la plataforma para el desarrollo de la inteligencia colectiva en logística. Este artículo expone conclusiones que permiten identificar el potencial para el desarrollo de este tipo de herramientas en América Latina, por ejemplo, debido a que la región carece una satisfactoria masa crítica de habilidades logísticas de "Clase Mundial", las plataformas web pueden jugar un interesante rol en el desarrollo de un "mercado spot" de inteligencia colectiva en logística. Un primer paso para valorar mejor el conocimiento logístico en la región, pero también, hacer más fácil el movimiento de los flujos de conocimiento logístico, más allá de las fronteras de las organizaciones. De igual forma, se presentan potenciales futuras líneas de investigación.

Palabras clave: inteligencia colectiva; logística; administración del conocimiento; informática; web; internet; pymes; América Latina; plataformas web

Abstract

Even though technological development is rapidly increasing in supply chains, logistics performance in any kind of organizations remains strongly related to a set of human-based skills and competencies. The aim of this article is to expose the design process and implementation of a web platform to develop collective intelligence in logistics for Latin American SMEs. Based on the case study method, it exposes the structure and processes used when programming the web-based platform to develop collective intelligence in logistics. This article presents conclusions that expand the panorama to develop this type de tools in Latin America. Indeed, since the region lacks a satisfactory critical mass of "world class" logistic skills, the IT platforms can play an interesting role for developing a "spot market" of collective intelligence in logistics. This is a first step to improve the value of logistics knowledge in the region, but also to stimulate the movement of logistics knowledge flux beyond the companies' bounds. Similarly, potential future research lines are presented.

Keywords: collective intelligence; logistics; knowledge management; informatics; web; internet; SMEs; Latin America; web platforms

Introduction

The increasing tendency to a "reverse globalization" is introducing important structural changes in companies operating in Latin America. The economic difficulties experienced by the region, mixed with the increasing nationalism / protectionism of different countries, are generating uncertainty and a renewed interest for internal markets (The economist, 2016; Capurro, 2017; Shih, 2020). While the trading world is breaking up into millions of markets derived from protectionist approaches (Caprice and Phadnis, 2013; Legrain, 2020), the customer's demands are increasing.

As a result, the supply chains are always more vulnerable to variability (Cedillo-Campos *et al.*, 2014) and require innovative spaces for improving logistics skills.

The strategy of different Latin American countries to move from an export-oriented paradigm based on big markets, to a major diversification, has become an important challenge for SMEs (González, 2018; CG, 2018; Bianchi, 2019). Since Latin American SMEs represent almost 99% of all companies and that they hire 67% of the total workforce, they are playing a crucial role in the economic and social development of the region (ECLAC, 2018). Nevertheless, the discrepancies in productivity should be filled since the productivity of micro-enterprises is 33 times less that the big ones' (ECLAC, 2018).

In this context, logistics is strategically important, not only regarding the direct cost it implies to operations, but also for the advantages it can bring to the overall regional economy (Guasch, 2011; Gillet-Martin, 2018). According to the Inter-American Development Bank (IDB), the national cost of logistics as a percentage of the Gross National Product (GDP) goes between 50% to 100% more important in Latin America and the Caribbean than in the other countries members of the Organization for Economic Cooperation and Development (IDB, 2018). Nowadays, developing collectively intelligent supply chains integrated to different markets is considered as a key element to the competitiveness of both companies and regions (Cedillo-Campos *et al.*, 2006; Barklay *et al.*, 2018).

It is even acknowledged that "productive systems are not disconnected from the territories" (Guerrero *et al.*, 2014) and that the effective coordination of the intra and inter-companies' flows generate collective economic advantages they could not reach on their own (Cedillo-Campos and Pérez-Araos, 2010). From that perspective and considering that "Latin America requires more supply chains" (O'Neil, 2018), the impulse of logistics innovation focused on Latin American SMEs is crucial to the future of the region. Actually, and since innovation tasks are traditionally leaded by the executive levels of the companies (EFT, 2017), four main reasons that prevent regional SMEs to grow have been identified: I) Lack of managerial skills to improve decision making; II) Lack of consciousness about the fact that sharing "better practices" improves organization's skills and empowers innovating potential; III) Weaknesses in specific technical knowledge; and finally; IV) Lack of integration in cluster's networks.

This is why one of the main challenges of the Latin American SMEs is to increase their logistic skills throughout the mobilization of human knowledge. It means moving towards the

development of "collective intelligence in logistics" as a mechanism of competitive development. To boost it, SMEs need to create contexts that favor the internalization of knowledge, innovation and practices already generated by other companies worldwide.

From this theoretical perspective, it must be said that even though different definitions exist for the term "collective intelligence"; in this paper, it will be understood as "a form of intelligence universally distributed, constantly improved, coordinated in real time, as a result of effective mobilization of competencies" (Levy, 1999) or in a nutshell "nobody knows it all, we all know something" (Levy, 1999). For logistics specifically, we define "collective intelligence in logistics" as:

> Ability to co-create solutions to complex logistic challenges throughout the synergy with a diverse group of people, members of an eco-system of organizations, who constantly share information, knowledge and best practices in a coordinated way, to reach a common performance that could not be achieved individually.

At the same time, since innovation is one of the key objectives when implementing a collective intelligence strategy, it is important to define best practices and technologies to develop it. For this paper, innovation will be understood as "the implementation of a new product or significantly improved (good and/or service), or process (a new or significantly improved manufacturing method or supply that includes significant changes in technics, equipment and/or software), a new marketing method (product design, packaging method, promotion, distribution or pricing) or a new organizational method in business practice, place to work or external relations" (OECD, 2005). Likewise, "open innovation" is considered as "the use of intentional knowledge inputs and outputs to accelerate internal innovation, as well as to expand markets for the external use of innovation" (Chesbrough and Crowther, 2006).

Today, thanks to reports as LPI (Logistics Performance Index), it is globally accepted that logistics is a key enabling sector for competitiveness. For example, it currently contributes close to 14% of the European GDP (Alice, 2015). Furthermore, innovation is responsible for almost 50% of U.S. annual GDP (U.S. Chamber of Commerce Foundation, 2015). Thus, the importance to create a context where innovation and logistics are connected is critical. In this sense, IT platforms

have been a great help when creating collaborative contexts to make innovations appear from spaces (communities) of creativity.

Today, there are two types of platforms that are driving innovation in logistics. On the one hand, we can find the platforms that make the interaction inside the organization easier, by improving document communication and interchanges between teams. A few even include persons from outside the organization such as suppliers, partners, etc. Shift and Macrolynk are good examples. Even though they both provide a favorable environment to effective flows inside the organizations, they could still improve their schemes and/or tools to solve problems dealing with logistic innovation.

On the other hand, we can find intermediaries platforms (open innovation intermediaries platforms) that focus on solving specific problems and create "solver" communities. Their aim is to attract, by extrinsic motivations, a large number of individuals with different experiences and willing to offer solutions to specific problems. In this category can be found general platforms (with no specific focus on logistics) such as Kaggle, Innocentive and Ninesigma. Nonetheless, they present two aspects that must be discussed. On the one hand, and because the problem-solving process is left entirely in the hands of the participants, the potential solutions can be creative. But on the other hand, since there is no minimum structure for problem solving, participation in these platforms is low (Majchrzak and Malhotra, 2013, 2014; Martinez-Torres and Olmedilla, 2016). This is not a minor question. According to Huang *et al*. (2018): "user contributions are important drivers of technological progress and business value".

This is actually an opportunity for "open" collective intelligence platforms to exist. Open platforms should be here understood as the ones that are not sponsored by an organization which creates products and/or services and uses the platform for asking consumers to improve them. From this perspective, the aim of this article is to expose the design process and implementation of a web platform to develop open collective intelligence in logistics for Latin American SMEs. To do this, the case study research methodology was selected to explore the processes and experiences when implementing it. This approach provided an "all-encompassing method" for systematically studying and describing a phenomenon (in this case, the implementation of a collective intelligence technology) within a real-life environment (Yin, 2003).

The document is organized a follows. Section 2 presents the background of the problems SMEs operating in Latin America are now facing. Section 3 discusses the methodology used to

analyze how the platform increase the users' collective intelligence in logistics. Section 4 exposes the analysis and discussion of results, and finally, Section 5 presents conclusions, limits of the research and potential future research.

Background

Improving logistic skills to meets clients' expectations, as well as increasing competitiveness are two of the organizations' main objectives of around the world when it comes to innovating. In fact, to the question "what is the most important element to innovate in your organization?" 28% of the participants to the survey carried out by EFT (Eye for Transport) answered: "meeting the client's needs", and 24% "remaining competitive" (EFT, 2017).

The same survey established that 51% of manufacturers, retail sellers, and logistics providers are not satisfied with the effectiveness of the supply chain innovation developed in their own organizations. Likewise, 52% of manufacturers, retail sellers, and logistics providers do not count with a formal innovation strategy. This means that they do not count with any budget or any "best practice" or process to support innovation.

For Latin American companies offering products and services worldwide, logistic innovation is becoming a key source of competitive advantage. In fact, Latin America and the Caribbean are the region with the main breach in logistic abilities (The World Bank, 2016). According to a study developed by McKinnon *et al*. (2017), 43% of the participants indicated that the availability of executives in logistics; that is to say work force with specialized knowledge, is "low" or "very low". Furthermore, for each of the three remaining workforce groups (operators, administrative and supervisors), almost one third of the participants mentioned a low or very low availability level of human resources.

In Latin America, knowledge and logistic practices transfers are possible thanks to global companies opening industrial facilities in the region. Nonetheless, the transfer process has not been easy. For corporations operating in different markets, the problem lies in how to transfer knowledge, best practices, or innovations to their operations in Latin America. But at the same

time, to adapt them to the local operational environment, always respecting the strategic objectives. It means, controlling the "hybridization" process of the standard model designed by headquarters (Boyer and Freyssenet, 2016).

Latin America SMEs lack corporative schemes to boost innovative processes. Consequently, logistics innovation is left to serendipity of "providence" with a limited impact on clients. Thus, logistic innovation in SMEs in Latin America are often "simply created" by operators as a result of a client's specific request. As such, SMEs realize many "one of a kind" innovations that cannot be profitable when implemented to a greater number of clients. In fact, without a corporative framework designed to take advantage of their "custom made" innovations, and with an operative framework based on closed business structures (local focus and family management), only a few SMEs can reach distinctive abilities.

Since logistic innovation is often based on remodeling current logistic solutions differently, another challenge for SMEs is about how to best motivate and "link" employees in ways that continuously let innovation emerge. According to Uhi-Bien and Arena (2017): "Part of the solution lies in the power of network structures and the ability of organizations to create what we have termed adaptive space". In that sense, the collective intelligence web-based platform here analyzed (SmartLogistiX3.COM) is a space where networks and an organizational context can be built through thematic communities. That space allows people to deliver ideas, best practices, experiences, and information that flow across organizations. It co-creates an adaptive space that facilitates flux of ideas.

Regional perspective

Nowadays, multiple factors, at different levels, are leading a progressive disintegration of the value chain, both horizontally and vertically. Consequently, current SMEs' operations in Latin America are more challenging than ever. This is the result of the ever-growing demand from Latin America, requiring more and more complex services and goods, with shorter and faster lifecycles. But this is also the result of operative risks such as the financial and market volatility, problems to meet

high quality levels, supply chain disruptions due to natural disasters or to human interference, reduction of security levels, challenges in infrastructures and corruption (Branco *et al*., 2014; WEF, 2020).

This is why Latin American SMEs need to quickly integrate the logistic knowledge currently outside their organizations' boundaries (Howells *et al*., 2003; Dahlander and Gann, 2010; Huizing, 2011; Lichtenthaler, 2011; Valdez-Juárez *et al*., 2018). In fact, the region starts to value exogenous logistic knowledge to boost endogenous innovation processes. Nonetheless, the important challenge is not only about information interchange, but also about the mechanisms to transform this information into concrete and innovative solutions as part of a community of specialists. In fact, Latin American SMEs need to move fast from the current traditional management practices in which innovation is usually considered as part of an extraordinary achievement, to an organized process that involves diversity, independence and highly integrated cooperation networks. To accept innovation as a social matter.

Different authors (Ebersberger *et al*., 2010; Spithoven *et al*., 2013; Vahter *et al*., 2014; Peltier *et al*., 2020; Zhang *et al*., 2020) found that to increase performance, free innovation flows are important for both SMEs and large companies. But as a starting point, opening collaboration and interchanging information and practices are even more important to develop innovation in SMEs. Other authors (Theyel, 2013; Ebesberger *et al*., 2010; Idrissia *et al*., 2012; Spithoven *et al*., 2013, Vahter *et al*., 2014) informed about different results regarding the success of SMEs when implementing free innovation flows strategies. In this sense, Serhat *et al*. (2016) argued that these contradictory results are related to the differences of company environment in different countries. Supply chains operating in a given geographical space are in fact the link between productive systems and the territories (local conditions) where companies are located. Logistic knowledge is therefore also a key element in synchronizing efforts to improve collective performance between members of the industrial system, and components of the territorial system (actors involved in constructing and managing infrastructure, creating, and broadcasting logistic knowledge, etc.). We are now witnessing the emergence of a new competitiveness based on the ability to develop "collective intelligence" on public-private logistic flows.

Nevertheless, and considering that collective intelligence not only requires a broad and continuous exploration of new ideas and concepts, but also valuable information and advanced technologies, Latin American SMEs are constantly limited by their internal abilities, not only for

exploration activities but also to absorb and convert acquired knowledge and technologies in profitable logistics skills (Vossen, 1998; Van de Vrade *et al.*, 2009; Chesbrough, 2011). Even though Latin America demonstrates some scientific production, and technological development in logistics; knowledge institutions and productive systems are highly disconnected (Stiglitz *et al.*, 2017).

Knowledge and research institutions are usually assessed on their scientific papers produced, which means that research topics are selected by considering the global trends of the main scientific journals in which Latin American researchers wish to be published. On the other hand, SMEs hardly ever count with enough human resources or training to understand and adapt the logistic knowledge produced by the local and international institutions. As a consequence, Latin American SMEs only have a limited "absorption capacity" to identify opportunities related to the business applications of the knowledge and state-of-the-art technologies in logistics (Cohen and Levinthal, 1990; Parida *et al.*, 2012). Actually, talent and tools specially designed to continually increase skills in logistics are still lacking (McKinnon *et al.*, 2017).

Over 77% of companies in Latin America are SMEs focused on export (ILO, 2015), since logistic innovation is becoming a key factor for competitiveness in foreign trade (Hausman *et al.*, 2013), most of them agree logistic innovation is critical to reach effectiveness (Maier *et al.*, 2014). But even in the automotive industry, one of the key manufacturing sectors for countries like Mexico, Brazil or Argentina, there is no effective structure to back up innovation environments and processes, whether in big companies or SMEs. Actually, over the last decades, the automotive industry has developed innovation schemes managed by headquarters and based on procedures that guarantee the alignment of all members of the supply chain to the strategic objectives of the company. Nonetheless, and because supply chains are currently becoming complex networks, logistic operations have become more and more of a challenge for all members of the automotive ecosystem (see **Fig. 1** and **2**). "Linear" analysis is now over; complex dynamic networks are in place; logistic skills must evolve.
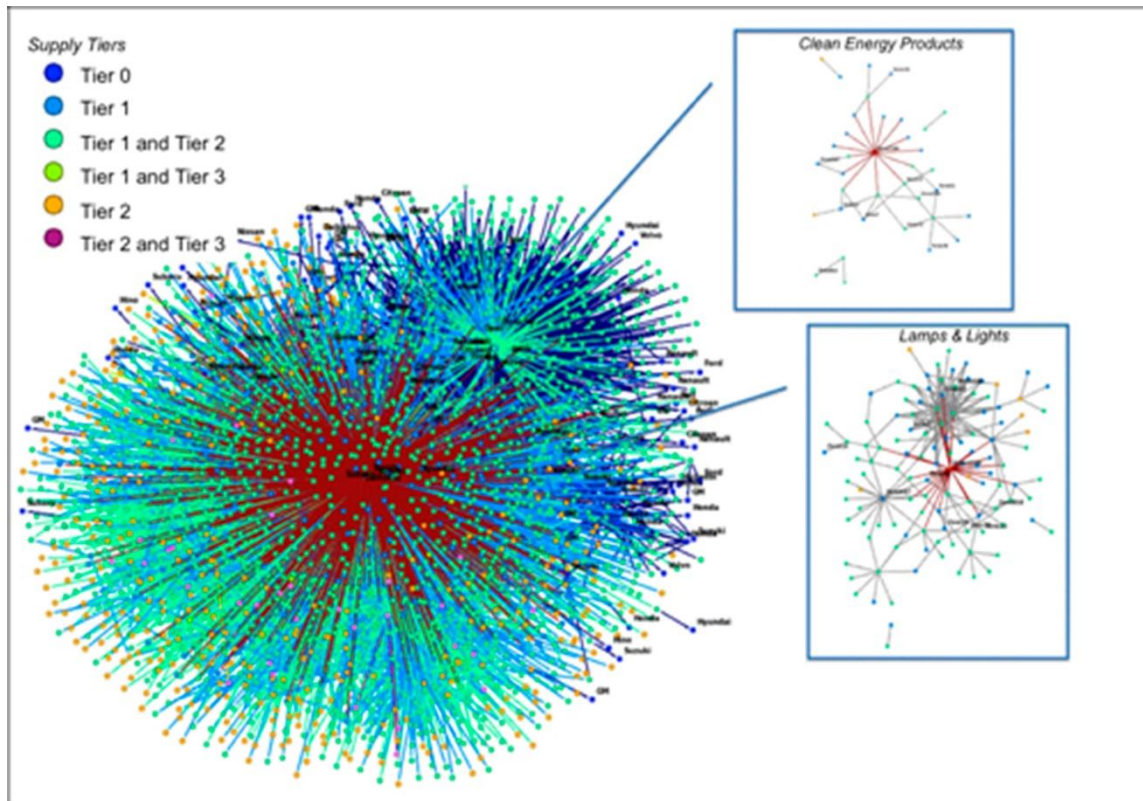
Fig. 1. Toyota integrated supply network (Brintrup *et al.*, 2011)
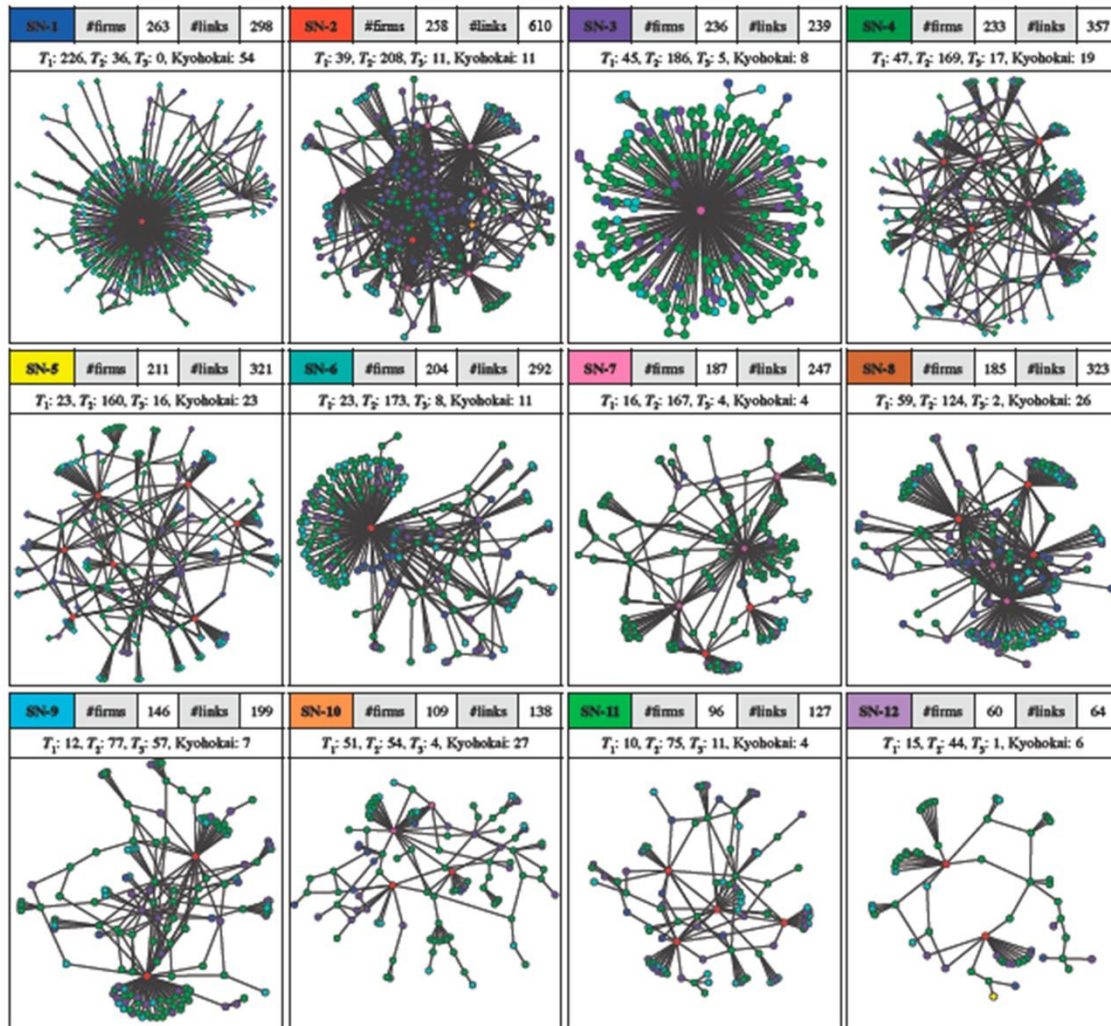
Fig. 2. Toyota sub supply networks (Kito *et al.*, 2014).

Typically, research and applications related to innovation in Latin America have mainly focused on the institutional links based on the physical interaction of people networks (Olavarrieta and Villena, 2014). However, the increasing internet services in the region provide a new environment to create collaboration tools based on Web 2.0 technologies (see **Fig. 3**). Since innovating is nowadays a highly social activity that requires a large and diverse work group, Web 2.0 has considerably reduced the access costs for a large quantity of individuals with different knowledge and location (Morgan and Wang, 2010; Terwiesch and Ulrich, 2009; Zwass, 2010; Lopez-Flores *et al.*, 2015).
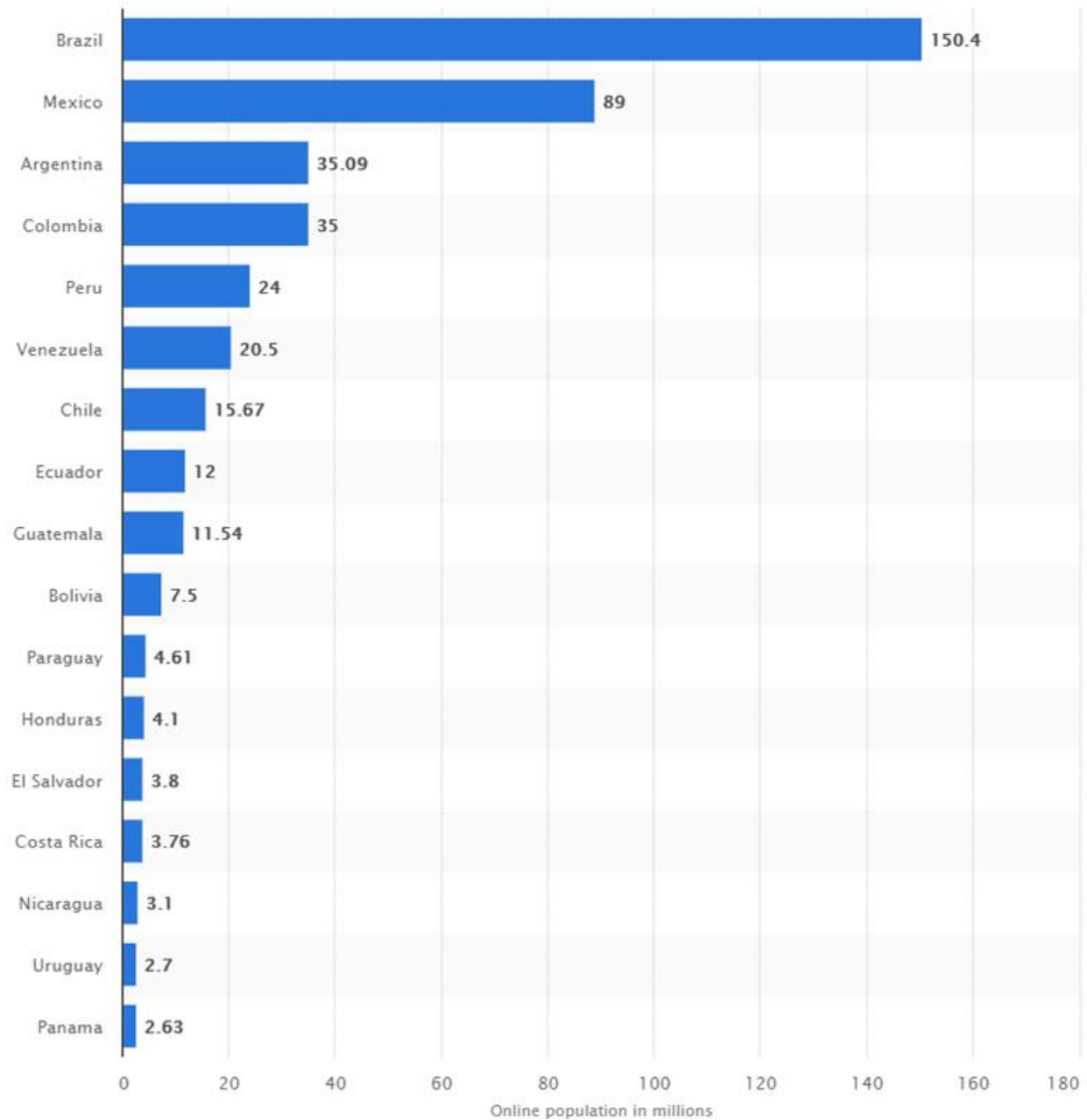
Fig. 3. Millions of Internet users in selected Latin America countries (Statista, 2020).

In fact, there is now in Latin America an important number of professionals with different knowledge, abilities, and cultures who work in different logistic areas. However, they do not interact yet in a way that could co-create collective intelligence.

Our hypothesis is that it is now possible to create systems that offer to logistic professionals an adaptive environment based on an interactive platform to share knowledge, practices, and

experiences, as a base to co-create collective intelligence. Creating collectively and continuously innovative logistic solutions could be the path to increase innovation in Latin American SMEs. This means taking a limited number of innovations, currently "custom made" to meet a specific requirement from a client and develop logistic solutions with a "mass customization" approach that can be modularly adapted to different needs. It also means fostering the profitability of the innovative solutions as a way to boost innovation in logistics.

Intelligent service system

The perspective of an intelligent service system is nowadays understood as a convergence between service science and open innovation (Abbate *et al.*, 2015). The next step could be to integrate service science and collective intelligence. From this perspective, a community of professionals based on Internet and focused on improving logistics in Latin American SMEs should consider three important components. The first one is to design tools that make communication easy and generate trust for all users. The second one refers is to establish suitable schemes that enable an active and well-organized participation of the communities in problem solving. The third one is the convergence of all the components mentioned above, so organizations can move from an open innovation scheme to collective intelligence based on a service perspective. The idea is to meet a transversal cognitive system, with services specialized in solving specific problems.

Research and technological progress in open innovation have mainly focused on fostering collaboration throughout organizational connections inside companies. However, the client is also a key element to the equation when co-creating added value (Marchi *et al.*, 2011; Poetz and Schrierier, 2012). Offering high quality interactions that enable supply chain partners, from suppliers to final client, to co-create highly differentiated logistic services, is the key to reveal new competitive advantage sources. The "wisdom of crowds" (Surowiecki, 2005).

Wisdom of crowds to co-create logistics added value is a new way of collective intelligence. In this sense, Page and Hong (2004) offer an important base. Their research found that a diverse group de problem-solvers reaches a better collective assumption than a group of solvers with a

better performance, but working independently. In other words, a group of multiple intelligences performs better when its analysis is integrated than when expert-minds only work isolated (Ball, 2014). However, to reach outstanding results, the solver group must count with a certain degree of diversity at different levels (gender, culture, professional background, mind-set, etc.).

Methodology

For achieving our research goal, we needed a method to facilitate a comprehensive understanding of process design and challenge implementation involving the selected web platform. Thus, a framework based on the case study approach (Stake, 1995; Yin, 2003) for collecting, analyzing, and triangulating several sources of quantitative and qualitative data, including documents, personal interviews, and direct observations, was selected. The case study approach was identified as a research method allowing us to develop an exploratory research, on an innovative collective intelligence technology within an inimitable circumstance, the Latin American SME innovation context. As Yin (2003) argues, a case study approach is suitable when investigating an up-to-date research object within its real-life circumstances.

We decided to study if a structured and systemic approach based on the web 2.0 technology to solve problems would be useful as a tool for developing collective intelligence in logistics in the Latin American SME capacity. As mentioned above, logistic innovation in Latin American SMEs usually emerges from an unplanned solution, meeting a specific requirement from a client. As a result, innovations cannot be often repeated and cannot be profitable either. In this context, using these innovations with other clients is just as expensive as reinitiating a co-creation process with another client. There is no scheme to develop collective intelligence in logistics.

To understand this context, Wagner, and Franklin (2008) argue that three aspects must be considered. First of all, this kind of "custom made" innovation is usually the result of the creativity and experience from operative workforce. Second, the nature of the challenge and the time available to solve it define the innovation grade of a solution. Third, since in logistics an innovation

is usually co-produced by combining specific tools owned by the service provider as well as by the client, this co-creation can hardly be reproduced in other organizations with similar challenges.

Thus, for studying the web-based platform, we decided to use the analytic framework proposed by Wooley *et al.* (2015) who argues that a system for developing collective intelligence should count with: I) Structure; II) Processes; III) Incentives and IV) Workforce.

Structure

To analyze the structure, the approach offered by Glenn (2003) was used. The author argues that collective intelligence is the result of an intense synergy between: I) Data/information/knowledge/practices/solutions; II) Software/hardware; and III) Participants. In a complementary way, a specific perspective called "collective intelligence in logistics" was defined.

The platform structure analyzed here is closely related to the figure of a "collective intelligence intermediary" (CII). It is a private company that offers an IT platform where professionals with innovation challenges can meet a community of solvers. But at the same time, these professionals can be part of a specific community in which all participants share innovations, best practices, and comments to improve their daily activities.

As part of the company business model, it charges for different help desk services to innovation, and also for the access to different organized communities of persons interested in specific topics. The web-based platform designed three main processes. The first one includes a search process of the best practices, knowledge, and comments related to a specific topic that interest users. The second one implies a connection process between solution searcher, and solvers in which toolkits and consulting in collective intelligence are offered. The third one refers to the help process to take advantage of the benefits the platform offers to answer identified innovation opportunities (adopting practices and knowledge, identifying solvers in an innovation challenge, etc.). Likewise, the platform-based offers training services online about marketing, intellectual property, and support to define accurately the innovation challenges or projects.

A critical part of the platform to promote the commitment of the user is the support provided by a "cognitive assistant". The key factors to develop the user knowledge contributions with an online community are, on the one hand, their predisposition to share with others, and on the other hand, their ability to contribute to collective knowledge (Huang *et al*., 2018). To improve both, the studied platform invites acknowledged leaders of the subject to be cognitive assistants or according to Arena *et al*. (2017) "central connectors". They are people who are selected based on their reputation and wide professional connections.

The platform counts with at least two cognitive assistants for each thematic community. This strategy has a double aim. First of all, it increases the predisposition of the users to share their knowledge, and practices with people they recognize as leaders in their professional sector. And second, it empowers cognitive assistants to spread knowledge, and to lead exchanges within each community. In fact, several authors had already outlined the role of the leader users (Von Hippel, 1986; Morrison *et al*., 2000; Morrison *et al*., 2004; Franke *et al*., 2006; Jeppesen and Laursen., 2009). It was even established that there is an increase in contributions from users when they receive direct acknowledgement from the cognitive assistants. At the same time, and just like Huang *et al*. (2018) did, we identified that the knowledge spreading process is a cause of major knowledge contributions to the platform, and also of increased trust between users.

Since "clockspeed" (Fine, 2000) increases every day in supply chains, logistics has become a specialized knowledge area. In this context, the platform defined different communities dedicated to collective intelligence. For example, as the AML report states (2017), vehicle routing problems (VRP), risk management, and inventory management are among the most common challenges for Latin American companies. For example, among the VRP community members, we can see a large number of decision makers, policy makers, and scholars.

In this sense, leaders for each thematic community or cognitive assistants screen specific topics and promote active participation from community members. The leaders of each community are cognitive assistant, in the sense defined by Abbate *et al*. (2015). They are the ones who learn, reason, and create connections between community members, and become helping entities to organize different roles inside the community (searchers, solvers, etc.).

Processes

Based on Wooley *et al*. (2015), we analyzed the organization of processes as follows: I) Memory in groups; II) Problem solving; III) Group learning; and IV) People.

Memory in groups

Memory in groups is understood as a shared system used by individuals in a group to codify, store, and recover best practices and knowledge. Thus, the studied web-based platform offers different digital tools to different communities.

To codify knowledge, innovations, best practices or an innovation challenge by solvers, users can use a template they can fill. Another option is to use the web camera of the computer to share a video with the same information required. The information is stored with key words defined by the users. This way, when another user is looking for information, key words help to find it (see **Fig. 4**).

Fig. 4. Information screenshot about available experiences (SmartLogistiX3.com, 2019).

Problem solving

Problem solving is the main process of the web-based platform. Even though there is a large number of platforms that try to promote value services to solve complex problems, they all seem to lack of structure to provide coherence to the challenges or problems put online by users. They also lack support schemes for users who try to offer solutions to challenges or problems. According to Georgi and Jung (2012), the lack of systems to solve problems makes the problem solving uncertain.

In this context, innovation toolkits are becoming an alternative to help users to innovate. According to Hippel and Katz (2002), the documented experiences about the use of toolkits show that the added value was created faster, and at a lower cost. Using online toolkits is not only useful to solve problems, but also to propose a new product or service to potential users, or a challenge to the members of a specific community.

Since solving a problem requires information, and specific skills, using a toolkit is a useful way to accelerate, and provide certainty to the innovation process. In this sense, and based on the most important topics mentioned by companies and academics (AML, 2017), nine logistic toolkits were put online. These toolkits help the innovation processes on topics such as: I) Vehicle routing; II) Inventory management; III) Warehousing; IV) Transport management; V) Supply chain strategy; VI) Supply chain risk assessment; VII) Supplier selection; VIII) Lean manufacturing; IX) international trade. Nevertheless, since there are many other complex logistic problems professionals must solve, the web-based platform also provides consulting to define problems and challenges.

Problem solving collaboration

By considering the collaboration process as key for an effective operation of the platform, developers designed a synchronic process. It means that an online community shares the data about a problem. As such, other members of the community immediately notice any change realized by anyone. The web platform followed a generic collaboration model in six steps:

1. Challenge detection.
2. Reward definition (intrinsic, extrinsic incentive or a mix).
3. Sharing with the solver community.
4. Receiving solutions.
5. Assessing and classifying solutions.
6. Defining the winner and providing feedback to other solvers.

Group learning

Another aspect is to make users' learning easier. There are two paths to learn. The first one is through participation to solve problems. Indeed, solvers learn when they design a solution, but also when they receive feedback about possible improvements regarding their proposed solution. The second path goes when users identify in the database an opportunity to adopt an innovation that was previously implemented and ranked by other users. Indeed, even though a "best practice" can work in an organization, adopting it and transposing into another organization require a specific thinking process, and an implementation development.

Any of the two paths depends on the specific skills the user can count with. In this sense, the platform offers online training services (webinars, short classes, proceedings of conferences in logistics, and other materials) that enable the users to increase their skills. In fact, in alliance with the Mexican Logistics and Supply Chain Association (AML), the platform offers a certification in logistic and supply chain management skills.

The owners of the web-based platform decided to sign a partnership with the Mexican Logistics and Supply Chain Association (AML) for its important role in skills development. In the survey carried out globally by McKinnon *et al.* (2017), most of the respondents (around 78% in developed regions, and 68% in emerging regions) consider that the professional associations in logistics have an essential or important role to play. Respondents argued that this kind of organizations must promote skill certification in logistics, transportation, and supply chain. The survey also mentions that in emerging regions (such as Latin America) "a significant major part of the respondents considered the role of associations as vital".

Since the web-based platform users want to count with help from experts in designing and implementing solutions; companies certified by the AML are allowed to promote their services inside the communities. This is why an algorithm was developed to identify the interests or needs of each user. Then, focused information is sent to them. Finally, to promote the protection of intellectual property created on the web platform, it offers links to specialized services of intellectual property protection, and also specific consulting in logistics, supply chain and transportation engineering.

A tool used by the platform to promote and assess learning in each user as well as their ability to increase collective intelligence in logistics is the "collective intelligence index in Logistics". This index is multi-criteria and takes into account aspects such as: I) Number of contributions (cases of innovation and best practices) to the community; II) Number of problems/challenges solved; III) Number of challenges proposed to the community; IV) Number of classes and webinars to which they participated; V) Certifications of skills in logistics, transportation and supply chain; and VI) Number of logistic products/services patented among others.

Incentives

The web-based platform manages two types of incentives: I) Incentives focused on the extrinsic motivation (monetary incentives), and II) Intrinsic incentives (the ones related to the

acknowledgment from the specialist community). The first ones come with a process of problem solving, linked to a challenge proposed by an organization or a professional that would grant a monetary reward to the community of specialists. The second ones are more related to winning a major acknowledgment through increasing the "collective intelligence index in Logistics" that ranks users. Actually, the rate is constantly recalculated depending on user's activity inside the platform.

The intrinsic motivation is one of the key elements to attract and retain participants when it comes to improving best practices. This is why the algorithm that measures the "logistic intelligence index" of the participants has become vital to motivate participation when sharing best practices. However, extrinsic motivation is more important when the aim is to attract and retain talents that are only interested in participating to solve challenges.

Since challenges come from problems exposed by a specific organization that expects a turnkey solution for which it would own the intellectual property rights, the participants expect a reward related to the added value the solution provides. The web-based platform strategy has been to help companies interested in posting challenges, as well as to define the proper reward so both parties would be satisfied. With this in mind, a "yield management" algorithm was designed to clearly establish the reward level for any specific challenge. It depends on variables such as: I) complexity level; II) Knowledge expertise level, and III) Number of people interested in participating, among others.

People

As Geum *et al*. (2013) mentioned, the success to innovate depends on the fact that the people involved must be the right ones. As a consequence, one of the most critical aspects is to attract skilled and motivated people. The central idea of Crowdsourcing is based on the notion that a large group of persons is more intelligent than a small elite, no matter how smart each individual might be (Surowiecki, 2005). This is why counting with a motivated community interested in developing specific solutions is now an important asset to companies. Nonetheless, because of the lack of

talent, attracting it has become an important challenge (Wang *et al*., 2013; McKinnon *et al*., 2017). Solving online challenges enables to involve enough experts from different background and skills to reach solutions with high added value.

On the other hand, the way skills are defined to solve a challenge is critical. Identifying properly the most appropriate solver community for a challenge as well as incentives, are two aspects that are also key to the success of the web-based platform. In this sense, an algorithm was designed to assign challenges to specific communities. It was defined based on the correlation of keywords assigned to a project or challenge, and the most frequently keywords shared in communities.

Analysis and discussion of results

The web-based platform is now showing an increase of 491% of its members. It went from 99 participants three months after it was launched in May 2016 to 486 in May 2017. These members have been organized in eight thematic communities (see **Table 1**).

Table 1. Thematic communities.

No.	Community	No.	Community
1	**Warehousing:** -Warehouse management. -Warehouse management system (WMS). -Warehouse distribution. -Flow analysis. -Labelling. -Warehouse risk.	5 6	**Inventory management:** -Optimisation -Cost analysis **International trade:** -Strategic fiscal controlled enclosures. -Procedures for verification of the origin. -Supply chain security.
2	**Transportation:** -Transportation management. -Operation costs. -Routes and territories optimization. -Transportation safety.	7	**Human resources:** -Staff allocation. -Talent management.
3	**Direction and operation of supply chain**	8	**Manufacturing**

	-Total logistic cost. -Risk analysis. -Continuity plan. **Supply chain strategy**: -Competitive strategy. -Business intelligence.		-Forecasts. -Lean Manufacturing. -Operative risk.
4			

Looking for a better understanding of thematic communities' behavior, we classified our analysis in three sub-sections: I) Motivation; II) Intensity of the interactions, and III) Thematic intensity.

Motivation

Based on the analysis provided by SmartLogistiX3.com, the motivations to develop interactions on the platform are:

a) Problem solving   39%

b) Acknowledgment   28%

c) Sharing information   19%

d) Communication tool   09%

e) Marketing   05%

Interaction intensity

Regarding the interaction intensity, we established that out of the entire community, the members located in the metropolitan area of Mexico City are the most active. They publish 67% more logistic experiences than the users' average. Equally, the members located on the States of Nuevo León,

Queretaro, and San Luis Potosi respectively publish 32%, 18%, and 2% more logistic experiences than the users' average.

Regarding gender of the members (see **Fig. 5**), men published more experiences in the States of San Luis Potosí, Nuevo León, Querétaro, Estado de Mexico, Sinaloa, Hidalgo, and Mexico City. Internationally speaking, the greatest participation was observed in Hamburg, Germany, and in Lima, Peru. On the other hand, women in Mexico published more in San Luis Potosí, Yucatán, Nuevo León, Querétaro, Mexico City, and Coahuila. From an international perspective, women published more in Lima, Peru and in Bogotá, Colombia.
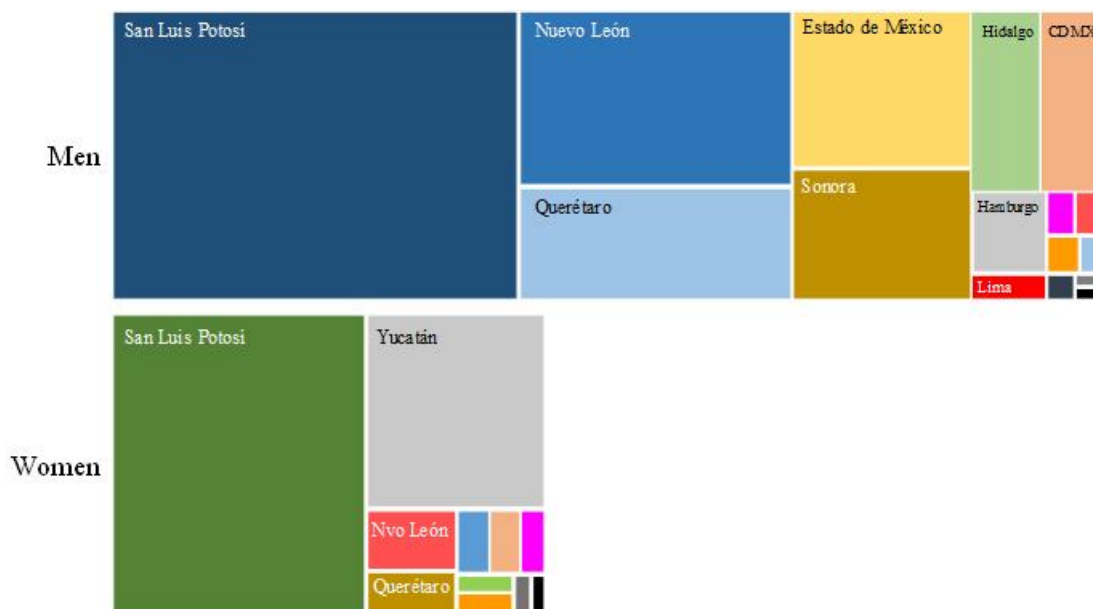
**Fig. 5.** Intensity of interaction according to gender (SmartLogistiX3.com, 2018).

Thematic intensity

The thematic analysis of the interactions exposed the most commented topics, why and with what intensity. In short, we established the intensity of interest for each of the eight topics identified in **Table 1**. For example, it was established that topic three (3) "Direction and operation of supply chain" was one of the topics that received more comments. However, it is not the topic for which

users share the greatest number of experiences. It is actually for topic one (1) "Warehousing" that more experiences were available. This is probably linked to the fact that warehousing is a key subject to absorb the increasing variability in USMCA (United States-Mexico-Canada Agreement) supply chains.

On the other hand, it is surprising that the topic that less comments and experiences received was "inventory management"; even more so because it is a topic that appears in various analysis as a source of concerns for logistic professionals. A reason could be the abundant amount of material available on the matter, and therefore highly specialized skills are required to add value. It is a topic for which contributions, and experiences are fairly low, but nonetheless, counts with an acceptable number of comments.
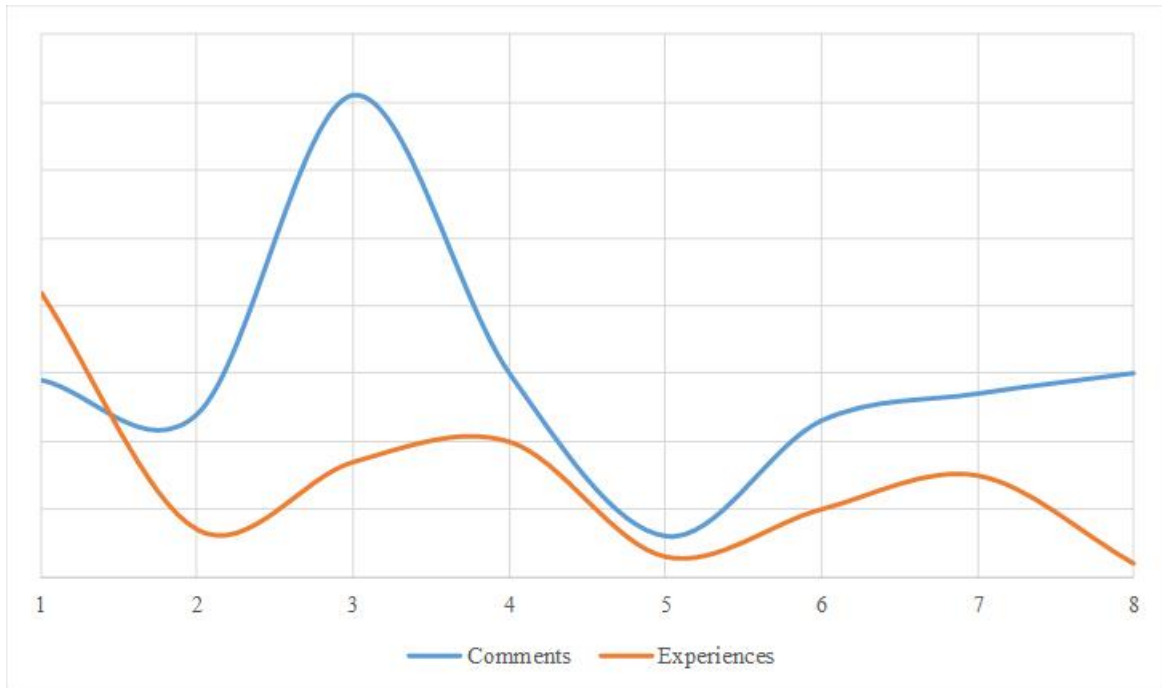
Fig. 6. Thematic intensity of interactions (SmartLogistiX3.com, 2019).

A possible reason, that would still have to be verified, could be the performance the thematic leader is playing. Indeed, their performance inside the community is a key influence on its dynamic. As such, a great notoriety of the thematic leader may inhibit participation from the members (fear of giving experiences and/or comments under an expected level of quality), but it could also be

because of the intensity and/or type of interventions the thematic leaders (or central connectors) developed inside the communities.

Conclusions and future research

It is important to mention that this article presents the importance of "online" communities to develop collective intelligence in logistics for SMEs, especially those running operations under a Latin-American context. Because of the increasing complexity and requirements of knowledge to develop efficient logistic operations, having access to a large group of specialists is more and more a key lever for the organizations competitiveness. Nonetheless, the reduced number of specialists in logistics, and the wide diversity of topics Latin American SMEs are now facing on a daily basis, make it virtually impossible to have access to knowledge, and intelligence required for stilling internationally competitiveness. Furthermore, as Van Hoek (2020) highlights, under critical circumstances (for example: H1N1, COVID19, etc.), nowadays, talent management in supply chains needs to stimulate attention not only on costs reductions, but also on resilience as well as on gaining collective intelligence from disruptive events to improve decision-making.

Based on McKinnon *et al*. (2017), we made clear that even though the use of technologies is an increasing part of supply chain management, the effective implementation of logistics in the organizations is still greatly linked to the skills of human resources. As McKinnon *et al*. (2017) mention, this link implies that the logistic performance of organizations, industries, and nations is every day more and more influenced by that quantity and quality of their professionals in logistics. The lack or poor training quality negatively affects the competitiveness. Moreover, because of what the mainstream logistics implies as well as its intense connection with different economic sectors, the lack of logistic talent reduces companies' effectiveness and widely, economic productivity of countries. This is why web-based platforms that make interactions between professionals easier, and increase their abilities to develop collective intelligence, could be useful for Latin American SME.

As a result of the analysis of the platform SmartLogistiX3.com as a case study, we could establish three conclusions. First, since Latin America lacks "World Class" logistic skills, the web-based platforms could play an interesting role for developing a "collective intelligence in logistics spot market". This is a first step to improve the value of logistics knowledge in the region, but also to stimulate the movement of logistics knowledge flux beyond the companies' bounds. In fact, global companies with specific logistic problems have been available to offer a reward for challenges their executives do not have time to solve. Second, we observed that Tier 1 and 2 companies are available to be "mentors" of SME by sharing knowledge, and best practices. An opportunity which is not currently fully exploited. Furthermore, to strengthen the regionalization process of global supply chains with more local suppliers, OEM are looking for using the studied web-based platform, to identify candidate SMEs for their supplier programs. Third, one of the main reason practitioners use the platform is to reach improved visibility for possible employers or consulting opportunities by increasing their "logistic intelligence index", as a result, this could be a seed to increase the critical mass of logistics experts in Latin America.

At the same time, three limitations of this research were detected. First, since the present study only focuses on one case study, it allows to deeply understand the procedures and innovation flows of this specific platform, but the analysis does not count with other elements of comparison to extract improved generalizations. This could not be done because we did not identify other platform with the same characteristics of operation, focusing on the logistics knowledge market. Second, even though we were granted access to an important and large data, central questions should still be answered, among them; how often do members participate to challenges? Are the challenges ranked by complexity? Is there a differentiated approach regarding the challenge level of difficulty? or what is the average time for a challenge to be solved? And many other. Third, the type of incentives and their impact on the platform dynamics were not analyzed.

As future research, we have identified not only to develop works that would answer the questions mentioned above, but also to establish an analysis from a financial perspective of the platform operation. The flow of resources that makes the platform attractive to solve challenges, deserves an extensive analysis to establish the mechanisms that have made the platform successful among the community of users. Likewise, research could be brought to define mechanisms "focused on the user profile", so this kind of web-based platforms could offer to each user accurate incentives to increase their participation.

Acknowledgement

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