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A new decade for social changes

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Social Economy and its relationship with the Industry 4.0. A study in Guanajuato's SMEs

María Guadalupe Arredondo-Hidalgo, Diana del Consuelo Caldera-González

Universidad de Guanajuato, Mexic

mg.arredondohidalgo@ugto.mx, dccaldera@ugto.mx

Abstract. The objective of this research paper is to determine the degree of relationship between the emergent technologies and the industry 4.0, and the Social and Solidarity-based Economic model. The research paper is a product of a quantitative analysis in 62 Guanajuato state's (Mexico) SMEs. The results show that there is a correlation between economy 4.0 and social economy. Therefore, it is necessary to create the required conditions to display the Industry 4.0 within the fabrication process, in which the following aspects are found: the development of national strategies, which lead the coordinate display of Industry 4.0; the creation of a multilateral mechanism, in which the interested parts institutionalize a participative scope in order to promote Industry 4.0; the creation of international cooperation mechanisms to accelerate the transfer of technology and technical knowledge.

Keywords. Industry 4.0, Social Economy, SMEs

Solidarity-based Economy

The term Social Economy originated from labor associationism in the XIX century as a result of laborers organization. Thereby, the first cooperatives and mutualist societies of the modern era arose before the eminent degradation of the laborer's life condition, as well as from the short term unemployment that the industrial revolution generated [1].

The National Institute of Social Economy [2] defines the Solidarity-based Economy as the "set of actions carried out by enterprises, cooperatives, and savings banks, that seek for a social transformation through collaborative work". The same institution adds that this economic model is also based in the consolidation of solidarity relationships, such as trust, community spirit, and social participation between different economic entities; hence, strengthening integration processes and, in consequence, contributing to diminish social inequalities. Social Economy Europe [3] mentions that social enterprises have certain common characteristics, including the establishment of a value system such as the prioritization of people above economic profit, democratic governance, and the cyclical reinvestment of utilities for the pursuit of community interest.

According to the Economic Commission for Latin America (ECLA), Solidarity-based Economy emerges as a key tool that pretends to offer more inclusive social and working welfare solutions in a context where the economies have a high inequality index and a lacking of

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consolidated welfare states; this problematic manifests as a layered access to public services, and in precarious and informal job markets [4].

In Mexico, the Organisms of the Social Sector of the Economy (OSSE) are indicated in the article 25 of the Constitution, and are also named in the Solidarity-based Economy law. The OSSE consist of ejidos (communal indigenous lands), communities or labor organizations, cooperative societies, enterprises that belong in its majority – or exclusively – to the workers, and all the forms of social organization that seek production, distribution, consumption of goods and services that are socially required

Industry 4.0: The Fourth Industrial Revolution

The actual concept of Industry 4.0 was born in Germany, at the beginning of 2010. It was coined by a group of specialists convened by the german government who were reunited to design a program to improve the productivity of the national manufacturing industry [5]. The term was first presented in the Hannover Fair of 2011. This resulted in it being a central axis of the german government's Strategic Plan of High Tech 2020; later, the term was installed worldwide as a conceptual reference of the Fourth Industrial Revolution or the denominated intelligent manufacture.

Based on the Interamerican Bank of Development, the Industry 4.0 is a transformation of the industrial process that generally refers to computerization and digitalization of production, along with the generation, integration, and analysis of a great quantity of data throughout the productive process across the implementation of facilitated tools provided by the use of Internet [6]. Broadly speaking, it is possible to define the industry 4.0 as a technological disruption in the contemporary productive systems, which is characterized by the exponential increase of the productivity, automatization, and the significant reduction of expenses derived from the substitution of less efficient work unities from the machine's productive capacity. In addition, the World Economic Forum [7] mentions that the Industry 4.0 is strictly associated with the "intelligent" and interconnected systems of production, that are designed to detect, predict and interact with the physical world with the purpose of being able to implement autonomous decision making that support production in real time and reduce margins of error.

The implementation of 4.0 technology during a product's fabrication process, the capacity of detecting time wasters, resources or energy, and failures in security, substantially improves the efficiency within the supply chain, reducing the inactivity margins and their further maintenance costs. It is necessary to note that the presented solutions by the Industry 4.0 in the traditional productive systems, promote great changes in the actual logistic and production model. Overall manufacturers – specially the ones in developed countries – are now experiencing an integration progress, and progressively adopting new technologies in all of their operations, including concrete tools such as the Internet of Things (IoT), computing, and cloud analysis, Big Data, Artificial Intelligence or Machine Learning.

In hand with the use of Internet, along with the gradual evolution of enterprises, the digital transformation transcends further from the economic model and sets a new technological map, in which all of the social actors intervene and – at the same time– connect in real time through several devices and digital platforms, changing the way we produce, work, and communicate.

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Social Economy and its relationship with the Industry 4.0

The Ministry of Economy, Finance and Industrial and Digital Sovereignty of France affirms that the social economy's enterprises position their social, or ecological impact, above from any particular profit gaining motives; for their primal mission is to achieve human integration, values like solidarity work as the axis of the economic model. Responding in this way to the big challenges that society faces [8].

The nuclear objective of the solidarity-based economy, is the establishment of value creation networks that fosters the communal progress and eases different social inequalities [9].

Moreover, considering this scenario, is precise to highlight that the relationship that exists between the new technologies – given by the Fourth Industrial Revolution and this disruptive economic model – must be essentially oriented as a tool that facilitates the achievement of their own ideals.

Integration and Democratization

One of the biggest goals of the enterprises that base their model in social economy, is the formation of a participative system that allows every member to be equally favored by the enterprise's benefits. To answer this, cloud computing is the cornerstone of any Industry 4.0 strategy; on that account, it can provide a viable answer to any Industry's 4.0 problematic. The full realization of intelligent manufacture issues the capacity to keep information connectivity between all of the different processes, like engineering, supply chain, production, sales, distribution and service [5] regarding of the technical differences between them. In addition, it brings along the possibility of collecting, store, and analyze a great quantity of data in a more efficient and profitable way. Cloud computing can also reduce the initial costs relating to the information and security management. Moreover, it is currently easier for small and medium manufacturers to have access to this tool, due to their capacity to adjust the recruiting plans of this services towards their particular necessities, and subsequently scale in those as the business grows. Such is the case of the free cloud computing tools that technology companies such as Meta and Google, which offer towards their user niches.

The Mexican SMEs have an enormous advantage with cloud computing, for the big developer companies allow the access to technology without worrying for the complexity, cost, or equipment maintenance [10]. It holds that the use of cloud computing adds a greater grade of collaboration to the enterprises. This, by allowing the users to communicate and to have access to the same information, in a safe and synchronous communication. Likewise, it acts as a practical inclusion element, for it allows the access from diverse electronic devices with greater or less sophistication; in other words, it does not matter in which link of the cooperative society the person is, with a minimum of practical training, the worker will be able to grant an equal following to all the gathered information in the enterprise's data base [11].

Reduction of inequality gaps: a common objective

As stated by UNCTAD [12], countries will only achieve the 2030 Agenda's goals for Sustainable Development if their capacities to transfer their resources to greater productivity sectors are optimally used, since it is in these sectors of the economy that the power of change is concentrated for the achievement of the proposed goals. Between these sectors, the growing market of the 4.0 industry technologies is identified. Their implementation works in order to directly reduce the environmental impact that the traditional industrialization causes, as well as

Technium Social Sciences Journal
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the exploitation of great productive potential that opens with the creation of new job opportunities that the imminent digitalization will replace in the medium term [13].

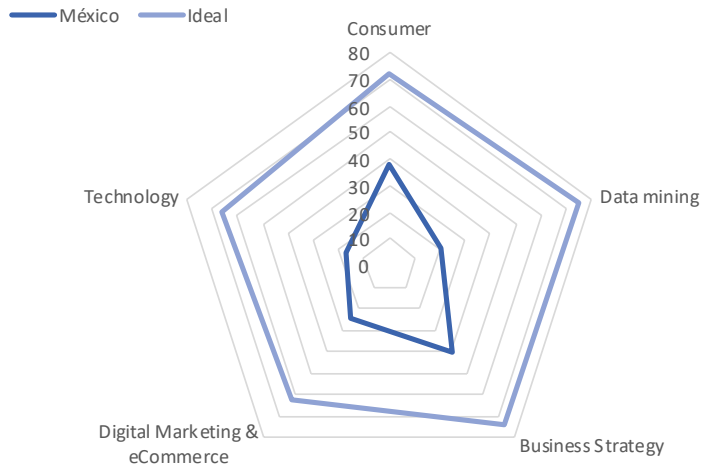
As enterprises become more productive, they are also more competitive and more likely to hire more highly-skilled workers in better positions [14]. In general aspects, the countries in which enterprises that exponentially adopt the Industry 4.0 could expect a greater increase in productivity and competitiveness, as well as in wages, which would have a far-reaching impact on the structural transformation of the countries; especially in developing countries, which are essentially the ones that could manage to capture a large part of the benefits derived from this transformation for inclusive development and the reduction of disparities.

Local Cooperative Societies and the Industry 4.0

Although there is a significative increase in digitalization and implementation of new technologies in world level enterprises, a lot of these innovations are still highly lagged in the Latin American region [15]. A previous study showed several of these social patterns, such as the fact that statistically only 22% of the population would be willing to travel in a remotely driven vehicle, and that only 8% would be willing to eat artificially produced meat [14], [16].

By the year of 2021, Mexico presented a slow and gradual digital maturity [17]. The results indicated the evaluation of competitiveness of the Mexican enterprises based on five dimensions: a. consumer's experience, b. data science, c. business strategy, d. digital marketing/e-commerce and, e. use of new technologies. The analysis concluded that the country is generally at a low level of digitalization, far away from the data that would be ideal based on the country's potential. Furthermore, it remarks that the average Mexican enterprises are lagging behind in an initial stage of the digital transformation or, to what is called the degree of adaptation; that is, in approximately half the percentage of progress that they ideally should have.

Figure 1. *Competitiveness of the Mexican enterprises based on the technological capacities.*



Source: extracted from the Digital Maturity Report in Mexico 2021-22 [16].

In the case of Guanajuato's state Mexico, the Coordinator for the Promotion of Foreign Trade in the State of Guanajuato (COFOCE) informed during the 2021 edition of the FORO GO – a plan of economic policy named Alliance for the Digitalization and the e-Commerce Cross-border – whose purpose is to encourage entrepreneurs in the adoption of new

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technologies trough the training of young people, as catalysts and replicators of the economic model "Digital Villages", created and spread around the world by the Chinese company Alibaba [17].

Nowadays, four villages have been successfully created in Guanajuato in three principal sectors: handicrafts, tequila, and ceramics. Given this, its potential to be significant generators of wealth for isolated communities, or those communities that do not have easy access to industrial infrastructure. On the other side, the collaboration between the public policies – related to the enterprise's digitalization – and those oriented to the promotion of the social economy's practices, have been working hand in hand over the last few years. This information indicates that the productive nodes that are in the State linked to the Institute of Innovation and Entrepreneurship for Competitiveness (IDEA Gto) have generated diverse benefits for local enterprises through innovation; for example, in León with the elaboration of plastic wood, through polyethylene terephthalate; in Irapuato, with bio-fertilizers; in San Luis de la Paz with shampoo and soap; and in Celaya with hydroponics.

These examples show that currently in Guanajuato different public programs are carried out, which in the short term has achieved the creation of solid cooperation mechanisms, between the adoption of new technologies, and the creation of enterprises that contribute to the community's welfare. Nonetheless, further from the achieved results in a local scale, it is precise to assert that Guanajuato itself currently has a particular perspective, whose nature is foreign towards the country's general reality. In the first place, there is a lack of investigation or reports that offer absolute statistics about the SMEs digitalization within the state. Additionally, the region is irreversibly connected, in the social and economic areas, to the rest of the Bajio (or center of the national territory) region.

Even though the state's government has recently invested in advocating public policies of human capital specialized in digitalization, seminars or broadcasting programs, and economic programs for the local SMEs development, there is still no sign of a significant differentiation gap with respect to other states – or economic regions of the country – therefore, national statistics should continue to be taken as the main reference.

Results

For the 62 analyzed enterprises, the convenience sampling was applied through a 14-item questionnaire. The variables consisted of: a. Approach to the 4.0 Economy, and b. Solidarity-based Economy Orientation.

Among the results that the questionnaire displayed, a Cronbach's Alpha of 0.815 is observed. Hence, the instrument has an acceptable reliability for the measurement in the study of the presented variables. The mean was 3.6, and a correlation factor of 0.65. This means that there is a significative correlation between the solidarity-based economy and the Industry 4.0.

Table 1 displays the type of enterprise that was considered for the investigation.

Table 1 *Types of enterprises*

Sector	Quantity	Percentage
Leather and footwear	11	18
Construction	4	6
Food	8	13
Automotive	13	21
Handicrafts	3	5
Agroindustry	1	2

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Others	22	35
Total	62	

Source: own elaboration, 2022.

The highest percentage corresponds to other industries of the enterprises, with diverse manufacturing activities corresponding to a 35% of participation; the automotive industry is the second category with the most participation due to the configuration towards the automotive cluster, as this is the axis of the entrepreneurship development in the Bajio area, where the state of Guanajuato is located.

Table 2 *Enterprise's seniority*

Sector	Quantity	Percentage
1 to 3 years	11	18
4 to 7 years	9	15
8 to 10 years	8	13
More than 10 years	4	6
More than 20 years	17	27
More than 30 years	5	8
More than 40 years	8	13
Total	62	

The highest participation belongs to the enterprises that have more than 20 years of operation. Seniority is relevant; the presence of the SMEs that have remained in the market has been possible, due to their adaptation strategies for the practice of the 4.0 economy.

Table 3 *Implementation Strategies of the Industry 4.0 in the Social Economy*

The Solidarity-based and Social Economy Challenge.	**Solution related to the Industry 4.0**
Pressure exerted by competition, observed with large companies/penetration into an existing market.	The adoption of new technologies like Internet of Things or Big Data allows the SME to compete in a more equitable way by having access to the same digitization tools as larger companies with a bigger presence in the market.
Tendency towards the verticalization of hierarchies within organizations.	The use of cloud computing grants an equal access to information to all the involved members, along with the establishment of more egalitarian responsibility and labor distribution relationships.
Lack of access towards financing instruments.	The use of massive communication tools and web platforms concedes the connection of enterprises with an investment public willing to participate in funding collective programs like crowdfunding.

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Inefficient or with elevated comparative costs chain supply.	The implementation of digital processes rewards the SMEs to connect with new market niches through e-commerce tools that allows the reduction of logistic costs. Besides, the use of cloud computing and Machine Learning can reduce, in the medium lapse, the resource waste margins and information management.

Source: own elaboration, 2022.

Conclusions

The economy 4.0 and its application to enterprises at a global level is a reality that is gradually evolving in a dynamic way. It can be stated that this industry implies emerging challenges for large and smaller enterprises. Thus, the primary capacities of the organizations must develop simultaneously with the human talent that collaborates with them. For all in the sense of being able to observe what the market needs, and also what society needs as a whole. This demands decision-making to adapt the so-called triple helix: society, economy, and environment [18].

Based on the stated objective of analyzing the application of economy 4.0 in the SMEs and its relationship with the social economy, the observation indicates that this is still a slow process for Mexico; where the SMEs' flexibility of action has awarded them to react to the changes that this sector withholds.

The developing countries will not be able to widely unfold the Industry 4.0 if they own a weak manufacture. They need to diversify their production towards more advanced technological sectors [19].

The state of Guanajuato has a crucial role in the promoting of potential sectors, essentially in the strengthening of innovation systems, the creation of coherence between the STI policies (science, technology, and innovation) and other social and economical policies, along with assuring a participative scope in this process. The governments should also promote an obtainable and high-quality access to Internet and create digital competencies in the business sector, SMEs included.

Therefore, it is necessary to create the required conditions to display the Industry 4.0 within the fabrication process, in which the following aspects are found: the development of national strategies, which lead the coordinate display of Industry 4.0; the creation of a multilateral mechanism, in which the interested parts institutionalize a participative scope in order to promote Industry 4.0; the creation of international cooperation mechanisms to accelerate the transfer of technology and technical knowledge.

Moreover, to foment the adoption of the Industry 4.0, the governments must sensitize the private sector, encourage the investments and facilitate the funding to the expansion of the Industry 4.0. The political leaders form the developing countries should also be attentive towards the changes in the commercial patterns and in the global value chains, along with their effects in their workforce.

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