

# Analyzing an Industry 4 Roadmap as a Tool to Advance the Adoption of the Fourth Industrial Revolution in Developing Countries

Gibran Aguilar Rangel, Luis Rodrigo Valencia Perez, Josefina Morgan Beltran\*

Accounting and Management Faculty, Autonomous University of Queretaro, Queretaro, Mexico

\*Corresponding author: [jmorganbeltran@yahoo.com.mx](mailto:jmorganbeltran@yahoo.com.mx)

Received May 17, 2021; Revised June 21, 2021; Accepted June 30, 2021

**Abstract** The objective of this paper is to analyze whether an Industry 4 Roadmap can be considered a successful tool in order to promote the fourth industrial revolution in companies in developing countries. As a case analysis Mexico's roadmap was reviewed. First an overview of the particularities of the developing countries are stated, in order to present how Industry 4.0 can potentially affect said economies and why their case is different from other countries. Afterwards a comparison between the advantages and disadvantages of the industry 4 for the companies in a developing country is presented. Finally, Mexico's Industry 4 Roadmap is briefly explained. The article concludes that although a roadmap could appear as a useful tool, it is not enough, especially for the SMEs that represent the majority of companies in a country.

**Keywords:** Industry 4.0, roadmap, MSMEs, developing countries, fourth industrial revolution

**Cite This Article:** Gibran Aguilar Rangel, Luis Rodrigo Valencia Perez, and Josefina Morgan Beltran, "Analyzing an Industry 4 Roadmap as a Tool to Advance the Adoption of the Fourth Industrial Revolution in Developing Countries." *Journal of Business and Management Sciences*, vol. 9, no. 2 (2021): 81-83. doi: 10.12691/jbms-9-2-4.

## 1. Introduction

From its introduction in the Hannover trade fair in 2011, the industry 4 term has incrementally gained traction all over the world. The term has been widely adopted and often used as a synonym with the fourth industrial revolution that experts affirm has been taking place from some years now [1]. Unlike the previous industrial revolutions, this one is comprised by several technologies [2] and processes which makes it difficult to assess the readiness level, especially for Micro, small and medium-sized enterprises (MSMEs). Governments worldwide have taken it upon themselves to boost the adoption of the industry 4 principles, with varying degrees of success. The so-called developing countries have specially struggled with the previous point. In this article Mexico's Industry 4 roadmap, called Crafting the Future, will be used as an example of a tool specifically designed to help the companies to implement industry 4 principles and what can be inferred from it.

## 2. Industry 4.0 and the MSMEs

The industrial world has been through three major revolutions, the first one happened with the invention of the steam powered machines which allowed to delegate

some tasks to machines reducing the number of people required in a factory. The second one was a change in materials but also, and more importantly, of processes, the mass production occurred as a result, so fewer jobs were required in factories but new jobs were created. With the advent of computers came the third industrial revolution, creating new fields of work, displacing some workers and accelerating the process of production. Globalization grew alongside the third industrial revolution and companies became truly global, cheap manual labor became a commodity, but as the countries with cheap labor grew, they became more aware of the value of skilled labor and creating their own companies, resulting in a more competitive landscape. The alternative for manual labor presented itself with the creation of automated machines and digitalization processes.

### 2.1. Industry 4.0

According to Deloitte [3] the term Industry 4.0 is about the union between physical and digital technologies, which include the internet of things, data analysis, artificial intelligence, among others, which will allow the creation of digital factories which will be interconnected and able to make more holistic and informed decisions. The previous definition results from the direct analysis of what companies understand or expect from the term, a more academic definition can be found from a group of scholars [4] who, after a literary review, define it as a collective

term that encompasses technologies and concepts in the value chain of organizations. They manage the areas of monitoring, communication and cooperation and use of data.

In a more comprehensive approach [5], the industry 4.0 can be defined as the sum of all those disruptive innovations, derived and implemented in a value chain to attend the trends of digitization, automation, transparency, mobility, modularity, network collaboration and socialization of products and processes.

When talking about industry 4.0, what is mostly discussed are the advantages it will have over production, the increase in competitiveness of companies and countries, as well as the creation of new specialized jobs, mainly related to information technology and automation, what is not so talked about, is the impact that it will have both on a social and industrial level for those subjects who cannot adapt to the changes that it brings.

## 2.2. MSMEs

Companies can be divided in several categories, depending on the activities they perform, their main goal as a corporation, among others, but one of the most common ways to divide companies is simply by size. Bigger companies usually get most of the attention by the media, but they make up the smallest percentage of business worldwide, for every Facebook, there are hundreds of smaller businesses.

The MSMEs are essential for the global economy, however they can usually lack the funding, resources and opportunities bigger corporations have. While most of the big corporations are global companies, MSMEs tend to be local and have a bigger impact on quality job creations, as well as being a fundamental player in the supply chain [6].

Given the importance of this type of companies, it is worrisome that it will be the smallest companies (in Mexico, MSMEs constitute around 98% of the productive sector) which will be negatively affected by the technological disruption, this sector will have a harder time adapting to the changes that Industry 4.0 will bring without incentives or adequate supports. In this part, the role of the government is considered essential, to achieve an inclusion of this type of industry in the industrial revolution that is taking place.

Industry 4.0 is strongly based on the quadruple helix model, in which industry, university, government and society intervene, this last element being one of the key drivers, since a pillar of Industry 4.0 has to do with personalization. and individual customer service, generating a high response capacity to the changing demands of society. The role of the government is therefore expanded unlike the triple helix model, since on the one hand it has to encourage and regulate the industry, and at the same time safeguard the interests of society and encourage the participation of academia.

Taking MSMEs to this level is not seen as a simple task, with the exception of those that, due to the very nature of their business, are part of related technologies, such as software factories or information technology consultancies. It involves not only a considerable capital investment, it also requires a change of mindset, internal organization, and that they obtain a sense of need sufficient to change their current strategy [7].

## 3. Crafting the Future? An Overview of the Roadmap

After the industry 4.0 term was announced and how it heralded the ongoing fourth industrial revolution, countries worldwide took it upon themselves to aid the local companies in order to make the shift. Some countries, especially the wealthiest ones, have funded this development through special aid packages, tax rebates and other incentives, this kind of measures are especially useful for bigger companies that know how to make the shift or can hire consultants in order to acquire the right technologies and implement the required processes.

There have been multiple studies on how the developed countries are tackling the challenge of implementing the industry 4.0 principles in their territories, however these actions cannot be easily translated into the developing countries who have different obstacles, different companies and overall a greater challenge ahead.

### 3.1. Mexico's Roadmap to the Industry 4.0

One of the bigger economies in the developing world is Mexico, a country that has a lot of industrial capabilities, but is at risk of getting left behind in the upcoming industrial revolution. In Mexico there is currently a guide or roadmap for the development of industry 4.0 in the country [8], in which they describe in principle what is understood as industry 4.0, then they review the strategies of different countries regarding the challenges that this involves, afterwards they make a review of the characteristics of the manufacturing sector in Mexico, and, as is usually already typical in any analysis of the industry in Mexico, they take the automotive industry in Mexico as a case of analysis. This is problematic in more than one sense, not only it's a case that has already been well studied, the automotive industry represents an example of a type of industry in decline (the days of gasoline-powered cars are numbered), it is also an industry in which the country has invested a lot (donating land, condoning taxes, encouraging the installation of factories), but that it does not have any national manufacturer, despite all the years that it has been developing in the country (unlike the industry in the India, where they already develop their own cars). The report concludes by listing the initiatives to promote industry 4.0, those led by companies come from foreign companies, and a SWOT for industry 4.0 in Mexico, as well as a series of optimistic statements about the future of Mexico.

The route map described above does not fulfill its role as a guide, a series of guides are needed at the regional level to help focus joint efforts as a nation, each entity has its own line or effort that is enacting in order to comply with the development plans, this implies that in certain entities the efforts may be duplicating, making some programs redundant, or that they try to implement support for certain industries that do not really have a pronounced presence in the region or are not a strategic area for it, but that in order to accommodate the roadmap and announce that they are working on it, they focus all efforts on the same point, usually by imposing information technology companies, thus losing sight of other priority areas, such

as the development of alternative energy generation industry or the agri-food industry.

## 4. Conclusion

The fourth industrial revolution is a reality whether the countries and companies are ready for it or not, while there are many valid criticisms [9], the changes in technologies and processes are happening. The MSMEs will undoubtedly be the more affected by these changes [10] and failure to adapt will not affect only said companies but all of the supply chain they form a part of.

It is important that governments get involved in supporting these changes, specially in developing countries where MSMEs have a lesser chance of adapting and surviving to sudden and sometimes costly changes. Programs like Crafting the Future, are a valid but ultimately insufficient effort, but it can and it should be taken as an example moving forward, so it can be improved upon.

One of the contributing factors as to why the developing countries are getting left behind is that not enough information is available in how smaller companies can get behind the Industry 4.0 principles, most articles and aides are directed towards big companies, which usually are not native to the developing countries, so they don't directly contribute to the country's technological assets and economy.

MSMEs need to be the center of attention in the developing countries and help them to achieve technological independence so this local companies can thrive and succeed in a globalized economy, simply imitating programs implemented in other countries will not work since the conditions are so different.

This article described what some of the main struggles for the MSMEs are in relation to the fourth industrial revolution and analyzed how a program from a developing country is aiming to help these types of companies to overcome the hurdles but it falls short of its objective. The

article also offers some insights on how this kind of roadmaps or guides could be improved.

## Acknowledgements

This manuscript has not been published and is not under consideration for publication elsewhere. We have no conflicts of interest to disclose.

## References

- [1] Kearney, T. (2018). *Readiness for the Future of Production*. Retrieved from [http://www3.weforum.org/docs/FOP\\_Readiness\\_Report\\_2018.pdf](http://www3.weforum.org/docs/FOP_Readiness_Report_2018.pdf).
- [2] Lu, Y. (2017). *Industry 4.0: A survey on technologies, applications and open research issues*. Journal of Industrial Information Integration, 6, 1-10.
- [3] Deloitte. (2018). *The fourth industrial revolution is here: Are you ready?* Deloitte Insight, 1-26.
- [4] Hermann, M., Pentek, T., & Otto, B. (2015). *Design Principles for Industrie 4.0 Scenarios: A Literature Review*, (01), 16.
- [5] Pfohl, H.-C., Yahsi, B., & Kuznaz, T. (2015). *The impact of Industry 4.0 on the Supply Chain*. Proceedings of the Hamburg International Conference of Logistic (HICL)-20, (August), 32-58.
- [6] Sarwoko, E., & Frisdiantara, C. (2016). *Growth Determinants of Small Medium Enterprises (SMEs)*. Universal Journal of Management, 4(1), 36-41.
- [7] Sony, M. (2020). *Pros and cons of implementing Industry 4.0 for the organizations: a review and synthesis of evidence*. Production and Manufacturing Research, 8(1).
- [8] Villarreal, I. G., Garza, J. R. G., Montemayor, R. E. R., & Taboada, J. A. (2016). *Crafting the future: a roadmap for industry 4.0 in Mexico*. Secretaria de Economia, 1-98.
- [9] Amaral, A., Jorge, D., & Peças, P. (2019). *Small medium enterprises and industry 4.0: Current models' ineptitude and the proposal of a methodology to successfully implement industry 4.0 in small medium enterprises*. Procedia Manufacturing, 41, 1103-1110.
- [10] Baritto, M., Billal, M. M., Nasim, S. M. M., Sultana, R. A., Arani, M., & Qureshi, A. J. (2020). *Supporting Tool for The Transition of Existing Small and Medium Enterprises Towards Industry 4.0*. 2020 International Conference on Data Analytics for Business and Industry: Way Towards a Sustainable Economy (ICDABI), (October).

