Industrial Enterprises in Cameroon are preparing for the Fourth Industrial Revolution (4ir) – What are the Requirements, Opportunities, and Challenges?

Mua, Kelly Kingsley and Kouam Tamto, Henri

Ministry of Finance, epublic of Cameroon, Cameroon Economic Policy Institute (CEPI)

25 February 2025

Industrial Enterprises in Cameroon are preparing for the Fourth Industrial Revolution (4ir) – What are the Requirements, Opportunities, and Challenges?

Prof. Kelly Kingsely Mua

Director of Finance Operations

Ministry of Finance, Republic of Cameroon

&

Henri Kouam

Cameroon Economic Policy Institute (CEPI)

Abstract: Disruptive technologies are revolutionizing end-to-end steps in production in most sectors across the economy. The fourth Industrial Revolution (4ir) such as the Internet of things, and artificial intelligence – will revolutionize traditional value creation models. This paper investigates the nature and impact of 4ir technologies on Cameroon's manufacturing sector, using survey data from 100 manufacturing companies and business entities. As shown in Figure 2, most respondents (28%) feel that Industry 4.0 will substantially impact their manufacturing and production systems. Twenty-one percent of manufacturers think that the fourth industrial revolution will have an overall impact on their business, while 16% believe that IT systems and networks are the only areas that will benefit from Industry 4.0. regarding plans, only 10 percent of respondents say they plan to adopt Industry 4.0 in the next twelve months, while 4% say it would take 13 to 24 months to establish the necessary infrastructure. However, 10% of respondents had no plans to apply Industry 4.0, while the rest (34%) wanted to digitalize their enterprises in the next 3-5 years. The findings from this study show that companies that adopt 4ir technologies are agile, competitive, and more productive. Companies in Cameroon's industrial sector should invest in 4ir technologies, train their employees, and incorporate 4ir technologies into their manufacturing practices.

Introduction.

Are the leaders of businesses and government agencies ready to harness the full potential of

Industry 4.0 to benefit their clients, people, organizations, communities, and society more broadly? This is a question posed by industry leaders, experts, policymakers, and members of civil society at large.

In the last decade, the manufacturing industry has been significantly influenced by the emergence of disruptive technologies such as information communication technologies (ICT) and the Internet of Things (IoT). Computers are getting smaller so that they can be embedded into technical devices, which could be used for converting conventional manufacturing resources into smart objects to communicate with each other in a worldwide network ((Weyer et al. (2015)).

Like other domains, manufacturing benefits increasingly from ICT and computer science. Advanced manufacturing systems in collaboration with ICT and data analytics are transforming manufacturing to the next generation, the industrial Internet of Things (IIOT). ((Zhou and Zhou (2015))

In Germany, the concept is called the 4th Industrial Revolution or Industry 4.0 ((Kagermann H., et al., 2013)), which aims to create intelligent factories to address the current challenges in the manufacturing system. In recent years, manufacturing companies have experienced globalization, intensified competition, dynamic markets/demand, and shortened product life cycles Mourtzis (2016). However, the Cameroonian industry is facing a set of challenges including unchecked competition following trade liberalization of the domestic market, weakness in output from both the industrial and service sectors, financing difficulties from SMEs, and low levels of development (UNIDO (2005)).

A growing and increasingly globalized marketplace and ever-changing product and regulatory demands require an agile and efficient manufacturing system. To deal with such multidimensional challenges, efficient, adaptable, and flexible production and logistic systems are essential Baines et al (2009). The 4th industrial revolution offers a new way of combining physical operations and information technology to overcome rigid production and planning processes (Lasi, 2014). By using Cyber-Physical Systems (CPS) and the Internet of Things (IoT), Industry 4.0 shapes connected and highly intelligent systems that enable companies to add more value to their products (Smiderman, Mahto and Cotteler (2016).

Germany introduced Industry 4.0 to ameliorate overall cost-effectiveness and improve control of the supply chain by integrating horizontal and vertical value-adding activities (Rubmann et al, 2015). German and Japanese companies are at the highest point of integrating horizontal value chains and digitizing internal operations. Scandinavian countries have followed Germany and embraced Industry 4.0 more quickly than many other nations (MBIE, 2016).

The main reason is that manufacturing industries have a massive contribution to their economies. In the case of Cameroon, manufacturing adds significant value to the economy in terms of jobs, which brings its contribution to the fore. Inspired by the pioneers in Industry 4.0, other countries such as China and Australia are highly investing in developing their strategies to implement Industry 4.0. However, not all countries are prepared for the implementation of Industry 4.0.

Industry 4.0 is a novel concept in Cameroon and small and medium size companies (SMEs) have some challenges adapting to the fourth industrial revolution. The reasons for this are not entirely known, but the regulatory framework and access to capital are some of the leading causes of the slow adoption of 4ir technologies (Kakdeu, L, M., D'Pola, K.U., & Egoh, M. A., (2020)).

However, lack of enough experience and shortage of available resources contribute to the challenges for Cameroonian SMEs towards implementation of Industry 4.0. This paper aims to identify the potential of Industry 4.0 for Cameroon manufacturers and their level of digital readiness through a survey study. Issues and challenges that need to be addressed for establishing business plans in manufacturing SMEs are discussed. The results of this study bring a grand vision closer to the business reality and illustrate the pathway of Cameroonian industries toward smart manufacturing in the context of Industry 4.0.

The rationale for this research hinges on the fact that manufacturing has allowed developing market economies to take advantage of the rapidly expanding global demand for goods and services in the second half of the century. Not only did this foster a learning-by-doing approach, Asian economies [1]that pursued export-led growth were able to create jobs and lift millions of people out of poverty. In China's case, it was able to lift 500 million people out of poverty in thirty years.

In this paper, brief background and introduction to Industry 4.0 are provided in the first section of this paper. This is followed by a description of key features of the fourth industrial revolution in Chapter Two, including robotics, smart factories the Internet of Things (IoT), and 3D printing. After that, the research methodology comes in section 3, where the paper presents the data collection method, demographic details, and target cases. The data from the questionnaire and analysis of results are presented in section four, followed by the discussion of the findings in the same section. In section four, the paper illustrates how the "AARP" model can be used to improve readiness and adoption of fourth industrial revolution technologies. Finally, section five concludes the study with recommendations.

[1] For a discussion of the East Asian export-led manufacturing growth model, see Wade (1990), Amundsen (1989), Johnson (1982). For a review of the literature, see Kyle (2017).

Chapter Two: Fourth Industrial Revolution Technologies

Robotization.

Robotization is currently well suited to routine, low-dexterity tasks—the kind executed along assembly lines by low-capacity labor. While robots have not significantly affected total employment, anecdotal evidence indicates they have already begun displacing low-skilled labor in China and Bangladesh.

As the cost of robots falls and their efficacy increases, the economic and political arguments for reshoring production closer to demand—back to Europe, the United States, and even China—will increase. Not only may robotization reduce the total number of manufacturing jobs globally, but these jobs may be even less likely to come to Africa. Companies[2] that champion robotization include the electronics manufacturer Foxconn and Tianyuan Garments, with extensive operations across China, the US, and beyond.

Smart Factories and the Internet of Things (IoT)

Smart technologies that can collect, interpret, and analyze data, using it to communicate functions to other technologies without using human-to-human or human-to-computer interactions – otherwise known as the Internet of Things (IoT) – are set to revolutionize manufacturing. A smart factory is premised on IoT and employs physical-to-digital technology in machines that sense, monitor, and control, with real-time communication between different parts of the value chain to serve as the basis for self-optimization.

The effect of smart factories on manufacturing will be twofold. First, there will be improvements to operational performance, including labor efficiencies. Second, physical-to-

[2] For example, Foxconn (Hon Hai Precision Industry), ranked 24 on Fortune Global 500 replaced 60,000 workers in one factory with robots. In 2012 Foxconn had 1.3m workers but this fell to 870,000 by 2016. See "Robots, not humans: official policy in China," Jenny Chan, 1 November 2017, New Internationalist, https://newint.org/features/2017/11/01/industrial-robots-china See also "A new t-shirt sewing robot can make as many shirts per hour as 17 factory workers", Marc Bain, 30 August 2017, That's Good for the U.S., Bad for Poor", Jon Emont, 16 February 2018, The Wall Street Journal, https://www.wsj.com/articles/the-robots-are-coming-for-garment-workersthats-good-for-the-u-s-bad-for-poor-countries-1518797631

digital technologies will rely on advanced services to make optimal use of the data generated. This implies that manufacturing will become less reliant on low-skilled (mass) labor, and more dependent on engineers, programmers, and other analytics-based professions to optimize these new technologies. Firms with smart factories include Germany's Siemens, auto parts manufacturer Hirotec America, and US appliances manufacturer Whirlpool.

3D Printing

Three-dimensional (3D) printing is currently used across sectors such as jewelry, toys, and cars. As costs come down and the technologies' sophistication increases, 3D printing's attributes of speedy delivery, customization, and responsiveness to consumer preferences have a solid potential to trump traditional methods of production.

By driving down the fixed cost of manufacturing, 3D printing can democratize manufacturing by fragmenting the sector and allowing companies in Africa to engage in manufacturing without the heavy investment once required. However, hubs of 3D activities may emerge closer to demand in high-income countries. The need for highly skilled, design-related labor will increase, while low-skilled labor employed in production and assembly will diminish, jeopardizing the opportunities that light manufacturing once offered to low-skilled workers. Examples include US car manufacturer Ford, which uses 3D printing for auto part prototypes, and General Electric, which uses 3D printing to manufacture its turbine parts.

Chapter 3: Research Methodology

The study captures the opinions and viewpoints of Cameroon manufacturers on the issues around the awareness and implementation of the fourth industrial revolution and Industry 4.0 concept. A random sampling approach as suggested by earlier research was used to gain as many respondents as needed. A semi-structured questionnaire was designed and deployed to 100 manufacturing firms in Cameroon, and the list was drawn from a range of websites and recommendations from the Ministry of Small and Medium-sized Enterprises. The questionnaire covers several topics relating to awareness, readiness, and rationale for adopting or not adopting industry 4.0 technologies in the manufacturing sector. It equally covered aspects such as the relevance of fourth industrial revolution technologies to companies' ICT infrastructure and potential benefits for businesses. The current study is based.

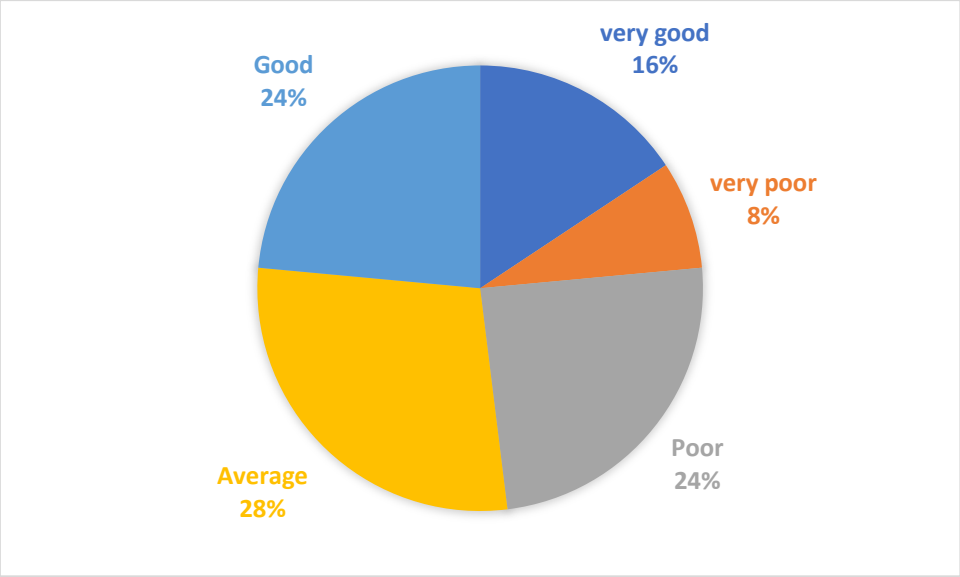
Chapter 4: Data Analysis and Results

Survey results and analysis In this section, a brief description of questions and analyzed results from the questionnaire are provided.

1) Level of awareness about Industry 4.0 Successful embracing the upcoming transformation into Industry 4.0 requires a high level of knowledge regarding digitization within the manufacturing industry. To identify the level of respondents' awareness regarding Industry 4.0, they were asked to state the first things that come to their mind by hearing "Industry 4.0" or "Industrial Internet of Things". To deal with the fuzziness of the answers and justify the written responses, the five-point Likert scale was employed by the authors. Hence, the level of participants' awareness was classified under "very poor", "poor", "average", "good" and "very good".

Figure 1 illustrates that 16% of the respondents presented a high level of awareness about the main functions of Industry 4.0 and its core technologies. It also indicates that 24% of manufacturers have good knowledge about the Industry 4.0 concept while 28% of them demonstrated an average level of awareness regarding the IIoT concept. The result shows that 24% of participants have poor knowledge regarding Industry 4.0, and the rest of the respondents (8%) have very low-level information about the 4th industrial revolution.

Figure 1: Level of awareness regarding Industry 4.0



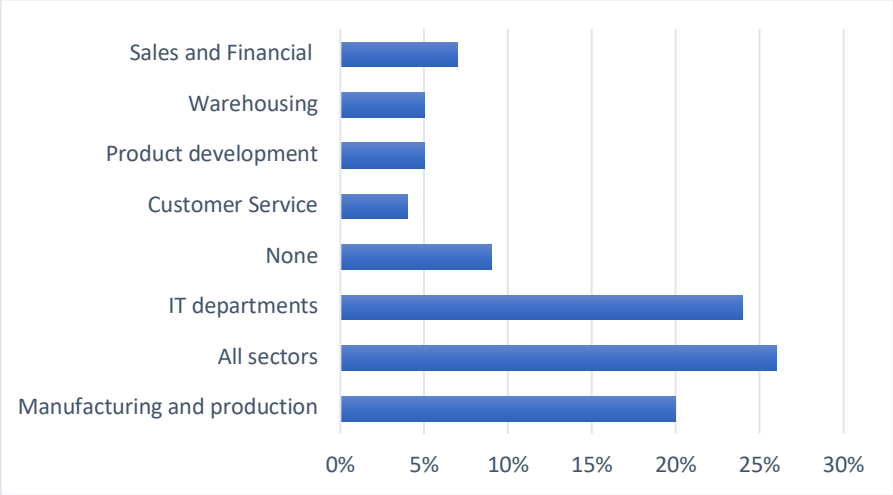
2) Aspects of Relevancy to the Company

Industry 4.0 has different aspects that can affect manufacturing companies in different ways. It can transform business models and production value chains by connecting embedded systems and smart production processes. As a result, the participants were asked to indicate which areas of their business could benefit from various components of Industry 4.0. As shown in Figure 2, the majority of respondents (28%) feel that Industry 4.0 will have a substantial impact on their manufacturing and production systems. Twenty-one percent of manufacturers feel that the fourth industrial revolution will have an overall impact on their business, while 16 percent

believe that IT systems and networks are the only areas that will benefit from the Industry 4.0 idea.

According to the survey's findings, 12% of respondents believe that no component of Industry 4.0 can help them enhance their firm. Customer service (9%), product development (7%), inventory management (5%), and the sales sector (2%) round out the top four positions in this ranking with lower margins.

Figure 2. Contribution of Industry 4.0 to the Participants' Businesses



3) Information technology application

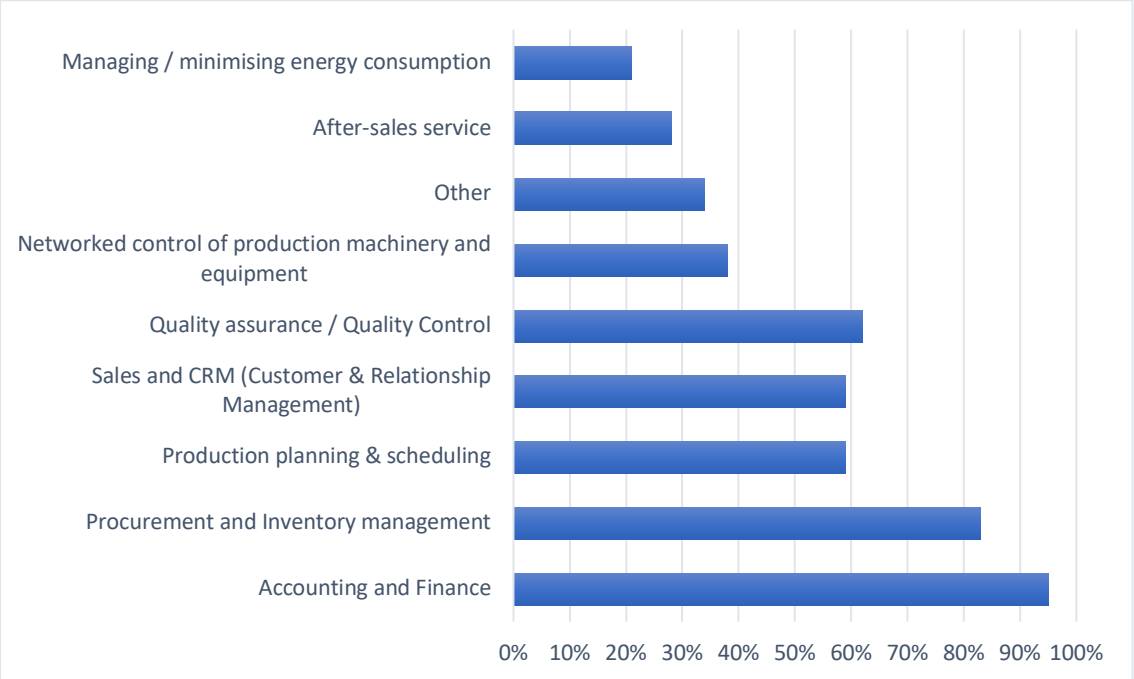
The notion of Industry 4.0 refers to the use of ICT in manufacturing and automation. In superordinate or 4ir-related IT, the main principles are digitalization, networking, and data analysis. The most effective strategies consider the competencies needed to enable internal digitalization or establish new digital business models.

As a result, it is critical to assess the existing condition of manufacturers in terms of IT system application. Participants were quizzed on which industries utilize IT to manage processes (multiple choices were possible).

Participants reported that IT infrastructure was widely used in business accounting and finance systems (90 percent) and that it also provided major benefits for procurement and inventory management (see Figure 3). (83 percent).

Based on the information provided by respondents, the last two sectors in which IT has the least contribution are after-sale services (28%) and energy consumption management (21%). Thirty-four percent of manufacturers use IT services for other purposes. Furthermore, with lesser margins, production planning, and scheduling (72 percent), sales and customer relationship management (CRM) (69 percent), quality control (62 percent), and production machinery control (38 percent) occupy the next four spots in the ranking.

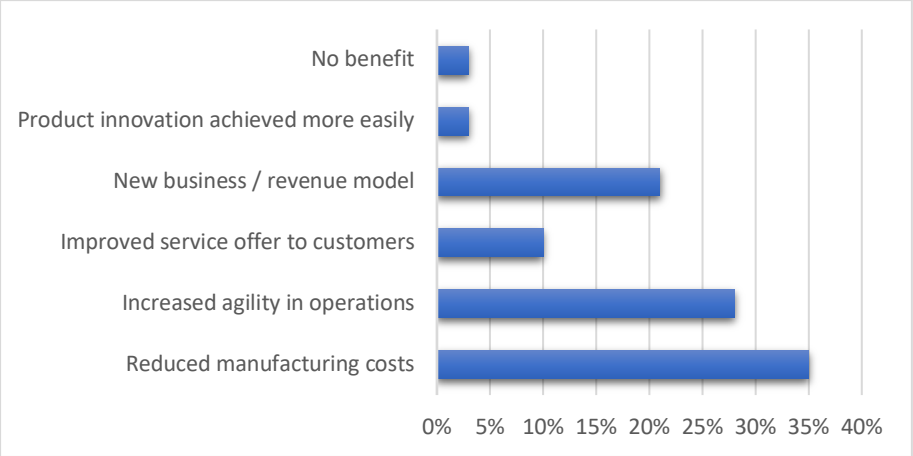
Figure 3. Application of IT to manage different processes



4) Potential advantages for the company The notion of Industry 4.0 cannot be implemented successfully until manufacturers accept it, and they will not embrace it unless all of the benefits and obstacles are acknowledged. The goal of this study is to find out what New Cameroon manufacturers expect from Industry 4.0 in terms of commercial benefits. As

shown in Figure 4, 36% of participants feel that effective adoption of Industry 4.0 will result in a reduction in manufacturing costs, while 26% believe that the most important outcome of 4.0 for their company is increased operational agility.

Figure 4. Potential benefits from 4.0



10% of the participants feel that Industry 4.0 can help them build a new business model, while 3% believe that if Industry 4.0 is properly implemented in their company, they will be able to achieve increased product innovation. However, 3% of respondents declare that Industry 4.0 will have no positive impact on their business and cannot improve the products and processes

5) Plan for starting Industry 4.0

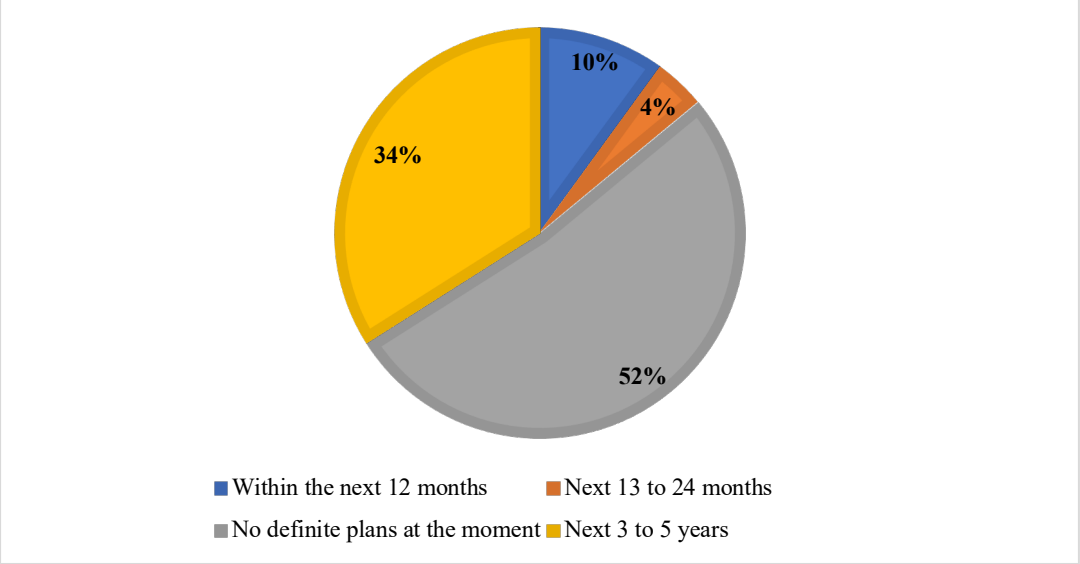
Industry 4.0 can create better productivity and higher efficiency. In five years, more than 80% of European companies will digitalize their value chain to increase efficiency by up to 18%. By 2020, European industrial companies will invest more than 100 billion Euros annually in Industry 4.0 [Davies, 2015].

It is critical to achieve and roll out digital capabilities across the organization to move forward with Industry 4.0. Because this process takes time, managers and decision-makers will need senior management commitment and large implementation investments to obtain or maintain

a first-mover advantage over competitors. They must assess their digital maturity right now and set clear goals for the next five years.

Participants were questioned about their future business plans for implementing Industry 4.0 if its worthiness could be proven. Ten percent of respondents say they plan to adopt Industry 4.0 in the next twelve months, while 4% say it would take them 13 to 24 months to establish the necessary infrastructure. However, 10% of respondents had no plans to apply Industry 4.0, while the rest (34%) wanted to digitalize their enterprises in the next 3-5 years.

Figure 5. The possible period for implementation of Industry 4.0



6) Major challenges and obstacles

Although there are numerous advantages to Industry 4.0, there are some important concerns that producers must evaluate and address. The survey results reveal that the lack of internal digital training has reduced the ability of businesses to exploit new business models. As such, these challenges need further study to unlock the opportunities that are latent in the fourth industrial revolution. Figure 6 summarizes respondents' ideas about the challenges and obstacles ahead. The survey reveals that 66% of the most critical barriers to implementation of the 4ir and associated are related to lack of financing.

Forty-one percent of the participants stated that they are busy with other challenges in their business and do not have a plan for Industry 4.0. Moreover, the lack of skilled people around Industry 4.0 is another problem that holds back 38% of manufacturers from approaching 4.0 while 17% of them believe that they did not have access to proper equipment and required software in Cameroon.

Twenty-one percent of participants have mentioned other obstacles in the line of 4.0 such as difficulty in convincing directors and upper management regarding the viability and value of the concept, lack of ability to integrate into the current operational footprint, and absence of clarity around 4.0. knowledge regarding adapting these changes into the business models to develop potential opportunities and minimize threats. Industry 4.0 could significantly transform the way companies operate and enable them to tap into new sources of value. To realize this transformation, manufacturing companies and their managers should achieve an in-depth understanding of the Industry 4.0 concept and explore how it can add value to the specific context of their operations.

Participants in this study indicate that 4.0 is relevant to manufacturing and production systems the most. This finding is in complete accordance with the main idea behind 4.0 and its final goal which is creating smart production systems. Industry 4.0 holds the promise of improving productivity, better quality, and increasing flexibility which enables Cameroon manufacturers to deal with the challenges of producing mass-customized products with short lead time to market.

IT infrastructures have a significant role to play, as they connect individual stages and provide a targeted means for managing them. Besides, developing a new industrial paradigm based on IIoT calls for IT infrastructures as well as IT managers and skilled staff to support further

growth in new ways. It justifies the answer of those participants who that noted the Industry 4.0 concept is more relevant to their IT department rather than other sectors.

Manufacturers who participated in this survey mostly run small or medium-sized businesses with legacy equipment and unconnected workstations. Instead of freely transferring within the company, information is isolated in separate islands of automation. The supply chain in such companies is a series of discrete activities and processes from product development and manufacturing to distribution and delivery to customers. This justifies why only a limited number of respondents find the Industry 4.0 concept relevant to their sales and customer services, product development as well as warehouse management.

Some respondents indicate that Industry 4.0 might not be relevant to their businesses and manufacturing processes. This idea can mainly be related to a lack of comprehensive understanding of the Industry 4.0 concept. Moreover, discrete and separated work and information flow within the companies makes it difficult for them to find relevancy between an advanced paradigm like Industry 4.0 and their legacy equipment and systems.

Most of the manufacturing companies surveyed indicated that in different areas, they do not have all the IT infrastructure they need to transform their firms into smart factories. However, they have digitalized some sectors and departments. Almost all of the respondents in this study use IT services to make their financial activities paperless as much as possible. Transformation of accounting and finance systems from traditional mainstream to client/server and networked systems can make a huge difference for the companies in the way of achieving intelligent business. These modern finance systems in collaboration with other networked systems can change the accounting functions from keeping records and reporting to guiding strategy in the entire firm. Also, more than half of manufacturers use IT-based systems such as ERP, CRM, and MES to control the processes and monitor the quality of operations and products. These

systems can be considered the backbone of Industry 4.0 in manufacturing industries which are already set up and just need to be customized and connected to other systems to form a digitalized enterprise.

Surprisingly, after-sale services and energy management systems attracted the least attention in Cameroon manufacturing companies in the line of being digitalized and controlled by IT systems. Industry 4.0 makes mass customization possible by getting customer feedback through after-sales services provided. The lack of a systematic and real-time method of collecting and analyzing customer requirements and feedback makes it impossible for companies to consider themselves smart and intelligent businesses.

Small and medium-sized manufacturing companies continuously face cost challenges. They employ the best strategies to reduce production costs and increase efficiency in the use of labor and technology [13]. Although Industry 4.0 requires initial investments, as soon as smartness is built into processes and products, the costs will plummet. Reducing production and operation costs is the most significant motivation for participants in this survey in the way of achieving Industry 4.0. They hope higher quality in the form of less time and material waste leads to lower personnel and operating costs.

Shortened product life cycles and at the same time high product variability require agility and flexibility in a production system. It is the main reason that manufacturers intend to make their production structures more agile. Such agile production systems can be rapidly reconfigured for dynamic product demands. Industry 4.0 brings excellent agility to a factory without sacrificing cost, quality, or speed. When smart products have information about their features, production will be accelerated throughout the production processes.

With lower cost, better quality, and higher ability to serve customers, Industry 4.0 makes the manufacturers a preferred supplier to current and potential customers [14]. It also opens up the

ways for companies to innovate rapidly, offer customized products with high quality, and thus achieve higher revenues. However, just a few of the participants believe that Industry 4.0 can add greater revenue or higher production innovation to their companies. Those respondents who believe Industry 4.0 may not have any benefit for their businesses must be deeply investigated. This idea mainly might be due to a lack of adequate knowledge about Industry 4.0 opportunities or manufacturers' concern regarding inherent risks brought about by the 4th industrial revolution.

Although Industry 4.0 is promising for manufacturing industries, it is time-consuming and challenging to achieve. Industry 4.0 seems to be a vision for the future as it includes many aspects, and companies might face different types of challenges including economic, scientific, technological as well as social and political issues in this way ((Zhou (2015), Khan and K Turowski (2015) and Chen and Tsai (2017)). Such a vision leads to an increased complexity on the micro and macro levels of manufacturing processes. Especially SMEs are uncertain about the financial and technical requirements of adopting Industry 4.0 and its overall impact on their business model (Schumacher, Erol, and Sihn (2016), Xu (2017), Zhong et al (2013)). Initial investment and securing the funding for implementing Industry 4.0 are the most significant challenges for manufacturers in Cameroon. It raises concern for manufacturers regarding whether investing in the implementation of Industry 4.0 would be profitable for their businesses. Unlike large manufacturing enterprises which invest in their own production and technological capacities, SMEs tend to cooperate with external suppliers and delay their investment until the costs of developing technologies decline.

Lack of time for in-depth investigation of Industry 4.0 aspects and developing a business plan is another concern of respondents. The companies are concerned about innovating their current business models as many internal and external challenges need to be identified and addressed.

It is also challenging for managers to develop novel and commercially feasible business models.

Manufacturing enterprises need to make sure that their staff and workforce are aware of changes taking place in the company regarding digitalization and make them prepared for that. Based on the results of this survey, one of the most significant concerns of manufacturers is the absence of skillful people around. Companies are fully aware of the fact that it is essential to invest not only in technological infrastructure but also in improving leadership skills and training workforces. They also know that the absence of digital culture and proper training systems in a country like Cameroon will be challenging for their businesses. Moreover, the lack of local consultancy groups with specialized expertise in Industry 4.0 is another issue that concerns manufacturers through the transformation of their businesses toward digitalization

Manufacturers in Cameroon are also concerned about the availability of appropriate equipment and software in the way of achieving Industry 4.0. Most of these companies are using legacy machines and software. Also, their existing infrastructures are discrete and fragmented which results in poor networking. For digitalizing their businesses, companies need to develop or purchase a wide range of components such as sensors, actuators, communication networks, control systems, marketing, and customer-facing applications.

The participant in this study also noted other obstacles in the way of Industry 4.0 implementation such as difficulty in convincing directors and upper management about the viability and value of the concept, lack of ability to integrate into the current operational footprint, and absence of clarity around Industry 4.0.

The absolute majority of the participants in this survey expressed their willingness to implement Industry 4.0 in the next five years since they find it a promising solution that can revolutionize their businesses. Apart from its opportunities, Industry 4.0 will bring significant

competition between different manufacturing firms and industries. Hence, remaining ahead in this competition requires more than just purchasing particular tools and software and observing them do the work. To keep up in such a competitive situation, manufacturers make their attempts to stay up-to-date with new tools, devices, and technologies. Companies should not only keep their eyes on an external source of changes but also should look deeply into their strategies and business plans. Decision-makers at the strategic and managerial levels need to identify the strengths and weaknesses of their company in the digital field and set a milestone for the next few years.

4. Proposed Implementation Model

Digitalization is significantly essential, but many companies are not well-prepared for that. Several steps need to be taken to make a factory smarter. In the way of digitalization and achieving Industry 4.0, a well-structured roadmap in the form of a framework will help manufacturing industries, especially SMEs with limited financial and technological resources. It can provide an overview of the current situation for decision-makers and help them to take the next steps with minimal risk. By combining the results from this survey with previous works, authors suggest an implementation model in 6 steps termed 'ARPPAD.'

Step 1: 'A' - Awareness of the concept

In the field of industrial change, there is little awareness of Industry 4.0. Most manufacturers are still unaware of the potential opportunities that Industry 4.0 technologies can offer. While technological aspects of Industry 4.0 draw the attention of industries, the impact of a deep understanding of Industry 4.0, even at the managerial level, has been underestimated. Industry 4.0 might have a disruptive effect on companies and change their landscape.

Some aspects of digitalization will undoubtedly be tricky. High and mid-level managers need to deeply understand different elements of Industry 4.0 and gain proper knowledge, skills, and

confidence to be adept at dealing with different situations and manage threats from new technologies of competition in the market.

Step 2: 'R' - Readiness for Industry 4.0

Achieving a comprehensive understanding of the current state and digitalization maturity of the company will be the next step. To define their current status, organizations need to develop or select an assessment tool that can quantify their organizational performance. This tool not only contributes to analyzing the current status but also helps the strategic planners in the way of designing a future roadmap for the organization. A maturity assessment tool is also essential for the evaluation of digital readiness in the company.

Step 3: 'P' - Planning

Once the organization has a clear outlook on its current status and digital maturity, a roadmap needs to be developed and presented to managers and senior executives. While advanced technologies are considered the backbone and enablers of Industry 4.0, key ones must be identified and studied. Hence, a technology selection method must be developed to assess and rank key available technologies based on the organization's criteria and objectives.

Step 4: 'P' - Pilot project

To provide proof of concept and demonstrate the technologies, pilot projects need to be set up. The possible options include installing actuators and sensors on critical manufacturing machines and using big data analytics for predictive explorer maintenance. Another example will be the horizontal integration of key suppliers by setting up tracking devices on the shipment to create end-to-end visibility. These primary steps help address the initial issues regarding digitalization and show a most promising approach for the company.

Step 5: 'A' – Analysis

Identifying and collecting the right data alongside cogent analysis of findings are critical for the successful implementation of Industry 4.0 (Zhong (2013) & Zhong (2016)). Thus, a highly efficient data analysis approach needs to be defined and developed with a focus on predictive as well as prescriptive analytics, automated feedback to the enterprise, and connectivity to employees. A sophisticated approach needs to be applied in the data integration layer which is linked to the Enterprise Resource Planning (ERP) systems and use tailored analytics methods and tools by use-case.

Step 6: 'D' - Digitalization

In the next step, the company must put effort into understanding customer needs and utilizing digital technologies to create and deliver value to them in an innovative and integrated solution. For example, cloud technologies could be used for digitalization so that manufacturing resources could be shared (Xu, 2012).

Conclusion

This paper presents the results of a survey conducted in the Cameroon manufacturing industry where Industry 4.0 will be implemented to upgrade and transform small and medium-sized enterprises (SMEs) in the future. Some analysis and insights are obtained from this paper. They are significant and useful for manufacturing companies when they are contemplating Industry 4.0 concepts and solutions.

An 'ARPPAD implementation model is suggested based on the observations. This model can be used in typical companies to enable them to get benefits from Industry 4.0 concepts.

Future studies will be carried out by evaluating and validating the proposed model in real-world case studies in Cameroon. Specific scenarios should be designed for examining different steps,

and qualitative as well as quantitative analysis needs to be provided. Additionally, this model requires some extensions by considering more detailed sub-steps. For example, in the pilot project step, how to define the pilot scope, how to set the objectives, and possible technical solutions, etc. will be further investigated.

Reference List

1. Chen, T. and H.R. Tsai, Ubiquitous manufacturing: Current practices, challenges, and opportunities. Robotics and Computer-Integrated Manufacturing, 2017. 45: p. 126-132.
2. Davies, R., Industry 4.0. Digitalization for productivity and growth. Briefing from EPRS. European Parliamentary Research Service, 2015.
3. Group, I., Digitalisation, and automation in the Nordic manufacturing sector – Status, potentials, and barriers. 2015.
4. Kagermann, H., et al., Recommendations for implementing the strategic initiative INDUSTRIE 4.0: Securing the future of German manufacturing industry; final report of the Industrie 4.0 Working Group. 2013: Forschungsunion
5. Kakdeu, L, M., D'Pola, K.U., & Egoh, M. A., (2020) "Obtaining Credit in Cameroon: Problems and Prospects" Being a Thematic Report N. 3, DBI Project, Nkafu Policy Institute, Denis and Lenora Foretia Foundation
6. Khan, A. and K. Turowski. A Survey of Current Challenges in Manufacturing Industry and Preparation for Industry 4.0. in Proceedings of the First International Scientific Conference "Intelligent Information Technologies for Industry" (IITI'16). 2016. Springer.
7. Lasi, H., et al., Industry 4.0. Business & Information Systems Engineering, 2014. 6(4): p. 239-242.
8. Mourtzis, D., Challenges and future perspectives for the life cycle of manufacturing networks in the mass customization era. Logistics Research, 2016. 9(1): p. 2.

9. Rüßmann, M., et al., Industry 4.0: The future of productivity and growth in manufacturing industries. Boston Consulting Group, 2015: p. 14.
10. Schumacher, A., S. Erol, and W. Sihn, A Maturity Model for Assessing Industry 4.0 Readiness and Maturity of Manufacturing Enterprises. Procedia CIRP, 2016. 52: p. 161- 166.
11. Sniderman, B., M. Mahto, and M.J. Cotteleer, Industry 4.0 and manufacturing ecosystems: Exploring the world of connected enterprises. Deloitte Consulting, 2016.
12. Weyer, S., et al., Towards Industry 4.0 - Standardization as the crucial challenge for highly modular, multi-vendor production systems. IFAC-PapersOnLine, 2015. 48(3): p. 579-584.
13. Xu, X., From cloud computing to cloud manufacturing. Robotics and computer-integrated manufacturing, 2012. Vol. 28(1): p. 75-86.
14. Xu, X., Machine Tool 4.0 for the new era of manufacturing. The International Journal of Advanced Manufacturing Technology, 2017: p. 1-8.
15. Zhong, R.Y., Q. Dai, T. Qu, G. Hu, and G. Q. Huang, RFIDenabled real-time manufacturing execution system for mass customization production. Robotics and Computer-Integrated Manufacturing, 2013. 29(2): p. 283-292.
16. Zhong, R.Y., Q. Dai, T. Qu, G. Hu, and G. Q. Huang, RFIDenabled real-time manufacturing execution system for mass customization production. Robotics and Computer-Integrated Manufacturing, 2013. 29(2): p. 283-292
17. Zhong, R.Y., S. T. Newman, G. Q. Huang, and S. L. Lan, Big Data for supply chain management in the service and manufacturing sectors: Challenges, opportunities, and future perspectives. Computers & Industrial Engineering, 2016. 101: p. 572-591.
18. Zhou, K., T. Liu, and L. Zhou. Industry 4.0: Towards future industrial opportunities and challenges. in Fuzzy Systems and Knowledge Discovery (FSKD), 2015 12th International Conference on. 2015. IEEE.

19. Zhou, K., T. Liu, and L. Zhou. Industry 4.0: Towards future industrial opportunities and challenges. in Fuzzy Systems and Knowledge Discovery (FSKD), 2015 12th International Conference on. 2015. IEEE.