The Transition to an SME 4.0: Between Opportunities and Threats

Nassima BOURI*

LARAFIT Laboratory ESE Oran
University of Oran 2
Algeria

nassimabouri@rocketmail.com

Received: 05/04/2021 *Accepted*: 10/10/2021 *Published*: 16/12/2021

Abstract :
SME 4.0 is the industrial enterprise that has undergone a cyberphysical transformation of manufacturing. The Industry 4.0 concept comes from the German initiative, launched by the government to promote connected manufacturing and digital convergence between industry, business and other processes. The move to a 4.0 business is complex, it is a fully interoperable ecosystem of machines and partners will be created throughout the supply chain and the data will feed and correct the flow of economic transactions and financial transactions. It is in this context that this paper proposes to summarize the main strategies of facilitating passage.
Keywords: SME 4.0, Industry, Innovation, Robotics, Cobotics, PLCs.

JEL Classification : L86.
* Corresponding author: Nassima BOURI. (*nassimabouri@rocketmail.com).*)

Introduction

Generally, it is necessary to think about the place of the human in this industry 4.0! Indeed, Industry 4.0 is a name given to the current trend of automating and exchanging data in manufacturing technologies. It includes cyber-physical systems, the Internet of Things, cloud computing and cognitive computing. Industry 4.0 is commonly called the Fourth Industrial Revolution.

Industry 4.0 encourages what is called a "smart factory". In structured modular smart factories, cyber-physical systems monitor physical processes, create a virtual copy of the physical world, and make decentralized decisions. On the Internet of Things, cyber-physical systems communicate and cooperate with each other and with humans in real time, both internally and through the organizational services offered and used by value chain participants.

The concept of industry 4.0 or industry of the future is a new way of organizing the means of production. This new industry is emerging as the convergence of the virtual world, digital design, management (finance and marketing) with the products and objects of the real world. The big promises of this fourth industrial revolution are to seduce consumers with unique and personalized products, and despite low manufacturing volumes, to maintain gains (Bosch, 2015).

This industrial revolution affects different aspects of our modern societies globally and the accompaniment of current employees on the other hand. New challenges emerge through this new way of producing. Industry 4.0 obviously affects the economic aspect but also has social, political or environmental impacts. It raises the question of the employment of millions of employees around the world.

I. Origin and definition of the concept

Industry 4.0 is the cyber-physical transformation of manufacturing. The name is based on the German Industry 4.0, a government initiative to promote connected manufacturing and digital convergence between industry, business and other processes. Industry 4.0 is the fourth industrial revolution, but there is disagreement about how to define revolutions. The first industrial revolution took place in the late 18th century and was marked by the mechanization made possible by steam and hydraulic power.

The second industrial revolution, which took place at the beginning of the 20th century, was favored by electricity and marked by mass production, assembly lines and the division of labor. The third, in the early 1970s, came from the use of computers to further automate machines and production processes. The vision of the fourth industrial revolution will result in a smart factory and fully exploit digital manufacturing (Hassani, 2020).

Currently in its infancy and beginning to unfold in isolation, it's fully connected and vast form remains a vision for the future. It should be an end-to-end digitization of the manufacturing sector. In Industry 4.0's vision, a fully interoperable ecosystem of machines and partners will be realized throughout the supply chain and the data will inform and correct stock prices.

II. Precursors of the concept

Industry 4.0 is one of the key projects of the German government's high-tech strategy, which encourages the digital revolution of industries. In France, companies like Fives, Schneider Electric, Dassault Systems, Siemens, Mecachrome Atlantique, sedApta-osys, Airbus Group, Bosch Rexroth, SNCF, are very involved in the development of the 4.0 plant. In recent years, France has seen the birth of new startups such as Usitab, Optimistik or TellMePlus that exploit new technologies to improve and optimize the French industry.

In July 2015, the Future Industry Alliance was created at the initiative of 11 professional organizations in the industry and digital, academic institutions (Arts & Métiers ParisTech, Institute Mines-Telecom) and technological (CEA, CETIM) to federate the initiatives of modernization and transformation of the industry in France. ELCIMAI is launching a research program on the unmarked modular plant (real estate component) on the 4.0 factory project.

The Bosch Group, with its Bosch Rexroth division, organized in France on 18 November 2015 the "Tech Day Industrie 4.0", a day of exchanges and conferences around concrete solutions for the industry of the future. By sharing with the French industry its vision and practices, Bosch emphasizes its willingness to open up its

know-how to better enable the exchange of ideas and foster partnerships in the key sector of the industry (Bosch, 2015).
In the United States the "Coalition for Intelligent Manufacturing Leadership" project is also working on the future of industrial manufacturing. Independently, General Electric has been working for a few years on a project called the Industrial Internet which seeks to combine the advances of two revolutions; the multiplicity of machines, devices and networks resulting from the industrial revolution, as well as the more recent evolutions of the information and communication systems brought by the revolution of the Internet.

III. Benefits of Industry 4.0

The benefits of the Industry 4.0 transformation will likely be numerous. Analytics will accelerate product development and then help OEMs determine how well customers have actually used a product in the way that was intended. The data provided by the sensors will indicate ways to optimize production, by continuously providing status updates that will be compared with a digital twin (a simulation that runs with perfect efficiency) to generate information, corrective and predictive maintenance alerts. Additive manufacturing will make lucrative productions very flexible or in small series lucrative. Augmented reality will stimulate efficiency and learning, as machines will assist those responsible for performing hazardous or complex operations and become more autonomous. Some of these advances are already happening on a small scale (Hassani, 2020).
The overarching and overarching goal of the Industry 4.0 vision is to transform manufacturing and related activities, from design to the end of a product's life cycle through logistics, into a process that meets the needs of customers. Customers more efficiently and innovatively, with the new business models and the revenue streams that flow from them. It should also transform cities and collective services.
While some companies are leading the way with a few one-off examples of what Industry 4.0 offers, it is likely that most businesses will struggle, especially because of the costs of new technologies. Interoperability will also be difficult to ensure as the various supply chain partners strive to share their data in a transparent manner. In addition, standards and safety should receive a lot of attention as Industry 4.0 applications and platforms proliferate and expand (Gamache, 2019).

IV. Challenges of 4.0

The implementation of a digital strategy integrated into the corporate strategy, and including the acquisition of new technologies, represents certain challenges. Here are the main ones:

- The connectivity of software and equipment, even equipment in place.
- Standardization of standards and processes that facilitates data sharing.
- Reengineering of working methods and processes.
- Cybersecurity management, to protect sensitive information and know-how.
- Access to specialists in digital technologies.
- The development of new skills.

V. The characteristics of a digitized SME

The third and inevitable consequence of the first two is the reconciliation of digital transformation - in business models and in the detection of new information-related information and information-related opportunities in evolution "as service". As we have already mentioned, the industry 4.0 is a concept that refers to a fourth industrial revolution and therefore, like the last 3 (steam engine and mechanization in the 19th century, mass production and conveyor in the 20th century, automation since the 1970s), to a new method of production.

More specifically, the Digitization of Industry or Plant 4.0 is an interconnected system that links machines, management methods (such as Enterprise Resource Planning, ERP) and products. It is an SME that is characterized by the following forms:

- An innovative SME;
- A fully digitalized SME;
- A flexible SME;
- An SME turned towards its external actors;
- A socially responsible SME;
- An economically efficient and environmentally responsible SME.

VI. Industry 4.0, automation, programming, and robotization: What links?

The development of the last decades has focused on controllers and their ability to communicate in a more user-friendly way. Communication protocols have evolved and the information collected by them in the course of operation can even be shared with MES software, among others. The standardization of communication is one of the challenges of Industry 4.0, and manufacturers are devoting efforts to creating standards in communication protocols. Recent equipment is even connected to the corporate Ethernet network. This can be the first step towards Industry 4.0, regardless of the extent of the company's fleet of machines.

1. Programmable Controllers (PLC)

An industrial programmable logic controller (PLC) is an electronic system that can control logical, sequential and combinatorial processes in real time. These processes control production equipment, including servomotors, pumps and other processing equipment.

2. Robotics

The robot is an equipment that needs programming to work. This task once required advanced computer skills. The constant evolution of technology, however, has made programming more and more user-friendly and intuitive. The robot can be manipulated manually by the operator in a task preparation mode, whether using a simulation device or a learning device.

3. Cobotics

Robotics is not new in itself, but its evolution has allowed us to move to a new stage in terms of its usability. Collaborative robots, or "cobots", represent a heavy trend testifying to new developments in robotics. "Cobotics is the domain of human-robot collaboration, the interaction, direct or teleoperated, between man (s) and robot (s) to achieve a common goal " (Bernard Claverie, Benoit Le Blanc et Pascal Fouillat, [2013]).

"The term comes from the English word "cobot", neologism from "cooperation" and "robotics". It was proposed in 1996 by J. E. Colgate, Wannasuphoprasit W. and A. Peshkin, professors at Northwestern University" (J. E. Colgate, W. Wannasuphoprasit and M. A. Peshkin, 1996). It was introduced and initially used to designate passive physical assistance devices that guide operators.

However, "Cobotics is not limited to the study of cobots, which are technical devices. She is more interested in real interaction, direct or teleoperated, between a human operator and a robotic system" (Théo Moulières-Seban, 2017). A cobot acts as an assistant and intervenes in a targeted way in complex and delicate tasks that are not automatable. It also has learning features. This type of robot is able to take an object, to give it to a human, in a cooperation environment that would not be suitable for more traditional robots. Cobots can be easily reprogrammed, moved (for example to mobile platform amounts) and redeployed at different stages of the production chain. The manipulated parts are generally smaller in size and weight limited compared to what traditional robots handle (Seban, 2017).

VII. The managerial strategies of the digital transformation of the industry

Maurice Ricci, [2016][1] proposed a relevant process for the digital transformation of the industry based on several parameters:

1. The reconstruction of the business model of the company

The integration of digital into the production process offers new opportunities for creating value for the company. It allows to reconstitute the means not only to optimize its activity but also to reinvent itself by positioning itself differently on the value creation chain (Ricci, [2016]).

2. Innovation and acceleration of the digital transition

In the face of technological change and the scope of opportunities offered by scientific research, the capacity for innovation becomes a key factor of differentiation, competitiveness and performance. It must become an essential axis of development of the company. Innovation is no longer the exclusive domain of technology and R & D. It invests the other dimensions of the organization: its processes, its way of working, its customer relationship, its production line, and, of course, its strategy. It becomes a process of transformation of the company as a whole and not only a way to improve the products. It opens up to the ecosystem and builds on it (Ricci, [2016]).

Digital is an almost inexhaustible source of innovation for the product, of course, but also for changing a usage, a process, a business model. From then

on, what better way to start opening than to get closer to the queens of the sector: start-ups and SMEs of the digital world. By going to meet them, the company will become familiar with the technologies and uses that it does not necessarily have internally: connected products, 3D printing, mobile uses, Big data, collaborative tool (Ricci, [2016]).

3. Strengthening the Company / Client relationship

The digital transformation of the industry contributes to the optimization of the relationship maintained with the customer. Digital technology enriches the latter by bringing more interactivity, proximity and transparency. It thus facilitates the coherence of the customer experience across all interaction channels.

According to Ricci, [2016], collaborative tools and customer relationship management (CRM) software are now called CX - Customer Experience. CX software, for example, provides a complete view of the customer and their situation (360 ° vision) by concentrating in a single space all the information related to it (lead marketing, opportunities, history, contracts in progress, service data, commercial data, litigation, etc.); this, regardless of the channel used by the client to contact the company (call center, email, mail, website, social media...).

4. Proactivity of the industrial chain

The answer of the digital to the question of the optimization of the production, it is to pilot it by the data. How? By digitizing and interconnecting all links in the industrial value chain: from sales order to delivery including sourcing and supplier interactions (Ricci, [2016]).

Thus digitized and synchronized, the chain is characterized by its flexibility and modularity. It can be reconfigured automatically and adjusted according to demand. It adapts to unavoidable variability (raw material prices and volumes, unpredictable supply, machinery breakdowns, quality fluctuations, etc.) while maintaining its quality objectives and optimized TRS.

The digitization of the chain begins with that of the factory. It is obtained by connecting to the IoT all its components: machines, parts, products, workstations. Equipped with sensors and transmitters, these cyber-physical systems communicate with each other and interact continuously, through networks, adaptation gateways and data exchange platforms (Ricci, 2016).

5. The revalorization of the role of the human

Give back the desire to work at the factory. Digital technology can contribute to this other ambition of the Industry of the Future program by better taking into account the human aspects and by revaluing the role of the operator. In a factory where the machines become more autonomous, the role of the operator evolves towards that of responsible pilot. Equipped with a mobile terminal connected (smartphone, tablet, etc.) possibly reinforced, it gains autonomy, moves and remotely monitors the current operations on several machines. Notifications on his mobile device alert him to incidents. It instantly accesses the necessary documentation (Ricci, [2016]).

Conclusion

Industry 4.0 is made possible by technologies that integrate both the digital and real worlds:

- The Internet of Things (IoT): Connects an ever-growing number of systems, devices, sensors, assets, and people through low-power, wide-area wireless networks and large wired networks capacity;
- Mobile Solutions: Includes tablets and smartphones, portable sensors and smart glasses;
- Cloud computing: Includes cost-effective data processing and storage solutions;
- Cyberphysics Systems (SCP): Monitor and control physical processes using sensors, actuators and processors, based on numerical models of the physical environment • Massive Data Analysis and Business Intelligence: Transform data in actionable intelligence, including early warning algorithms, predictive models, decision support tools, workflows and dashboards;
- Advanced Manufacturing Technologies: Include robotics and 3D printing. Industry 4.0 is directly following the third industrial revolution, and began a few years ago. It is a kind of mix between all the latest technologies created. But instead of using them separately, they are improved and used together to form a "super automated system", in order to provide a totally different service (Jovanovski, 2020).

Several studies have shown that[2]:

- Industry 4.0 introduces significant challenges. Governments and industry associations can support businesses;
- The Internet of Things improves productivity and resource efficiency (an increase of about 20% in efficiency over a five-year horizon);
- The Internet of Things is transforming the business as a whole and must be part of the concerns of leaders;
- Connectivity is paving the way for new business models;
- By 2020, more than 80% of companies will have digitized their value chain.

Bibliography:

- Acemoglu, D., and P. Restrepo (2017). "Robots and Jobs: Evidence from US Labor Markets," paper presented at the American Economic Association Annual General Meeting, Chicago, January 7.
- Agrawal, A., J. S. Gans and A. Goldfarb (2017). "What to Expect from Artificial Intelligence," MIT Sloan Management Review, Vol. 58, No. 3.
- Autor, D., D. Dorn, L. F. Katz, C. Patterson and J. Van Reenen (2017) Concentrating on the Fall of the Labor Share, Working Paper No. 23108, National Bureau of Economic Research.
- Derviş, K., and Z. Qureshi (2016). The Productivity Slump-Fact or Fiction: The Measurement Debate, working paper, Col. Global Economy and Development, Brookings.
- Ericsson, N.R. (2016). Economic Forecasting in Theory and Practice: An Interview with David F. Hendry, Board of Governors of the Federal Reserve, coll. "International Finance Discussion Papers", No. 1184.
- Frey, C. B., and M. A. Osborne (2017). "The Future of Employment: How Susceptible Are Jobs to Computerization? "Technological Forecasting and Social Change, vol. 114, No. C, p. 254-280.
- Fung, B., and H. Halaburda (2016). Central Bank Digital Currencies: A Framework for Assessing Why and How, Staff Analysis Paper No. 2016-22, Bank of Canada.
- Kaplan, G., B. Moll and G. L. Violante (2016). Monetary Policy According to HANK, Working Paper No. 2016/2, Council on Economic Policies.
- Lev, B., S. Radhakrishnan and P. C. Evans (2016). Organizational Capital: A CEO's Guide to Measuring and Managing Intangible Enterprise, coll. "Measuring and Managing Organizational Capital Series", No. 1, The Center for Global Enterprise.
- OECD Compendium of Productivity Indicators 2016, Paris, OECD Publishing.
- Poloz, S. S. (2016). From Wood Cutters to IT Professionals: The Expansion of Canada's Service Economy, delivered at the C.D. Howe Institute, Toronto, November 28.
- Schwab, K. (2016). The Fourth Industrial Revolution, Geneva, World Economic Forum.
- Syverson, C. (2016). Challenges to Mismeasurement Explanations for the U.S. Productivity Slowdown, Working Paper No. 21974, National Bureau of Economic Research.
- Van Ark, B. (2016). "The Productivity Paradox of the New Digital Economy," International Productivity Monitor, Vol. 31, p. 3-18.
- Varian, H. (2016). "Intelligent Technology," Finance and Development, vol. 53, No. 3, p. 6-9.

- World Economic Forum (WEF) (2016). Digital Transformation of Industries: Logistics Industry, World Economic Forum white paper prepared in collaboration with Accenture.
- World Economic Forum (WEF) (2016). Digital Transformation of Industries: Automotive Industry, World Economic Forum white paper prepared in collaboration with Accenture.

[1]President of the Future Industry Committee Syntec "Digital".

[2]PWC, Industry 4.0: Opportunities and challenges of the industrial Internet, 2014: www.strategyand.pwc.com/media/file/Industry-4-0.pdf.