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Industry 4.0: Change Involves Giant Leaps for Individuals and Plants

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Abstract. The case focuses on digital transformation of manufacturing commonly called "Industry 4.0" that entails profound changes for companies and their employees. These changes and how they are managed are illustrated by some examples of French companies of various sizes and that operate in diverse industries. Instructors in general management / international management may use this case to highlight the complementary reasons that lead to digitalization of manufacturing processes and the issues related to managing these changes, including inertia and resistance.

Keywords: digital transformation, manufacturing, management of change, general/international management.

1. Discovering Industry 4.0

Digitalization has revolutionized the production and delivery of goods and services over the last 10 years – and has been an ongoing revolution ever since. Part of this revolution has been occurring right in front of our eyes: who has never used Uber, AirBnB, Amazon, Netflix, or any other digital services that either did not exist or used to be delivered so differently in the past? Still, another structural, yet more invisible transformation is taking place: the digital transformation of manufacturing. Often called "the Fourth Industrial Revolution" or "Industry 4.0[1]", this move is deeply altering production processes, the way work processes in factories is considered, and the products that result from such renewed processes.

Industry 4.0 alludes to "the intelligent networking of machines and processes for industry with the help of information and communication technology[2]". Simply put, it means integrating and combining information and communication technologies in plants to make the industrial value chain more effective and efficient. The "plants 4.0" thus become so-called smart factories.

1. https://www.sciencedirect.com/science/article/pii/S0925527320301559?via%3Dihub
2. https://www.plattform-i40.de/IP/Navigation/EN/Industrie40/Vision/vision.html

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In these smart factories, traditional and physical production systems rely on such technologies as augmented reality, autonomous robots, collaborative robots (i.e., cobots), additive manufacturing (more commonly called 3D-Printing), cloud computing, Artificial Intelligence, Internet of Things (IoT), etc. Production systems benefit from advanced control systems, use internet that allows connectivity via IoT and can be updated thanks to their embedded operating system. Accordingly, smart factories are now made up of machines that communicate with each other, and can be easily reconfigured the. In this way they can adapt and deliver products cost-effectively that are more alligned to customers' changing qualitative and quantitative needs[3].

Because of this high level of technological integration in new machines and of the digitization of older updated equipment, plants 4.0 are supposedly more effective and efficient. They are also considered easier to maintain as maintenance can be fully or partially done remotely. This has contributed to the development of the global Maintenance, Repair and Operations (MRO) market, valued at $616.01 billion in 2020 (and potentially worth $701.3 billion by 2026[4]). Similarly, e-commerce has also strongly supported the development of the MRO market, as an increasing number of firms have developed their B2B online platforms on which they sell industrial tools and equipment.

2. Industry 4.0 in Practice

2.1. JPB Système: "My Smart Factory Can Be Yours"

JPB Système is a French industrial SME created in 1995, taken over in 2006 by Damien Marc when his father, one of the two co-founders, passed away. JPB designs and produces customized self-locking devices (plugs, fittings, or fasteners[5]) that resist extreme vibrations for the aeronautic and aerospace industries. According to information on its website, these innovative and patented products enable its customers, (e.g., Safran, GE Aviation, Honeywell Aerospace, and Rolls Royce[6]) to decrease their maintenance costs by some 60%[7]. In 2021, the firm had 140 employees, and a 22M€ turnover[8] (up from 1.3M€ in 2009, and 12M€ in 2016).

Initially, JPB used to design and prototype its products, while their production was outsourced in Poland. However, facing an increasing demand and

3. https://www.usinenouvelle.com/editorial/tribune-pas-de-transformation-industrielle-sans-projet-d-entreprise-a-long-terme.N815265
4. https://www.mordorintelligence.com/industry-reports/maintenance-repair-operations-mro-industry
5. https://jpb-systeme.com/Solutions.php
6. https://www.jpb-systeme.com/customers.php
7. https://jpb-systeme.com/

considering that the firm had become too dependent on its supplier, Damien decided to internalize the whole process, including production. This led him to invest 4 M€ in 2016 to modernize and fully automate its plant in Villaroche, purchased three years before in the south of Paris.

As he explained[9]:

> I had noticed during my business trips that aeronautics subcontractors in low-cost countries, such as for instance in Poland, did not strive to optimize their processes and bring more added value [to their customers], precisely because they had a cheap workforce. This is quite the opposite at JPB Système. We are pushed to being imaginative. So, we have robotized as much as we could, which enables us to offer our customers an exceptional and consistent quality.

Operational since the first quarter of 2017, the 3,000m² site has been equipped with six production lines. Those have been designed to be flexible and to enable the production of customized products that can match the specific needs and requirements of customers. The lines have also been conceived to facilitate the operators' work and predict the need for maintenance. Thus, operators can rely on a network of cameras and sensors to remotely monitor and pilot, in real-time via their smartphones, several machines simultaneously, as well as reduce the wear and tear of their tools[10].

Developing this, however, has not been easy. Indeed, to automatise the plant, Damien bought two brand-new machines, costing 500,000€ each, but discovered soon after that they could not communicate with each other! As he explained, "*we had a very effective set of machines, but also very stupid ones. Everything had to be manually done via an excel sheet*[11]". Also, as he had experience of many traditional plants, he was amazed at how much time was lost by operators who were waiting for machines to finish their task: "*I tried to identify everything that did not bring any added value for the operator, and we robotized it. So, operators can focus on higher-level issues*[12]". In the end, only two people piloted the production line, where less automation had required six people.

Given the news coverage of this new plant by specialized media, JPB soon became a technological showcase, visited by many firms that wanted to

8. https://www.lesechos.fr/pme-regions/actualite-pme/frontalier-de-lukraine-jpb-systeme-mobilise-les-patrons-francais-pour-les-refugies-1390227#:~:text=Actualit%C3%A9%20des%20PME-,Ukraine%20%3A%20en%2024h%2C%20le%20patron%20de%20JPB%20Syst%C3%A8me%20a%20cr%C3%A9%C3%A9,des%20enfants%20venant%20d'orphelinats
9. https://www.bpifrance.fr/nos-actualites/french-fab-interview-de-damien-marc-jpb-systeme - Source of the picture: https://www.linkedin.com/in/damienmarcjpbsysteme/overlay/photo/
10. https://www.industrie-techno.com/article/piloter-son-usine-avec-un-smartphone-c-est-possible.50686
11. https://www.industrie-techno.com/article/robotisation-controle-a-distance-et-maintenance-predictive-jpb-systeme-accelere-son-projet-d-usine-4-0.64259
12. https://www.usinenouvelle.com/article/chez-jpb-les-robots-evitent-la-delocalisation.N625618

understand how it had implemented this technology and had benefited from its expertise. The news coverage increased in 2020, as JPB announced the launch of *Keyprod*, which it called the "Shazam for the industry[13]". Simply put, Keyprod was a solution that combines software with hardware equipped with specific sensors that "listen" to any machines' vibrations to collect information about their state (e.g., a drill that has worn out, lower productivity levels, etc.). Initially, Keyprod was supposed to be used internally, to make JPB's machines even more efficient and effective. However, faced with the long-term repercussions of the Covid-19 pandemic on the airline industry, Damien decided to turn Keyprod into an actual commercial solution. He therefore created a subsidiary of JPB that developed and sold Keyprod[14]. This was a major change in JPB's business model, that would now market its expertise through Keyprod, rather than just selling physical products.

2.2. Lectra: "We Design the Machines That Will Give Birth to Your Own Designs"

Lectra has more than 800 employees, headquartered in Cestas, near Bordeaux, and is present in more than 34 countries. Created in 1973, Lectra manufactures machines capable of autonomously cutting leathers, fabrics, and other kinds of flexible materials which are sold to the automotive, fashion and furniture industries. Lectra does not just produce hardware, but also develops software and provides services[15]. This enables the firm to sell its customers full high-tech solutions. In addition, Lectra has a large R&D centre, which is open to its customers for visits. This R&D centre constantly improves the machines and applications that Lectra sells. Simultaneously, it also continually refines the devices and systems that are used to create those machines and applications[16]. Accordingly, the firm has strongly automatised its own production chain over the years, which enables workers to focus on tasks of high added-value.

13. https://www.usinenouvelle.com/editorial/cette-pme-qui-lance-le-shazam-de-l-industrie.N967841
14. https://www.keyprod.com/
15. https://www.lectra.com/en
16. Discover Lectra's R&D center and showroom in this short video (2'48): https://www.youtube.com/watch?v=eF_ioPrnST8