

Written Report

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Advanced Industry 4.0

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Introduction

Most businesses nowadays are working hard to understand what business model innovation means for them and how they could implement this new concept into their existing business model. This report will also show the difference between a business model (BM), which is how the company designs its value creation, mechanisms, and delivery, and a business model innovation (BMI). BMI is the connection between the business model into the company with all critical elements used to achieve the improvements and changes (Sjödín, Parida et al. 2020).

This report will look at two critical technologies used in the manufacturing industries the Internet of Things (IoT) and Additive Manufacturing (AM). IoT is the network system running the production flow with immediate access to modify errors or raise alerts, have the technologies interconnected at a large scale, track the system, and can be used to guard against cyberattacks.

Due to its flexible manufacturing method, added to the short lead time, AM is still in development; because of its limitations, but it is used more every time to achieve complex shapes and reduce weight in the engineering industry. In the same way, an overview of Industry 4.0 and its interaction with the business model and cloud manufacturing (CM). Additionally, this paper proposes the correlation between AM, IoT and CM and how they will be more useful working together (Haghnegahdar, Joshi et al. 2022).

Business Model

There are different concepts used to define what a business model is. However, the generation of income and the way in which companies receive compensation for it are the two main perspectives that have strong arguments to be the base of this business model term. The business model term was introduced by Michael Lewis when he mentioned that the internet would be the most powerful tool to generate income for businesses (Munna 2021).

There are different methods that a company can use to test whether or not the implementation of a new business model will be or is being successful. Considering this, the executors of a new business model need to understand what will be the outcome or income generated, have clear objectives to achieve, and have good knowledge of who will be the customer or receptor of the new business model. The business models can be shown by combining new ideas or just using the old ones to improve or give new values to existing methodologies or processes to obtain internal improvements in the business. Customers not only have advantages by receiving a good product but will also be profited when a good service is provided. Furthermore, it is here when it can be seen that a business model is clearly represented in two parts. The first one will focus on the services sold, like delivering a product or offering services, negotiating a sale, and finding and obtaining customers. The second one is related to defining what kind of service/product (i.e., design, manufacture, raw materials) the business is or wants to work with (Magretta 2002).

Industry 4.0 & Business Models

The fourth Industrial Revolution, also called Industry 4.0, is mainly the transformation of manufacturing business through the implementation of new technologies to improve production, communication, efficiency, and flexibility in others to be more competitive in the market.

On the other side, there is a global concern to have more sustainable companies friendly with the environment, which can reduce resource consumption and energy (Bai, Dallasega et al. 2020).

The technologies used in this industry revolution (I4.0) are the Internet of Things (IoT), cloud computing, big data, artificial intelligence (AI), additive manufacturing (AM), advanced robotics, and sensors. The convergence of using these technologies with business models leads to the introduction of another concept into this revolution called Business Model Innovation (BMI).

BMI is the tool that can be used to make the new business model ideas interact with the digital technologies to come up at lower cost with better solutions in order to achieve the business objectives during their transformations. Besides improving the internal management of the business, it is easy to identify that the outcome for customers will be hugely increased.

Customers can easily change existing products, satisfy specific needs, have accurate solutions, and better quality products (Marcon, Le Dain et al. 2022).

Internet of Things (IoT)

In 1999 the term Internet of Things (IoT) was mentioned by Kevin Ashton when he was discussing supply chain management. IoT can be described as a group of smart connected devices/things and sensors through the internet or other protocols of communication. It is strictly

necessary to have these three components to make sure that the architecture of IoT has been set up correctly:

1. Equipment: a network of sensor nodes in an immersed communication and circuits connected.
2. Server: handling resources, analysis, and data storage.
3. Software: end-user devices compatible with different platforms to present the data clearly.

(Shafique, Khawaja et al. 2020).

Intro the manufacturing industry IoT is a powerful tool that can help to resolve challenges through its applications for human-to-machine interconnection, production quality control, and equipment performance optimization and monitoring. Besides this, data collection, data storage, and the analysis of manufacturing processes are other services used in the industry. The vast capacity of IoT requires the use of cloud-based technologies and, consequently, Cloud Manufacturing (CM), but this requires improved innovations in services and applications with capital investments.

CM is the cloud network service provided to manufacturing businesses with two characteristics: shared and knowledge data. Data is shared throughout the supply chain after being collected and stored (Haghnegahdar, Joshi et al. 2022).

Additive Manufacturing (AM)

From the manufacturing processes additive manufacturing is the one which can be fully controllable by computer-driven machine in line with the Industry 4.0 technology. These machines also are compatible with IoT, and CM to be controlled online in any time.

Additionally, the waste of material that can be controlled and reduced with this AM process is huge compared with other highly used process like machining. The most common process used by AM processes is the addition of the materials to the previous surface by layers via different techniques until obtain the final model. Direct energy deposition, powder bed fusion, binder/material jetting, vat photo-polymerization, sheet lamination and extrusion are the different techniques used into the engineering processes. Metallic compounds, polymers and ceramics are the predominantly materials utilised with poor quality finish on the final surfaces, but the flexibility to obtain different geometries, short lead time, and the low-priced processing gives good advantages to keep increasing its use into the engineering industry (Mehrpouya, Dehghanghadikolaie et al. 2019).

The company Ford has gone one step further with the technological connectivity into this Industry 4.0, and has been able to close the ring in the production line by replacing the human action with robots to control the 3D printers. They have fulfilled to keep different autonomous systems talking between them the same language even if they are from different manufacturers (Trop 2022).

Discussion

As can be seen, the literature shows that the new technologies can be implemented into the different businesses through the correct use of BM and BMI tools. It is not necessary doing drastic changes to the traditional business models to start using these new technological aspects like IoT, AM, Cloud Computing, Big Data, Robots, Artificial Vision (AV) or Augmented Reality (AR), because this is one the big advantages of BM and BMI as they can work independently and gradually to achieve the end with a radical innovation. Manufacturing companies can transform and include new BM by following the next four methods:

- 1- Internal and external process improvement: more efficient inventory management, better maintenance, quality control, and more efficient production. Connectivity between internal and external processes with suppliers, and employee training to get better communication and flexibility.
- 2- Improve customer interaction: use social network/data to understand customer needs to predict, and offer a personalised marketing. Digital sales improved to save time and cost by having a personalised customer service.
- 3- New Value Network and Ecosystems: increase value and growth by relying on one another in real time on production, personal availability, sales and inventories.
- 4- Smart services/products (New Business Model): collect environment and customer information through smart products. Direct relationship with customers to participate in the creation process from the beginning (Ibarra, Ganzarain et al. 2018).

Conclusion

It can be said that a business model is success depending in how well the executors known the service, product or improvement to achieve, at the same level of its customer/objective to produce money by turning out value. Further more, the flexibility presented by business models and the way these do not address the company as a complex system can be shown as a weak point (Munna 2021). But others think in the opposite way, because it helps to reduce high risks during the implementations of new improvements or modifications into the company.

At the present time AM process has huge advantages to be used as prototyping, to obtain quick 3D models to do trials, close end parts for development products, achieve complex shapes, final parts to be used where a high finish is not required (Haghnegahdar, Joshi et al. 2022). On the contrary, high production costs, weaker parts compared with traditional machining and Die casting processes, and the slow process are some of the disadvantages that still happening in these dates (Mehrpouya, Dehghanghadikolaie et al. 2019).

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