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1. Introduction

1.1 Motivation

As the consumer goods market has changed dramatically in the last few years, the industry itself had been fallen behind regarding the potential of computer science by just doing upgrades that only tend to keep the companies to their segment standard. Service oriented companies needed to change over the years and digitalize, in order to keep up with the market as costumers incorporated digital technologies in their everyday life. This digitalization left important sectors like the book industry being almost completely wiped out, but also giving other completely new markets the possibility to emerge. This extreme shift in the business is arriving in the industrial sector, consumer as well as producer goods companies are going to shift the way the production systems are handled.

One of the main goals of an industrial engineer is to be able to improve systems thanks to the knowledge in a wide variety of fields like mechanics, electronics, IT and economics. The concept of Industrie 4.0 is not only in itself a major shift for most organizations but also reflects overall the broad capacity of concepts that an industrial engineer needs, as the multidisciplinary skills are essential to understand to the fullest the impact that it'll have in the years to come.

1.2 Relevance

In order to understand how big this jump for the industrial production is, it's relevant to denote how much importance it's given by the biggest companies worldwide as well as it's aided by the different governments. This is specially the case for heavily industrialized countries such as Germany, France, Japan, China and the USA. The definition "Industrie 4.0" originated in the Hannover-Messe fair in 2011, as it is one of the most significant exhibitions with regards to industry.¹ This concept has grown throughout the years and is nowadays recognized by a lot of businesses as a game changer, knowing that in the future the key technologies will need to be considered in order for some sectors to survive. With all this changes taken into account, the traditional business models used until now need to be adapted to make use of their full potential.

The current trend is to go from an industrialized nation to a service oriented countries. As this third sector keeps having more importance, the amount of data (and therefore information and potential knowledge) keeps growing at an exponential rate. Moor's Law, whose observation was to foresee the capacity of transistors in integrated systems can be easily identified in the amounts of information that machines process nowadays.²

This evolution can be seen in the change of the composition of the sectors of the GDP throughout the years. As an example, there's the USA, which has evolved from a primary agricultural based country until around 1870, and with a similar industry-service growing proportion until 1915, nowadays has the tertiary sector making an estimated 79,5% of the GDP in 2016.³ Economists are also discussing the possibility

¹ (Lukas, Wahlster, & Kagermann, 2011)

² (Brauckmann, 2015, pp. 16-17)

³ (CIA: The world fact book, 2017)

to add a fourth one: the quaternary sector. This most recent one is mainly composed of knowledge related areas like IT, communications, consultancy and R&D.⁴ This new dimension, to see a part of the economy by the base of knowledge, makes it possible to comprehend the impact that computer science has since the world-wide-web.

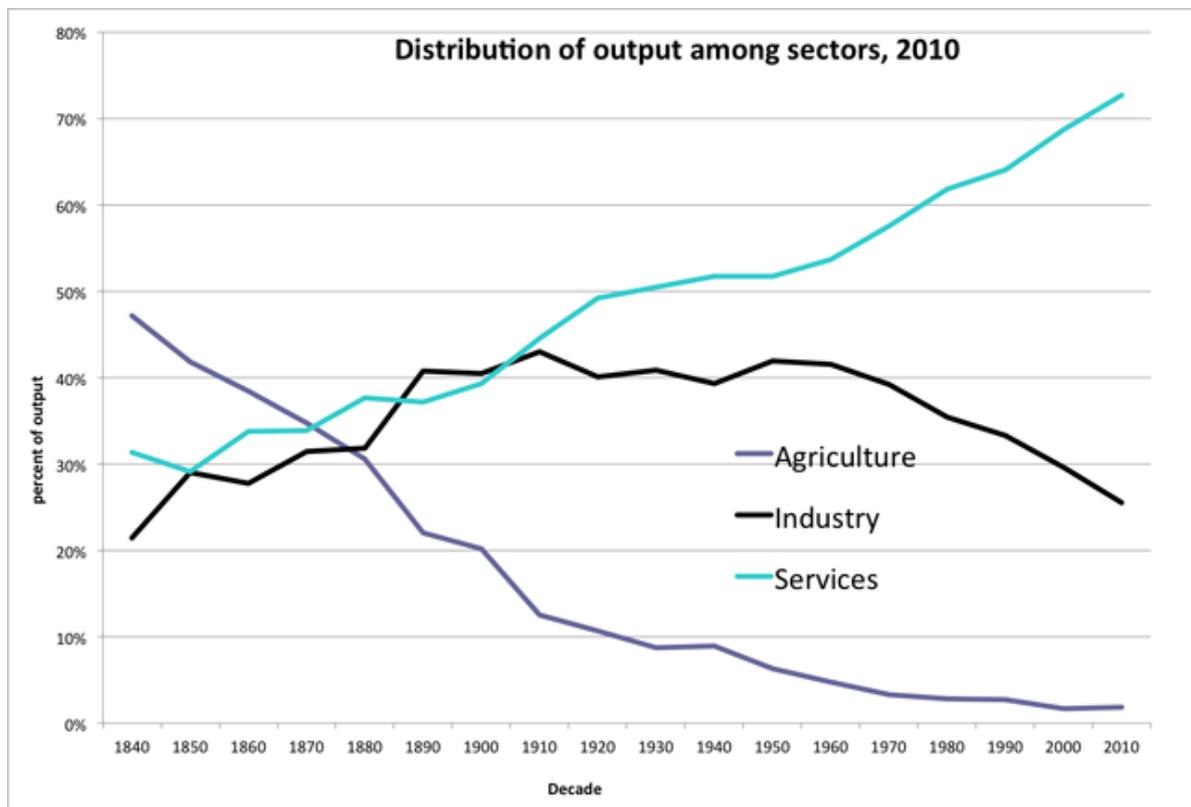


Figure 1 Evolution of output by activity sectors in the USA⁵

1.3 Structure

In order to understand the relevance of the actual redevelopment in the interconnected industrial production there are some inevitable things that must be explained. To fully understand the impact, the second chapter will handle the theoretical basics of what are the elemental components within the Industrie 4.0, knowledge management and business modeling, handling different key features that construct these.

The third chapter will deal with KM models, explaining how these work and if it's the case also the context for which it's supposed to be used. At the end the advantages and disadvantages of each model will be analyzed, as each one has a different approach to this topic.

After that I'll develop my own model, which handles Industrie 4.0 technologies and how with the proper knowledge management measures, the impact in the business side of the company will do. After explaining the model, which is divided into three different parts, there are going to be two examples with their own context in order to show how the model is supposed to be implemented.

After the model is presented, different characteristics will be discussed, which could affect the way in which the model works. I'll also discuss the possible measures that

⁴ (Business Dictionary, 2016)

⁵ (Johnston, 2012)

can be implemented in order to improve the business models according to the full potential that the fourth industrial revolution offers. Following that I'll clear out the limitations of the model by the things that were not taken in account, but could be owrth taking into account for a more developed model.

At the end, I'll express my conclusion and outlook regarding the topic and how the sector will probably evolve in the years to come.

The following figure depicts the steps taken for the thesis:

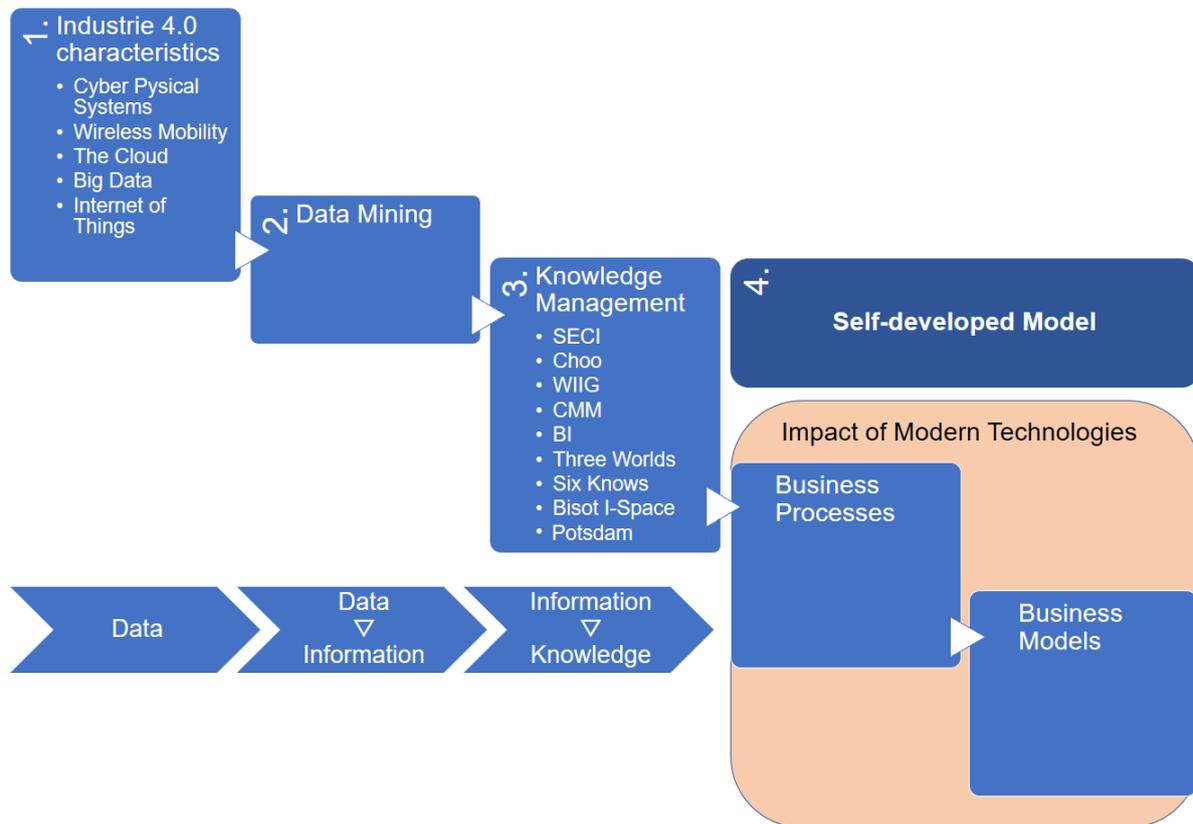


Figure 2 Visualization of structure⁶

⁶ Own representation

7. Conclusion and Outlook

In this thesis, various knowledge management models were presented as well as various key technologies of the Industrie 4.0, to further on develop a new model that focuses on how these technologies would affect knowledge management in an organization and its impact on business models.

At the beginning, the basic components to understand the most important features of Industrie 4.0 were explained. These were Cyber Physical Systems, which are a fusion of physical and software components, Wireless mobility, which showed the various connection range options for components, the Cloud, with its immense storage capabilities, Big Data, especially regarding Data Mining, and the Internet of Things, which focused in the connectivity of objects. Furthermore, the concept of knowledge and knowledge management as well as business modeling and business process were explained.

Following this, eight different knowledge management models, with different perspectives and focuses, were presented as well as shortly discussed on some which could be suited for better uses depending on the advantages and disadvantages of each one.

After the models were presented the development of my own model started. Having a strong focus on artificial intelligence by the technologies of Industrie 4.0 and the Six Knows KM model, a base for the model was formed. After this, three main departments with their functions were added: the IT, the manage control system and the upper management. Each of these three having a different but vital point of view on how to approach a successful knowledge strategy. The environment was also taken into account, especially regarding infrastructure, workers organization and political context. The last step stated that depending on how strong the knowledge network within an organization is, the more flexible and profitable an organization would be, as the business processing is more efficient overall.

After this, several statistics about the implementation of Industrie 4.0 technologies were analyzed and it's possible impact on the model. What was also discussed was the effect of digital technologies on the workforce, as some new jobs are created others become completely outdated. Also the environment differences, focusing on infrastructure(especially in electricity and telecommunications) and workers organization, by comparing an industrialized and a developing country, were review.

At last, some limitations that were not fully considered in the model but could be interesting to take into account for a more developed one were pointed out. Such handled topics were cyber security, the implementation of these technologies in small organizations and the issue of personal data being compiled during work.

As computer science keeps evolving and changing everyday life by offering new and better goods and services, industry branches should keep up by also being able to incorporate and implement these in the digitalized production. New technologies not only allow to break limitations that were restricting possible advancements, but they also open doors for opportunities that nobody ever considered possible. The

personnel will be assisted by artificial intelligence, which improves from year to year with astonishing rates, making knowledge recognition and processing more efficient. This will lead to an overall improvement in the organization and its strategies. As a result, companies will be able to profit from digitalization of production by exploring the new frontiers and satisfying the ever-growing demands of the customers.