



The Arrival of the Industry 4.0 and the Importance of Corporate Big Data Utilization

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Abstract

Purpose – An increase in automation has been as a result of digital technologies. The data will be instrumental in the determination of the services that are more necessary so that more resources can be allocated for them. The purpose of the current research is to investigate how big data utilization will help increase the profitability in the industry 4.0 era.

Research design, Data, and methodology – The present research has conducted the comprehensive literature content analysis. Quantitative approaches allow respondents to decide, but qualitative methods allow them to offer more information. In the next step, respondents are given data collection equipment, and information is collected.

Result – The According to qualitative literature analysis, there are five ways in which big data utilization will help increase the profitability in the industry 4.0 era. The five solutions are (1) Better Customer Insight, (2) Increased Market Intelligence, (3) Smarter Recommendations and Audience Targeting, (4) Data-driven innovation, (5) Improved Business Operations.

Conclusion – Modern companies have been seeking a competitive advantage so that they can have the edge over other companies in the same industries providing the same services and products. Big data is that technology that businesses have always wanted for an extended period of time to revolutionize their operations, making their businesses more profitable.

Keywords: Industry 4.0, Big Data Utilization, Corporate Strategy, Qualitative Literature Analysis

JEL Classification Code: C25, C55, L11, L60

1. Introduction

Kagermann (2015) suggested that industry 4.0 is a revolution in how companies and organizations, mostly in the manufacturing industry, improve and distribute their products and services to the market for their consumers. In this new era of manufacturing, technology has been used in a big way. The success of many industries in the era of industry 4.0 has been the advancement in technology and knowledge in manufacturing that has been happening in the recent decades; therefore, technologies such as artificial intelligence (A.I.), cloud computing and analytics, and the Internet of things (IoT) have been on the forefront in bringing the chance that is experienced in industries (Kohnová, Papula, & Salajová, 2019). Technology has made it easier to increase the quality of products so that they have improved efficiency, and at the same time, these products are affordable, giving the common people have the technology that they need to make work easier and also increasing output.

An increase in automation has been as a result of digital technologies. The result has been lowering the cost of production since with machines, and only a few people will be needed to operate them (Oltra-Mestre, Hargaden, Coughlan, & Segura-García del Río, 2021). This has made it possible for the investors to run these companies profitably, which has made it possible for mass production and the opening up of branches in various parts of the world with the intention of meeting the demands of most of the customers in various markets. The other benefits that come along with increased technology are a new level of efficiencies, improved responsiveness to customers, self-optimization, predicament maintenance, and automation (Bondar, 2018). The introduction of smart industries was the beginning of manufacturing industries entering the fourth generation of the industrial revolution (Provost & Fawcett, 2013). The use of high-tech IoT devices in the smart factories has made it possible to improve productivity and the quality of services that they will be offering to the markets. Manufacturing errors have been significantly reduced due to the introduction of A. I, that has replaced manual inspection (Liu & Chen, 2020). With the A.I., the management of the organization is able to know of the various processes and activities that are taking place in the organization, and the data will be instrumental in the determination of the services that are more necessary so that more resources can be allocated for them (McAfee, Brynjolfsson, Davenport, Patil, & Barton, 2012). In addition to that the AI is more efficient than human beings in knowing the minute details in the manufacturing process of the company that can lead to detrimental effects if left unchecked.

With minimum knowledge and skills, the supervisors or the manager of the industry can use a smartphone connected to the cloud to monitor the manufacturing process, and they will be able to virtually access and view all the activities that are taking place in the organization remotely from a distance, and therefore they do not need to be available physically in the organization for activities to be taking place. With the use of machine learning algorithms, it is possible for the manufacturers to detect errors immediately and take the necessary action in good time before the situation can get out of hand, and this saves on money and time since the bigger the problem, the costly it will become and the more time it will be needed for it to rectify which will derail the activities of the organization.

2. Literature Review

Tavera Romero, Ortiz, Khalaf, and Ríos Prado (2021) suggested that industry 4.0 has been a big thing in the world of manufacturing. This is due to the benefits that are associated with these new advancements in the field of manufacturing. All the other fields have been affected by the advancement of technology, and Industry 4.0 would not have been any different since it was one of the sectors that needed the knowledge of technology to advance since they are capital and labor-intensive. Therefore, any solution to reduce the costs of production would have been accepted by many industries.

Therefore, Industry 4.0 has been a revolution period that has significantly improved the quality of products that the manufacturing companies have been providing in the market for their customers. In the recent times, almost any manufacturing company has been using the Internet of Things and Artificial Intelligence (Leusin, Frazzon, Uriona Maldonado, Kück, & Freitag, 2018). These two advancements in technology have been the cornerstones of for Industry 4.0 to be revolutionary so that it will be able to serve its purpose in the world of commerce. The improvement of technology will mean that more industries will be efficient and the cost of production will keep on lowering to the levels that will make manufacturing more profitable, and the customers will be able to get more goods at a lower price (Wamba, Akter, Edwards, Chopin, & Gnanzou, 2015).

2.1. Existing Research Gap in the Literature

There Since the inception of Industry 4.0, a lot has been studied on the effects it will have on the manufacturing industry and how these effects will lead to change in the ways of doing things. Most of the studies have inclined on the positive side of things, not taking into consideration the arrival of Industry 4.0 and the importation of big data utilization also has its side effects.

It is important for people to always know the pros and cons of any technology so that they can be better prepared when the technology does not give the desired results and know how they can respond to the issue accordingly. It is a fact that Industry 4.0 and big data utilization have an adverse effect on the manufacturing process, the organization, society, and even the society. Knowing these effects will help in ensuring that they are always prevented so that when they happen, there will be a solution to them that will ensure that it will not be costly to rectify the problem and also the society and the industry affected will not have to derail their processes so that there can be a good flow of products in the market that will ensure that the society will continue to be the product for the common good of everyone. Challenges of any technology will always have a solution and a way out.

The first challenge that has not been addressed significantly that is related to Industry 4.0 and big data utilization is the siloed data. The reason for this condition is a lack of cross-platform and poor interdepartmental sharing of data. This has been one of the biggest challenges that Industry 4.0 and big data utilization have been facing, and there has been little attention to it. The bad thing is that siloed data can only be of benefit to one department or section of the industry, and it will go to waste since it cannot be reused in other departments and sections of the manufacturing process. Siloed data will always lead to significant losses since the primary intention of Industry 4.0 and big data utilization is to ensure that data can be used in as many departments as possible and bring about coordination that will be instrumental in improving the quality of products and services that they will be offering in the market for their customers. But it is never the case with siloed data (Kamp, Ochoa, & Diaz, 2017). The industry will be forced to increase its resources so that it will have all the data that will be needed in all its departments.

Shayganmehr, Kumar, Garza-Reyes, and Muktadir (2021), data system redundancy is another significant challenge that is associated with Industry 4.0 and big data utilization. Most companies use the enterprise resource planning systems, which help them in keeping tabs on all parts of the business which, including the customers and vendors (Kamp et al., 2017). The process of gathering data and conducting their analytics will be more efficient. Data analytics have been instrumental in many industries for the benefits that they come along with, such as understanding the trends in the marketing, making it possible for the industry to prepare and plan better for the future and the things they need to improve on (LaValle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011). However, when the data analytics are defective, it will be hard for the organization to know what they can implement since the inaccurate data gathered when their A.I. services were not accurate can lead to a lot of loss, unlike the predicted profits that were expected by the organization.

Industry 4.0 and big data utilization have been a revolution in many industries. However, this has come up with a big challenge which is a shortage of talent. The more Industry 4.0 and big data utilization is becoming effective, the greater the need to have specialists in the industry who can offer the quality of services that will be needed by these industries. However, the people with skills in big data utilization are few, and it is getting more expensive to procure their services. Therefore, it could be easier to cut costs in other areas of production, but it will lead to an increase in costs in areas that really need trained personnel.

Security and data access is a great threat associated with Industry 4.0 and big data utilization. This is because Industry 4.0 has encouraged most of the industries to start using the Internet of Things is the storage of their data. This has a positive and negative effect in the sense that the Internet of things is highly vulnerable, and unauthorized parties can have access to it, and it will lead to the loss of valuable information to third parties such as hackers who can expose it to their competitors (Asdecker & Felch, 2018). This will make the industry to lose data that they have worked for years to acquire, and the loss will be costly since they will have to start to gain the process of gathering new data or have to pay the hackers so that they can have their money back. Industry 4.0 and big data utilization are not immune to competition and other disruptive technologies. Due to this fact, many industries have been on the lookout for the technology that will be much better than big data utilization. The main reason for this is to ensure that they will always have an edge in the market and dominate the industry. Due to this fact, there has been a delay in the acceptance of the technology despite what people might be thinking. Many investors have suffered a lot due to disruptive entrants and technologies in the market, and they do not want to be in the same situation due to big data utilization.

3. Method

The present research has conducted the comprehensive literature content analysis. Quantitative approaches allow respondents to decide, but qualitative methods allow them to offer more information. In the next step, respondents are given data collection equipment, and information is collected (Sung, 2021). A third party or the patient may give the drug. On the other hand, Respondents must have been informed of the study's goal and assured of the data's confidentiality. The acquired data is examined and analyzed in the final stage (Schreier, 2020). Following that, the researchers present their results and make suggestions based on them.

By picking examples in an ad hoc manner, the prior study mentioned that the researchers can gain additional analytic benefits (Schreier, 2020). Statistical inference is infrequently employed in qualitative textual method applications, partially because it might lead to ludicrous conclusions regarding nonexistent populations. Robustness testing may be used to see how extra examples affect the interpretation of results (Yari, Ardalan, Ostadtaghizadeh, Zarezadeh, Boubakran, Bidarpoor, & Rahimiforouhani, 2019). For researchers who desire considerable interpretability, parsimonious and intermediate solution words may contain configurations that were not seen but may happen in future contexts (Widnall, Grant, Wang, Cross, Velupillai, Roberts, & Downs, 2020). In hypothetical settings, making too many assumptions based on a short quantity of facts might be hazardous. Researchers may establish a threshold for truth table rows to reduce the latter's impact. Measurement inaccuracy may be dealt with several ways and with various approaches (Mende, 2022). Those who concentrate on their workplace have a comprehensive awareness of the events and issues they research. Tracing deviant cases after they might help find neglected cases. Model specifications can be corrected using robustness testing. Internal authenticity may be jeopardized by the absence of substantial variation in social reality. Varied qualitative techniques have different responses to these validity concerns. By incorporating knowledge from earlier instances, case-oriented qualitative content approaches may be able to compensate for the lack of variation (Tajabadi, Ahmadi, Sadooghi Asl, & Vaismoradi, 2020). This technique emphasizes substantive interpretability when creating criteria for authenticating counterfactual assertions. In the parsimonious solution term, configurations comparable to or supersets of those in the intermediate or conservative solution terms are employed. According to this strategy, a "configurationally correct" qualitative solution should only comprise causally connected components.

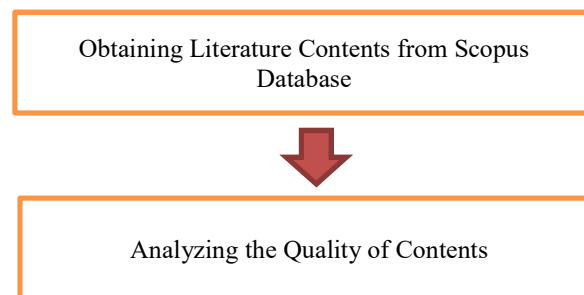


Figure 1: Two Main Procedure of Qualitative Literature Analysis

The method that emphasizes the employment of redundancy-free models assumes that most qualitative content results are causal assertions. Researchers that emphasize the usage of redundant-free models come up with non-conservative results. When the qualitative content results are analyzed on a case-by-case basis, they may be better comprehended. Different tactics emphasize these challenges in different ways. Skewed data can significantly impact internal validity. Researchers can use descriptive statistics and graphical approaches to detect, avoid, and report ex-ante skewness. The importance of need demonstrates that almost constant circumstances are meaningless (Kang, 2021). Updated consistency and coverage equations, especially for condition-focused research, might make skewed data less sensitive (Hall, 2018). Instead of enormous theories, a case-based approach to qualitative content analysis can create more moderate theories. More generalizable claims can be made in exploratory, condition-focused, Large-N QCAs with excellent external validity. Formal theory evaluation allows researchers to rigorously assess set-theoretic propositions against empirical facts, regardless of case orientation. The researchers must be clear about their aims to get the most out of the qualitative comparative analysis (Hall, 2018; Han & Kang, 2020). The issue is figuring out how to utilize qualitative analysis to evaluate hypotheses meaningfully. The relevance or insignificance of individual

components to an outcome may focus on expectations. Set-theoretic or complicated causality is more widespread in social science concepts than most think (Mayring, 2019). For necessary conditions to be recognized as causally important, redundancy-free (disjunctions of) minimum adequate conjunctions are required. Only supersets of the outcome can be interpreted as substantial necessary conditions by researchers who value substantive interpretability (Park, 2021).

4. Results

The Big data is one of the most potent tools in driving smart business changes and decisions, making it one of the most sought-after technologies in the business world (Schroeder, 2016). The new trends and demands of the customers have been the driving force for industries to prefer using big data technology, especially in the era of industry 4.0, where things have to be automated for increased efficiency saving time and resources (Wang, Kung, & Byrd, 2018). However, it is important to have knowledge of what big data could be so that there would be no confusing or having the wrong meaning of the term. Big data is the creation of omnichannel marketing systems and e-commerce or IoT-connected devices and other business applications that have the ability to generate information about activities and transactions, increasing efficiency and the rate of productivity (Alam, Sajid, Talib, & Niaz, 2014).

The primary reason why many industries have preferred using big data in their operations is their ability to cut the cost of production and also improve the quality of services and products. This enables the industry to take products in the market that can be afforded by the common person at a price that is fair for them. Due to this fact, the pool of loyal customers that the organization has been having has been on the rise, and this ensures that the business will be profitable even in months or years to come. Therefore, organizations will continue to use big data until there will be a better alternative in the future that can replace it. Big data platforms have the optimization for large data sets, which leads to a huge volume of data that involves a history of the crucial activities of the organization that can be used for analysis. This data is necessary for analyzing of the past ends, which can be used in predicting the future of the organization and knowing the necessary steps to take so that the profitability of the organization can be maintained (Berawi, 2018).

The characteristics of data systems is that they can contain XML documents, text files, raw log files, videos, images, audio, and traditional structured data. This leads to a variety of big data that an organization will need in their operations, such as storing and retrieving of valuable information. The following are some of the ways in which big data utilization will help increase the profitability in the industry 4.0 era.

4.1. Better Customer Insight

In the recent times, data has become more significant to the modern business. This is because data will help in understanding the customers, whether individually or in categories (Alsghaier, Akour, Shehabat, & Aldiabat, 2017). Big data gives the management of an organization a wide range of sources from which they can choose from. This is achieved by determining traditional sources of customer data, such as their purchases and support calls. Data in the purchases will make the organization know better about the products that they should be taking into the market (Calic & Ghasemaghahi, 2021). They can increase the production of the product and even increase its variants so that the customers will have a variety of the same thing to choose from. The social media activity is also important in this case since it will help the management know of the products that are viewed more and the ones that the customers have been inquiring more about from the company (Braganza, Brooks, Nepelski, Ali, & Moro, 2017). Therefore, it will be upon the organization to increase the production of these products to meet the demand that is there and increase their sales.

4.2. Increased Market Intelligence

The benefits of big data range from helping organizations make an analysis of the complex shopping behavior of the customers to deepening and broadening our understanding of the dynamics of the market (Ajah & Nweke, 2019). One of the tools that have been of significant use in increasing market intelligence has been the social media platforms. The social media has been a common source of market intelligence for various product categories, which the companies have been taking into the market.

The good thing is that social media platforms have been efficient in the creation of awareness of the products and services that the companies have been providing in the market due to the high traffic that they have, which leads to a

high rate of turnover and conversion to actual buyers (LaValle et al., 2011). The social media enables the management of the company to know of the references and expectations that people have towards their products. With such data, it will be possible to respond to the customers by adjusting their services and products to meet the expectations of their customers so that the company can continue to be profitable and relevant in the market. Such data has been the cause of success for organizations.

4.3. Smarter Recommendations and Audience Targeting

Since the advent of big data, consumers have been familiar with recommendation engines. Customers can know the quality of a product or service in the market by simply checking the recommendations and reviews that have been left by the previous buyers of the product. These services are mostly available in e-commerce (Yin & Kaynak, 2015). Therefore, it is upon the company to provide the best quality of services and products in the market for their customers since the metrics of big data will reveal the products that do not meet the expectations of the customers.

The recommendation system has been a big advantage to the organizations too. This is because happy clients will recommend the products to their friends and relatives who will also want to buy, and this will lead to an increase in sales of the organization, making it more profitable (Brown, Chui, & Manyika, 2011). Therefore, with big data, the company has no option but to deliver the best quality of services and products in the market. By so doing, this will help in creating a reputation that will always work in their favor in the future as the brand will dominate the market since they will be receiving good reviews and recommendations.

4.4. Data-Driven Innovation

Innovation in the business world is not just a matter of inspiration. There is a great deal of hard work that is involved in identifying subject areas that will be promising and which will need new efforts and experiments so that they will be profitable for the organization (Upadhyay & Kumar, 2020). This process can be facilitated by the use of big data analysis. The available technologies and big data tools have the ability to enhance research and development. This is necessary since it will lead to improvement of the products that the company will be provided in the market in the future (Marashi & Hamidi, 2018). However, it is important to note that data by itself will never provide the organization with new insights since human elements will be needed, such as data scientists and analysts, B.I. Analysts and other professionals with the skills needed in data analysis and interpretation.

4.5. Improved Business Operations

Big data has been found to be useful in all business activities. Professionals have found a way in which big data can be used in the optimization of business processes with the intention of generation of cost savings and increasing productivity which should lead to customer satisfaction (Ram, Zhang, & Koronios, 2016). The process of recruiting the best fit for a position in the organization has been improved by the use of big data (Hu, 2018). Hiring and H.R. management have become more effective.

With big data, the H.R. can get to know the history of an individual, and this will help determine whether they will be influential and committed to the core objectives of the organization. Big data has been used by managers to detect fraud (Wamba & Mishra, 2017). Technology and the use of big data helps to monitor transactions of the organizations, and if there are activities that are out of the ordinally, the management is noticed, and they can decide to cancel these transactions until they have been verified that they are genuine before the business can lose large sums of money through fraudulent activities.

Table 1: The Summary of Research Findings

Main Topics	Resources	Findings
1. Better Customer Insight	Alsghaier, Akour, Shehabat, & Aldiabat, 2017; Calic & Ghasemaghaei, 2021; Braganza et al., 2017	Companies can increase the production of the product and even increase its variants so that the customers will have a variety of the same thing to choose from.

2. Increased Market Intelligence	Ajah & Nweke, 2019; LaValle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011	The benefits of big data range from helping organizations make an analysis of the complex shopping behavior of the customers to deepening our understanding of the dynamics of the market.
3. Smarter Recommendations and Audience Targeting	Yin & Kaynak, 2015; Brown, Chui, & Manyika, 2011	The recommendation system has been a big advantage to the organizations too. This is because happy clients will recommend the products to their friends and relatives who will also want to buy, and this will lead to an increase in sales of the organization, making it more profitable.
4. Data-driven innovation	Marashi & Hamidi, 2018; Upadhyay & Kumar, 2020	There is a great deal of hard work that is involved in identifying subject areas that will be promising and which will need new efforts and experiments so that they will be profitable for the organization.
5. Improved Business Operations	Ram, Zhang, & Koronios, 2016; Hu, 2018; Wamba & Mishra, 2017	With big data, the H.R. can get to know the history of an individual, and this will help determine whether they will be influential and committed to the core objectives of the organization. Big data has been used by managers to detect fraud.

5. Discussion

Industry 4.0 and big data utilization are the future that many consumers and business managers have been waiting for. This is because of the technology that can be used to make services and products to be better and also improve the interaction that customers have been having with managers of their brands. Big data has been instrumental in the process of marketing by making the organizations to be aware of the current trends that affect the buying patterns of their customers. The data can be compared with the past trends, and this will help in the determination of what the future will be like in the market, and the organization will prepare accordingly. However, big data has its advantages and disadvantages.

The technology helps to increase accuracy and lower the cost of production. Therefore, most of the employees have to be fired since the automation of Industry 4.0 and big data utilization have rendered some job positions to be redundant, and many managers have been quick to let go of employees in these positions. However, the increase of big data needs specialized skills that are not easy to find. Therefore, jobs are lost, but at the same time, others are created for the people who have the necessary skills in the utilization of big data technology in the process of production. Nonetheless, the technology is highly vulnerable to third parties who have malicious intentions of gaining access to the computer systems that have stored large volumes of private and confidential information belonging to the organization. These third parties, most hackers, will ask for ransoms or sell the data to their competitors.

Modern companies have been seeking a competitive advantage so that they can have the edge over other companies in the same industries providing the same services and products (Slimene & Youssef, 2021). There is any technology that will help them achieve their objectives faster and easier will be necessary and highly welcomed. Big data is that technology that businesses have always wanted for an extended period of time to revolutionize their operations, making their businesses more profitable. Marketing has been one of the activities that many organizations and companies had trouble with. This was because, in the past, there was no advanced methods that would help in the determination of the trends in the market. However, big data is more precise in gathering data from the market that will influence the decision-making process of the organization since they will know what is best to start with and what would be more profitable. By so doing, the organization will not waste too many resources in trying various methods in marketing to figure out what will work out and what will not. In addition to that, the management of the organization will be able to determine the quality standards that customers need in the market and work on that.

Big data-driven projects in organizations are preferred developed for the purpose of workflow and automation benefits (Acharya, Singh, Pereira, & Singh, 2018). The machines which are A.I. Enabled have been instrumental in reducing the amount of work that human beings can undertake in an organization. This has a lot of advantages to the

management of the organization since they will be able to reduce the excess labor force whose activities have been taken by machines (Da Costa, Dos Santos, Schaefer, Baierle, & Nara, 2019). As a result, the operation costs of the organization will lower, and this will enable the organization to offer high-quality services and to the customers at a price that is favorable for them. Customers will likely buy on impulse since the goods and products are of a high quality, and they are highly affordable. As a result, the unit profit per unit product might be less, but due to the fact that they are selling in bulk will make the overall profit to huge. Increased profits have led to many organizations to acquire the most recent technology that they will need in their operations, and this will help them to maintain their competitive edge and dominance in the business market.

Analytics is the part of big data where precise predictions kick in. Big data and analytics will enable the management of the organization to see not just the patterns but also the trends in the market that are worthy for better performance of the organization (Jin & Kim, 2018). Trends and data, if not properly analyzed, will not have the effects that the management of the organization might expect. Therefore, every organization that is inspired by the use of big data has to invest in personnel who can interpret the data well so that they can make the right decisions on what to do to be competitive. Achieving the industry 4 status call for better analysis methods so that the organization can have an edge in the market. The good thing is that it is easier to achieve those statuses if they can manage to use big data in the identification of the hidden partners in the market (Otlés & Sakalli, 2019). The social and economic objectives of the organizations are easy to achieve with the use of big data. Market dominance depends on how well the company will be able to respond to the needs of its customers based on the information they can correct in the market.

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