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The Impact of Industry 4.0 on Supply Chain Management

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Abstract
Analysis of Industry 4.0 and related technologies' impact on supply chain management, with recommendations for small and medium-sized enterprises (SMEs).
This study relies heavily on numerical data for its analysis. Secondary data, such as articles from the literature and books from the library, are used in the study.
Although it has been discovered that supply chains are profoundly impacted by Industry 4.0 and that technologies of the Fourth Industrial Revolution make it possible for supply chains to function in real time with minimal human disruption, the level of implementation is still low at the present time. Due to differences in the quality and quantity of resources available, small and medium-sized businesses (SMEs) and large corporations (COs) implement new technologies in distinct ways.

Keywords: SC, SCM, Industry 4.0, Logistics

Introduction

Background

From the first sharp rock used as a weapon to the invention of the spear, humanity has been constantly innovating in order to increase its chances of survival. But that wasn't the end of it; as technology advanced, so did the sophistication of the tools used by ancient societies; and as populations grew, so did the demand for ever-greater quantities of tools. When several members of the tribe decided to become artisans to meet the needs of the community, Industry Zero was born.
A second giant leap occurred much later in human history. Refining ores for more useful tools was the first step in what would become Industry 1.0, as was harnessing the energy of wind and water to turn millstones. When we started exploiting our environment, businesses started popping up all over.
We made the leap to Industry 2.0 because we discovered electricity, new modes of transportation, and new methods of communication. This newfound interconnectedness paved the way for the development of sophisticated supply chains that cut across oceans and continents. The advent of the assembly line made it possible to mass-produce goods previously thought impossible.
Most of the world's manufacturing is currently operating in Industry 3.0. Industry as a whole had been revolutionised by the advent of robots and the internet in this era. The data could now be transferred and stored digitally, with instantaneous access to data from anywhere in the world. This resulted in today's supply chains, which are extremely intricate and employ a wide range of cutting-edge technologies to get a product to the consumer. The world as we knew it had changed dramatically, and now people were wondering what would come next in terms of industrial development.
Industry 4.0 marked a significant technological advancement with the introduction of fully autonomous systems that did not require human interaction, ushering in a new era for the industry. Such automation was previously only seen in science fiction, where robots did the work of humans in factories. Modern factories can now have their own mini-Internets thanks to developments like the Internet of Things (IoT), which enables the interconnection of electronic machines and sensors. The (Epicor 2021) However, in today's supply chains, manufacturing accounts for only a fraction of the total process.

Structure of a Thesis

- The outline of the thesis looks like this:
- The first section provides an overview of the topic, outlining the research's context, primary aim, and any relevant limitations.
- The second section provides an overview of Industry 4.0 and the associated technologies.
- The third section analyses the results of industry 4.0 on supply chain management, both good and bad.
- In the final section, we look at some real-world applications of Industry 4.0 technologies in the SC and how they were

implemented.
- Part five includes both an analysis based on the previous data and instructions for implementing the aforementioned technologies within the SC.

Limitations

There were some caveats to this study. The primary data needed for the study was lacking, which was the biggest barrier to progress. Gathering this type of information requires conducting interviews, questionnaires, and surveys with the target populations. However, it is difficult to find a Supply Chain Manager who is working directly with such technologies or even knows about industry 4.0 due to the concept of industry 4.0 not being fully realised, especially during a global pandemic when social contacts were limited. Secondary data, such as previous research and studies on the same topic as well as articles and journal publishing, consequently became a primary source of information. This means the results here are less solid than they would be in studies with access to primary sources.

Research Methodology

Study Design

Selecting an appropriate research strategy is crucial to the final outcome of any study. Different research approaches will be needed to solve various research issues. Using an inappropriate methodology can seriously compromise a study. Therefore, to get a convincing result, it is essential to select an appropriate research method for the research field. In this section, we delve deeper into the study's preferred research methods.

Both qualitative and quantitative research methods can be useful in the study of a topic. Quantitative research relies on numerical data to answer the question and must cover a sizable research area and be statistically significant, while qualitative research focuses more on verbal and written word and any visual data. The sample size is determined by the specific goals of the study.

By its very nature, quantitative data is structured and amenable to analysis through the use of graphs, statistics, and diagrams; however, qualitative data necessitates additional organisation on the part of the researcher in order to be usefully applied to the research at hand. The goal of quantitative studies is to create and test hypotheses, theories, and mathematical models of phenomena. The act of measuring is fundamental to quantitative study. They link quantitative relationships expressed in mathematics to their empirical observations. When the research model is well-defined and can be used to test the theoretically-derived research hypothesis, quantitative research methods are often employed. (2019, Steefkerk)

Due to the need for definitions and the use of words to explain and analyse the data, a qualitative research approach was prioritised for this study.

Strategy for Research

When discussing research methods, both empirical and theoretical approaches are commonly brought up. Searching and selecting basic concepts and ideas as a theoretical basis for the topic, forming scientific hypotheses, predicting properties of research objects, building models, etc. are all components of the theoretical research method. Conceptual or operational prototypes. First hand encounter. Information, such as theoretical foundations, specific research results published in journals, and statistical data, must be collected and processed by researchers. Empirical studies rely on direct observation of phenomena to either fill in gaps in knowledge or inspire new ideas. This thesis's primary emphasis is theoretical because of the restrictions associated with the novel topic. Both approaches are attempted here. Simultaneously, the data gathered through empirical methods provides crucial insights into the topics under investigation. This will allow the researcher to double-check their hypothesis against the current theory while also putting the theory through its paces in the real world. The next step involves contrasting the findings of theoretical studies with those of empirical investigations. Seeing the gaps between theory and practise allows researchers to fill them in and fix them, leading to more thorough and objective research. (Dan 2017) Data collection techniques. Researchers have a choice between two approaches to data collection. One of these is amassing primary data, or information gathered by the researcher for use in the study. This is done through the researcher's own preparation of interview guides, questionnaires, and surveys. This makes primary data collection a trustworthy method because it is not biassed and relies heavily on the precision of the questions asked of the study's control groups. Primary data also has the advantage of being up-to-date at all times, making it more trustworthy for the researcher. Furthermore, the data used will always be fully owned by the author of the research. Primary data, on the other hand, is time-consuming to collect and analyse, particularly when control groups contain a sizable number of participants; additionally, there are costs related to questionnaires that are conducted via mail or in person. However, the main problem with this approach is that it is nearly impossible to find people for interviews and that questionnaires and surveys contribute little to nothing to the research because of the complexity of the topic. Secondary data collection is an alternate strategy. This method of data collection entails amassing all literature data, from definitions of related terms to studies conducted on the same topic. Its primary advantage is that it can be accessed quickly and for little cost by the researcher. zero dollars, regardless of whether or not the information is available to the public. One advantage of secondary data is that, in contrast to primary data, it can be analysed quickly because it has already been processed by other parties. The analysis of secondary data can also help to shed light on and expand upon previous studies of the topic. However, since it is provided by third parties, secondary data isn't always accurate; the author would have to check it against other similar studies or conduct his own investigation to ensure its veracity. The secondary data may also present challenges due to the complexity of the research question, particularly if the topic is novel or has not been explored as thoroughly as others in the field. In this case, the researcher may be forced to sift through a large volume of data that is only tangentially related to the study at hand.

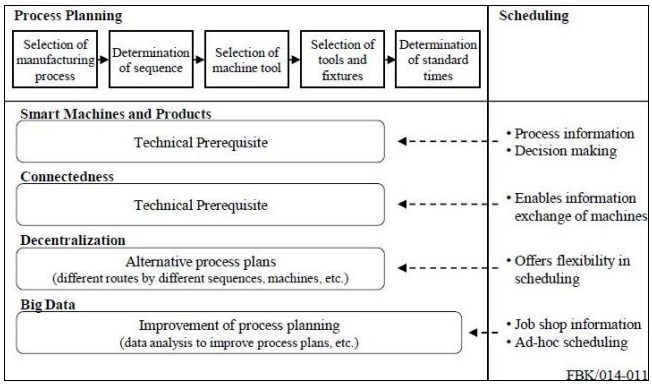
Due to the complexity of the research question and the inaccessibility of relevant primary sources, secondary data collection was chosen for this study. Forming an alliance where both the digital and real worlds, and human beings and robots, can benefit from one another. The dawn of the robot age, in which machines can perform tasks previously reserved for humans. Presenting state-of-the-art strategies for waste-free manufacturing. The year 2019 in Lackey. In the middle of the third decade of this century, 30% of

company audits will be conducted by artificial intelligence thanks to the widespread use of sensor technology; 10% of the population will be using Internet-connected clothing; 10% will be using Internet-connected glasses; and 10% will have mobile phones implanted in their bodies. The 2021 I-Scoop.

Computer systems' ability to store and analyse data in real time is the key to achieving perfect symbioses between different divisions of a company. There will be no lulls in communication between levels of management, ensuring that no details are lost in translation. And since the raw data will be sorted in predetermined databases or the analysis will be performed automatically by the artificial intelligence systems, there will be no need for a lengthy analysis. If a sensor in the manufacturing department notices a drop in output, the procurement department can immediately place orders for replacement parts and communicate the need for repairs to the maintenance staff. The year is 2021 (Higgins). These are just a few of the many illustrations of the characteristics of the fourth Industrial Revolution that will be presented in this study.

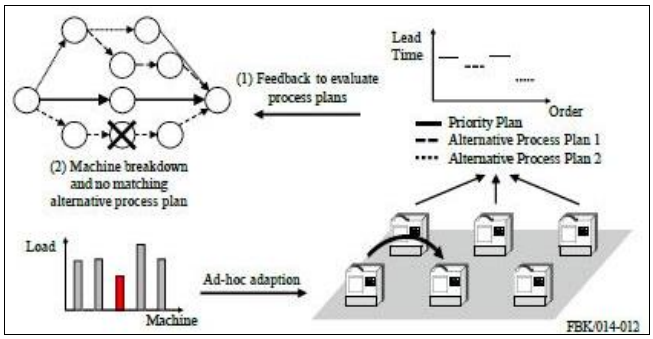
The Impact of Industry 4.0 on supply chain management

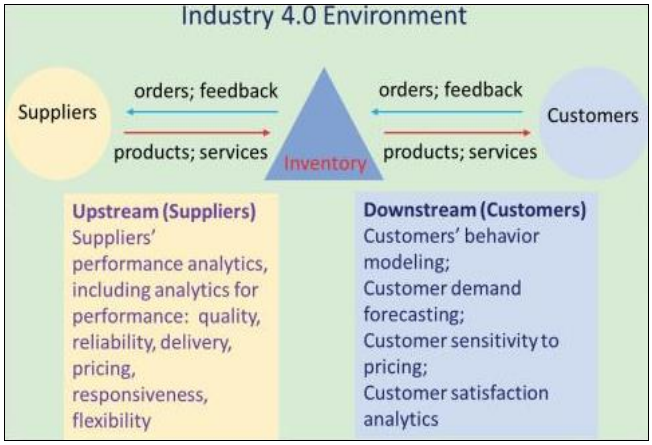
The focus of this chapter is to introduce and evaluate the technologies that will drive the Fourth Industrial Revolution. Since there is little consensus on how exactly new technologies will affect the various links in the supply chain, this topic is timely. The worldwide economic effect of Industry 4.0.The economic, social, and ecological effects of the Fourth Industrial Revolution are monumental. Although beneficial in the long run, these effects cause significant course-correction difficulties in the near and intermediate terms. Manufacturing methods and costs will be affected by industry 4.0's economic effects. It also has a beneficial effect on inflation around the world. Energy efficiency is improved through the use of cutting-edge technology. The pressure on prices that drives inflation around the world has been greatly relieved thanks to the advent of additive manufacturing, which saves significantly more on raw materials and storage costs than conventional cutting technology. Transitioning to a more efficient, intelligent, and resource-efficient world (Pfohl *et al*., 2015) is needed to meet rising demand. While some industries will experience significant growth as a result of this revolution, others will face difficulties in the form of short- to medium-term adjustment costs. Industry will need to drastically reduce its workforce (Schröder, 2017). Many new companies emerge and expand rapidly, developing higher-quality technologies, while others that can't keep up with the competition shrink or even disappear. This is true across all industries, including growth industries. With the decline in power of many developed countries whose economies are based primarily on resource exploitation like Australia, Russia, and Norway, the global economic map may have to be redrawn as a result. Saudi Arabia has recently made public its intention to reorganise its economy and make efforts to lessen its reliance on oil. The reliance of the economies of the BRICS countries on mineral resources is a major source of difficulty, with the exception of India. Make technological advances first. The United States is regaining its ecological leadership position with the advent of Industry 4.0. Japan, Korea, and Taiwan are just some of the many Asian countries that have active role in this revolution. The Chinese government stands to gain the most. China's economy has been struggling to adjust to lower growth rates since the last decade, but this revolution is helping to cushion the blow. China's workforce is undergoing radical changes. More than 154,000 robots were set up in China in 2018, out of a total of 422,271. (The Year of the Robot 2019) Germany and Norway are just two examples of European nations that hope to reap the benefits of industry 4.0. Reference: (Bauer *et al*., 2015) [10]. However, many other European economies appear to be gasping for air in this race despite having a good human resource system; this can be attributed, in part, to a lack of an entrepreneurial spirit and an environment conducive to the development of new technologies, especially when compared to the United States and Northeast Asian countries. A new generation of tech startups is upending the traditional power structure of industries, challenging established giants that have ruled the market for decades. Examples include the rapidly expanding Google and Facebook, and the restructuring process being endured by IBM, Microsoft, Cisco, Intel, and a string of large Japanese electronics corporations collectively known as Ban. The fall of Nokia, like that of Kodak before it, demonstrates the risk of wrong decisions that businesses face in today's era of intense competition. This technological revolution is entering its era at a breakneck pace. Traditional automakers face stiff competition from newer, more innovative manufacturers like Tesla, which is increasing production of electric and autonomous vehicles. Management of the Supply Chain. The term "supply chain" refers to the network of businesses and individuals who work together to bring final products to consumers. The supply chain's main flow is data and raw materials, which are transformed at each stage along the way. Someone has to oversee the supply chains, just like they do the rest of the company. SCM, or Supply Chain Management, is the process of regulating the flow of goods and services along the supply chain, from procurement to production, in order to meet demand as quickly as possible. The authors (Johnson and Pyke) In addition, effective SCM can optimise the supply chain, making it possible to run more efficiently by managing the relationship with suppliers and reducing supply chain costs. (Vorst 2004) From the origin of raw materials to the final consumer, today's supply chain typically spans multiple countries and even continents. The final consumer, making it more difficult to manage them as a result of increased complexity in the industry. 2017 (Verwijmeren) This study's focus on the emerging phenomenon of Industry 4.0 highlights the growing significance of SCM. Industry 4.0's Effect on Scheduling and Planning.



The effects of Industry 4.0 on IPP&S, as shown in Figure 1 (Procedia manufacturing, 2019, 171).

As shown in Figure 1, the system initially conducts an automated analysis of Big Data to determine the optimal course of action. After thorough investigation and evaluation, manufacturers will be presented with workable alternatives from which to select the most efficient method of production. In addition, the analysis system will automatically suggest the best production sequence, production tools, and production time for each individual plan. Managers benefit from intelligent machines because they can quickly process and share information all over the system, resulting in uniformity. Managers can make better decisions under difficult conditions of product diversity with the help of the analysed data. Having backup plans for the process can also help you be more proactive if any issues arise while you're making the product. Most importantly, self-learning machines will continuously improve and discover novel solutions by updating themselves with fresh data.





Previous chapters have examined the effects of Industry 4.0 on logistics and supply chain management. Companies should use the SWOT diagram to conduct a thorough analysis before making any decisions regarding the implementation of 4.0 technologies.

Benefits: A more open, adaptable, and dynamic supply chain is established thanks to the innovations made possible by Industry 4.0 technology. Better and more consistent information sharing between customers and suppliers also contributes to increased customer satisfaction and a competitive edge. Product quality can be maintained and inventory can be efficiently managed at all times with the help of remote monitoring devices. In addition, the electronic supply management system with smart marketing will always be responsive to the ever-evolving needs of customers, allowing for reliable forecasting. Cost savings and increased profits are the direct result of increased efficiency, which has reverberations beyond individual businesses and into the GDP of countries willing to invest in the advancement of Industry 4.0 technologies and regulations. Thanks to Industry 4.0, the supply chain as a whole can undergo radical transformation, from its supply and inventory management to its time to market and environmental impact.

Weakness: Implementing cutting-edge technology in manufacturing calls for costly capital expenditures, intricate facilities, and highly trained personnel. SMEs have smaller supply chains but less access to resources, while large corporations have access to more resources but have more complex supply chains that require a higher level of commitment to modify using the new technologies. Therefore, due to the interconnected nature of Industry 4.0 technologies, the process of technology implementation is challenging to complete to its full extent. No matter where in the supply chain they are implemented, artificial intelligence and machine learning require a massive amount of data. Artificial intelligence (AI), machine learning, and other similar technologies can't function without backend infrastructure like Big Data, Cloud Computing, and the Internet of Things (IoT). While Amazon and Walmart provide proof that automation of operations is possible, many other businesses find it challenging to implement. In addition, companies that use these technologies in their operations have a vested interest in sharing data on how they are currently performing, as this is crucial to the industry 4.0's ongoing commitment to improving both existing and new technologies. It can cause a significant lag in the rate at which technology is updated. Another issue slowing down the fourth industrial revolution is the lack of a suitably trained labour force; businesses can't afford to keep up with the constant stream of technological advancements, and training existing employees can take years and a lot of money. It is easier for large corporations to hire recent college grads with a background in IT than it is for small and medium-sized businesses.

Possibilities: Industry 4.0 presents numerous growth possibilities for present and future enterprises. Companies can increase output without incurring higher labour costs and in significantly less time. In addition, businesses can improve their responsiveness and create sustainable development with the help of analysed data. (Hansen *et al*., 2017) Increases in the number of companies working on and supplying industry 4.0 technologies have the potential to lower prices and increase their market availability in the future. In addition, public technologies like public cloud, which rely on auxiliary technologies, are becoming more widely available on the market. The available public technologies are deployable and include an implementation strategy that takes into account the organization's preexisting digital infrastructure. They address the problem of businesses needing to spend extra money to prepare their infrastructure for the new technologies, and they are accessible for as long as the contract with the technology manufacturer is in effect. This bodes well for the future availability of such technologies and the possibility of fully outsourcing their implementation. It is possible to solve the workforce shortage by implementing new government programmes that provide greater benefits to students majoring in information technology and data science and by increasing the degree to which universities internalise their operations. While it may take some time, this method may end up being the most permanent solution.

Dangers: Humans face new dangers as a result of progress in technology. Data protection comes first. The computer is the repository for all data and company information, making it vulnerable to theft and disclosure. There is a risk that Industry 4.0 will be slowed down due to the rise in industrial espionage and cyber-attacks if companies do not invest in security. Concerns have been raised about the potential for harm caused by automation processes. While it's true that robots and AI are gradually eliminating routine tasks, the demand for people to keep those technologies running has been rising at a rate that has outpaced the rate at which menial jobs have been eliminated. The problem is that not all businesses are willing to pay for the training of their employees. Workers who will be made redundant by automation, despite Amazon's success showing the industry's potential. While this isn't exclusively a business problem, it has the potential to cause significant social issues in developed countries over the coming years, and may become even more complicated if no action is taken by local governments to restrict the rate at which automation is replacing human workers in the workforce. The role of Industry 4.0 in the prevention of the next covid pandemic. Many parts of the global supply chain have been negatively affected by the current COVID-19 pandemic. Because of the severe lack of available labour, many businesses were forced to halt production. However, many businesses have swiftly shifted their production strategies, applying 4.0 technology and moving towards building smart factories in order to overcome difficulties in mass production. Connecting and automating every stage of production is made possible by technologies like AI, Big Data, and the Internet of Things. With just a computer and an internet connection, managers or employees can work from anywhere, and customers can shop online and have their purchases delivered to their homes. This demonstrates that covid 19 has had a significant impact, providing a strong impetus to shift production to the industry 4.0 trend. Industry 4.0 is paving the way for cutting-edge new technologies that will save workers time and money by eliminating the need for as much low-skilled labour. Industry 4.0 technologies like robotics, 3D printing, and smart factories were already being used by businesses around the world prior to the outbreak of the pandemic in order to decrease supply chain risks, increase factory flexibility, and enhance product quality. The pandemic, however, highlighted not only the commercial but also the public utility of such automation and data analysis advances. The purpose of 4.0 technology during the pandemic is to promote automation solutions. Accelerate the production process by automating the collection, transfer, storage, analysis, and tracking of information systems in a variety of manufacturing industries and related fields. export. By utilising remote consultation forms, digital technology is opening virtual clinics that can ease hospital congestion and allow for more efficient record keeping. As a result, the Fourth Industrial Revolution has enabled significant advances that will lessen the effects of the Covid-19 pandemic by providing novel solutions for businesses and fostering the advancement of technologies that can be used to address the problems posed by the pandemic.

How industry will shape the future of supply chain management 4.0

While the effects of industry 4.0 on supply chains are still unfolding, the future of SCM is highly dependent on how well companies deal with the aforementioned threats. Faster product time to market and cheaper return logistics are two benefits of rising automation levels that are fueling the growth of the online retail sector. Shah *et al*. (2019). When it comes to implementing new technologies that can optimise logistics, manufacturers rely heavily on their partnerships with suppliers and logistics providers. While the falling cost of manufacturing robots is encouraging, it is still not as low as the cost of the workforce in less developed countries or countries with a large population. Consequently, manufacturing lines are more likely to adopt robots in facilities that do not have access to a cheaper workforce, while facilities in countries like India, China, and Vietnam are less likely to do so. However, the advent of additive manufacturing, robotics, and AI has the potential to improve business operations in developed nations and shorten the distance between the factory and the consumer, while also allowing small and medium-sized enterprises (SMEs) to begin manufacturing much more quickly and at a lower cost, as they will not be competing on an international scale at first.

New advances in SCM may result from progress in AI. Artificial intelligence (AI) is currently effective for marketing operations and inventory management, both of which require swift decision making and data analysis but present a challenge for organisations of scale. The Internet of Things (IoT) will continue to advance in the direction of lowering costs and expanding to all points in the supply chain because collecting data is just as crucial as using the technology that relies on it. While the concept of fully automating the manufacturing process is still in its infancy, it will become more accessible to more businesses as 4IR technologies continue to grow in the market.

Summary and Discussion

In the age of industry 4.0, new technologies have given businesses the opportunity to enhance their supply chain procedures and gain a competitive edge. With varying degrees of success, this sparked a mad dash among businesses to adopt technologies of the Fourth Industrial Revolution. Understanding the full impact of industry 4.0 on Supply chains is challenging because it took decades for the technologies of the first industrial revolution to become ubiquitous and used by all industries. The new technologies can revolutionise the entire supply chain, but right now only the isolated successes are visible.

The Fourth Industrial Revolution is characterised by a focus on automation and connectivity. Each contributes to the investigation's overarching goal of determining "what is the impact of Industry 4.0 on supply chains?" Thanks to improvements in data collection that enable continuous monitoring and the anticipation of potential bottlenecks, supply chains are not only more flexible under Industry 4.0, but they are also more predictable. By freeing up workers for things like production monitoring and control or even new product development, robots and additive

manufacturing have made manufacturing in the supply chain more efficient than ever before. By hooking up the newest generation of industrial robots to the IoT, predictive maintenance can be carried out, boosting uptime and, in turn, productivity. In contrast, additive manufacturing offers a novel approach to the production of complex goods from digital blueprints. In addition to helping delivery drivers take the most efficient routes, real-time data analysis has many other applications in the logistics and transportation sectors.

Due to their novelty and lack of widespread adoption, these technologies come with a heftier price tag than those more widely used across industries. There are other barriers to adoption of industry 4.0 technologies, such as a lack of IT specialists and data scientists, in addition to a lack of workers who are able to work with these technologies. Furthermore, the new technologies necessitate a well-established digital infrastructure capable of handling massive amounts of data collected via networked sensors. This creates a very unfavourable environment for small and medium-sized businesses. Because they simply don't have the resources that larger companies do. This necessitates a greater emphasis on long-term planning and an analysis of the pros and cons of the supply chain by SMEs. According to the results of this research, supply chains are poised for significant change; however, this is a long-term endeavour that is just getting underway. The widespread adoption of new technologies is slow, despite the fact that automation and data usage are already challenging the traditional understanding of how supply chains operate. More and more links in the supply chain are finding ways to use consumer and product development data to their advantage, which only increases the data's value. The supply chain of the future might be best described by the idiom "works like a clock"; all of the links would be linked to one another, and the whole system would work in unison to get the final product to the consumer as quickly and efficiently as possible.

References

1. This is the year of our Acieta. Robot transport vehicles, or RTUs. Article. On November 12th, 2021, you can go get it, 2021. Visit https://www.acieta.com/automation-application/ to learn more about our Robot Transport Units.
2. 2020's Adonis. The implications of Industry 4.0 for the logistics and shipping sector. Whispir's domain name. Taken out on October 10, 2021. Visit https://www.whispir.com/blog/the- to read more.
3. impact-of-industry-4-0-on-the-transport-logistics-sector
4. Ashodian J. The effects of Industry 4.0 on supply chain management. Date of Access: 1, 2016.
5. This coming September, 2021. Supply chain professionals can learn more about the implications of Industry 4.0 by visiting https://www.automationworld.com/factory/iiot/blog/13316416.
6. Auschitzky E, Hammer M, Rajagopaul R. As Exhibit A. The power of massive data sets to increase output. Article. As of 7 October 2021, you can get it again, 2014. To check it out, go to https://mck.co/3oj1bvy.
7. It is the year 2021 in the Balbix calendar. Cyber security's significance in the Fourth Industrial Revolution. To be retrieved on or after September 13, 2021. For more information on cyber security in the age of Industry 4.0, visit https://www.balbix.com/insights/.
8. Investments in the multi-billion-dollar transformation of Walmart's supply chain (Banker). Article, 2021.
9. A date of October 11, 2021, has been set for retrieval. This Forbes article (https://www.forbes.com/sites/stevebanker/2021/04/23/walmarts-massive-investment/?sh=5e54d5a0340e) describes Walmart's efforts to transform its supply chain.
10. Bauer W, Michael Hammerle, Stefanie Schlund, Christian Vocke. The emergence of a hyper-With the help of Industry 4.0, we can build a more connected economy and culture. Publication by Elsevier B.V. On September 4, 2021, you'll be able to obtain this. Here is the link: https://bit.ly/3088e1M to get there, 2015.
11. Europe's Future and the Fourth Industrial Revolution. Berger, Roberta. The publisher is the strategy consulting firm Roland Berger GMBH. The delivery date is set for September 5th, 2021. Visit http://www.iberglobal.com/files/Roland_Berger_Industry.pdf to download the report.
12. The OECD published a book by W. Bradberry titled Government and Business Implications of the Coming Production Revolution. Report. Set to become available on September 25th, 2021, 2017. Check out https://read.oecd-ilibrary.org/science-and-technology/the-next-production-revolution_9789264271036-en#page4 to get your hands on a copy.
13. Brkljac M, Sudarevie T. The Millennial generation and the economy of sharing and Industry 4.0. DAAAM Group, Inc, 2018.
14. Publication. Proceedings of the 29th International Conference on 3902734-20-4, ISSN 176-9679, Pages. 1092-1101. Get it after October 15, 2021. Downloadable at https://www.daaam.info/Downloads/Pdfs/proceedings/proceedings_2018/156.pdf
15. Caggia C. How Augmented Reality Can Help Industry 4.0, 2021. Archived from Sunday, September 13, 2021. Articles about how AR can help industries can be found at https://www.qualitymag.com/articles/96416.
16. Cerasis is a logistics provider. The impact of technology on the supply chain, logistics, and manufacturing sectors. Ebook. Dated for access on October 2, 2021. Visit https://bit.ly/3H4LqRF to view.
17. Report Synopsis on Industry 4.0 from CIPS, 2018. Extracted on the 10th of October, 2021. Industry 4.0: An Overview Report by the Advanced Distributed Processing Group, Next Generation is at https://www.cips.org/Documents/Knowledge/Procurement-Topics-and-Skills/Innovation%20and%20Technology/Industry%204.0/Industry%204.0%20Overview%20Report%20ADPG%20Next%20Generation.pdf.
18. Cotrino A, Sebastian M, Gaya C. Industry 4.0 Roadmap: Implementation for Small and Medium-Sized Businesses. UNED's official journal. Accessed on the 4th of November, 2021, 2020. This article can be found online at https://www.mdpi.com/2076-3417/10/23/8566.
19. Year Cybernet. Reverse logistics in the age of Industry 4.0. Online Journal entry dated April 28, 2021.

20. Dated for access on September 10, 2021. Industry 4.0 and the Future of Reverse Logistics, a Blog Post, is Now Live at https://www.cybernetman.com/blog/
21. Dan V. Both empiricism and nonempiricism can be used. Berlin University Press Publication. Get it after September 9, 2021. In stock atmuenchen.de/personen/wiss_ma/dan_viorela/empirical_and_non_empirical.pdf
22. A brief history of robots in industry. Davids M. 2017. Posting on July 17th, 2017. You can get this on September 12th, 2021. Available at https://blog.robotiq.com/a-brief-history-of-robots-in-manufacturing
23. Dilmegani C. Top 12 cases/ application of AI in manufacturing. Article. Dated for retrieval on September 13, 2021. Available at https://research.aimultiple.com/manufacturing-ai/
24. Edwards D. Amazon now has 200,000 robots working in its warehouses. Robotics and Automation News. Retrieved on 24 October 2021, 2020 Available at https://roboticsandautomationnews.com/2020/01/21/amazon-now-has-200000-robots-working-in-its-warehouses/28840/