

Actual Managing and AI Problems of Healthcare Supply Chains

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Abstract: Problems of supply chains can be very diverse; the goal of this article is to explore the issues and the solutions provided by AI. Artificial Intelligence is already present in many areas of our lives and affects it. In this article we are not only investigating how it reduces uncertainty in the supply chain, but also the potential pitfalls of using artificial intelligence should be explored. What impact it will have on the results of the supply chain in the healthcare sector? The opportunities provided by this ever-developing technology must be used in the most efficient way. The research reveals how we achieve most effective satisfaction of the customer including AI technologies in our processes, also highlighting some important issues related to the use of AI. In today's world, being in possession of information is the greatest capital, a lot of information has to be processed every day, but the winner will be the one who has it all and is able to process it. We are examining a post-covid period, during this examination AI software was introduced to a customer service team, also we took into account the advantages and disadvantages.

Keywords: Artificial Intelligence, Supply Chain Management

1 Introduction

The COVID pandemic drew attention to the shortcomings and weaknesses of healthcare supply chains and thus pointed out possible directions for development. [1] What challenges did they face? Among other things, lack of foresight, high demand for products, medical equipment, ensuring accurate delivery and minimizing costs. COVID period pushed companies to search for new innovative solutions to survive these extremely difficult times.

In our case study an AI driven software was implemented to a customer service team of a healthcare supply chain. The company is one of the leading multinational companies in the healthcare sector. Deals with the manufacture and sale of medical equipments, accessories and related devices, also handles installation and maintenance. In our case study, we were focused on the customer service team, which sells medical equipments and accessories.

In the supply chain we can face multiple problems on a daily basis, in the following we examine the most common problems that occur according to five aspects, which are:

1. Lead time;
2. Communication (external, internal);
3. Product shortages;
4. Delivery issues;
5. Lack of information.

We've highlighted the most crucial problems which we try and potentially can be solved by implementing an AI driven software to the customer service team.

Managing Supply Chains can lead to competitive advantages, in addition traditional, more time-consuming processes can be replaced by new technologies, which can save considerable time and manpower. Software-based, physical artificial intelligence is already part of our everyday lives. Our smartphones, smart watches, digital assistants, industrial robots, self-driving cars, autopilot functions etc. all work with AI softwers. Also, AI plays an important role in the healthcare industry as well, AI driven softwares and applications can help doctors to analyze patients images (X-ray, MRI, etc.). The purchase of these softwares is becoming more and more available for larger companies, if they want to gain a competitive advantage over competitors in this post-COVID situation, they must take this step and be open to technologies that sometimes require big changes.

2 Artificial Intelligence and understanding its importance

Today's modern information technology provides the appropriate tools, for example Internet enables global real-time communication. However, we cannot stop here since we can talk about the creation of AI technologies from around the 1950s, when Alan Turing raised the following question: "Can machines think?". Turing proposes a machine intelligence test, he believes that if a machine can make people think it is human, then it has intelligence, actually Turing test is a method to determine the intelligence of a machine. [2] Even today, the test is an integral element of AI research.

The term Artificial Intelligence was first coined in 1955 in a mathematics course by Professor Jonh McCarthy at Darthmouth University as follows: “Artificial Intelligence is the science and engineering of making intelligent machines”. AI aims to reproduce mental activities with the help of machines. These activities include for example, perception, understanding and decision-making. [3]

2.1 Supply Chain Challenges solved by AI

At the beginning of the article, we mentioned a couple of challenges caused by the COVID pandemic, which pointed out some of the most critical points in the chain. Now we want to help solve these problems by embedding AI software.

2.1.1 Interpretation of the definition of supply chain

The first definition of Supply Chain was determined by the Supply Chain Council in 1997: “SCM encompasses the planning & management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners including suppliers, intermediaries, third-party service provides, and customers. In essence, SCM integrates supply and demand management within and across companies.” We differentiate both material and information processes, include the flow of the product from the supplier to the final consumer, as well as the reverse product flow. The coordinated operation of logistics processes is essential for the smooth operation of companies participating in the supply chain. [4] The number of chain members may differ from company to company it may be simpler or more complex. In order to achieve effective supply chain management, coordination of activities, mutual trust, and unhindered cooperation are necessary. Information is the basis for establishing a relationship, and its rapid flow is a condition for efficient operation.

2.2 How AI works

John R. Searle american philosopher studied the behavior of AI, based on this, we distinguish weak and strong AI. Weak AI reproduces or imitates a special behavior, even able to recognize and solve problems but the machine does not understand the reason of act. In contrast, strong AI not only acts rationally, but also has emotions, it has its own thought processes and consciousness. [2] Today, strong AI exists at the level of plans for the time being, research has already begun and progressing rapidly worldwide. For the rest of this paper, we will consider the existing AI – i.e. weak AI.

AI softwares are using the following AI-driven technologies:

1. OCR - Optical character recognition: text recognition technology responsible for reading documents;

2. First-time recognition: extracting information from documents seen for the first time using deep learning technologies;
3. Automatic learning: machine learning technology that increases recognition rates by learning from user corrections.

2.2.1 Deep learning

Deep learning is a part of a variety of machine learning methods, which gives the ability to AI to produce similar activities as the human brain's neural network. [5]

Deep learning opportunities have already benefited the healthcare industry, for example image recognition applications can support doctors analyze images.

Why not use these technologies at other members of the chain?

2.2.2 Increasing efficiency of supply chains with AI

Why is it beneficial for us? First, the AI-driven software is ERP-compatible. In addition, using artificial intelligence, not only data scientists can perform business analysis, but also people with knowledge of the business field. [6] Several functions are available on a single platform: reports and results all contribute to planning. We will know, for example, what stocks we have to count on from the expected more accurate forecasts, we strive to achieve the optimal stock level, since holding unnecessary stocks is a cost, so this will also decrease. At the same time, elimination and prevention of shortage problems. [7]

Secondly, it offers more profitable marketing strategies, which helps determine the customer needs, and it communicates well about product development. Not least thanks to cloud-based solutions, it positively influences sustainable development. [8]

Errors caused by human inattention can be completely eliminated with the help of artificial intelligence. Automate, improve and simplify ordering processes as a single task. Humans can make several mistakes, such as misspelling important identification numbers and product numbers, but the software does not make such mistakes, it is more accurate. AI software increases the speed of document processing, up to five times faster order processing is available, thus reducing reaction time. This saves time for other important tasks: customer calls, customer inquiries, handling complaints. Finding customers is one of the most important tasks that must be focused on, since the customer is the key figure in the supply chain, without whom businesses cannot continue.

2.3 Regulation of principled issues related to the use of AI

Confidentiality issues arise in connection with the use of AI, but there are regulations to protect people and business information. [9] On April 21, 2021, the European Commission published its draft regulation on Artificial Intelligence in

Brussels, the main goal of which is to comprehensively regulate AI for the first time in the world: “In order to accelerate, act and align to seize opportunities of AI technologies and to facilitate the European approach to AI, that is human-centric, trustworthy, secure, sustainable and inclusive AI, in full respect of our core European values, this review of the Coordinated Plan puts forward four key sets of proposals for the European Union and the Member States:

- Set enabling conditions for AI development and uptake in the EU
- Make the EU the place where excellence thrives from the lab to the market
- Ensure that AI works for people and is a force for good in society
- Build strategic leadership in high-impact sectors” (European Commission, Brussels, 21.4.2021, COM(2021) 205 final)

Primarily, increasing the competitiveness achieved with AI and exploiting economic and social benefits. On the other hand, the minimization of risks and disadvantages, in order to ensure the human rights and EU core values are not violated. [9] The European Commission would also like to increase people’s sense of security and trust, at the same time giving free space to technological development.

Should the employee be afraid of losing his job with the introduction of AI? In the near future I would say no, since humans train and control AI and not the other way around. However, globally millions of people have already lost their jobs as a result of the incredible fast development of robotics. [10] Another question arises: Are humans or AI doing the job better? Originally, the introduction of AI software was not introduced to completely replace human labor, but to facilitate their work and increase efficiency, but probably the rapidly developing artificial intelligence will revolutionize the labor market. [11]

3 Obstacles of implementing AI into the supply chain

We distinguish problems arising from the use of AI according to whether they violate principled reasons or whether we encounter technical obstacles.

We saw the principle problems in the previous chapter, so in the following we present technical problems that occurred during practice and testing.

After a lot of planning, the problems really become apparent in practice. Before we start using a software live, it is preceded by a test period. What technical obstacles do we encounter during testing?

Technical problems can be approached from several perspectives, in this article we examine two sectors: data and human.

First of all, there are various data problems. AI works and learns from data, so if the data is insufficient or incomplete, the software will not have enough examples to draw conclusions. For example, not all AI softwares can read handwritten texts and documents, due to its uniqueness it is difficult to identify individual characters. Secondly, data quality can also be a problem. We can have a lot of data, but it should not be inconsistent and unbalanced, this would lead to over represent data of a group and would give us false results. Data privacy and security it is a highly important factor, because there are a lot of risks involved: loss of data can lead to the loss of reputation, loss of customers and loss of money. The data of the company and their customers has to be safe and protected from cyber attacks. Therefore, it can be said that both the quality and quantity of the data must be adequate for the problem-free operation of the AI software.

Human factor is one of the most important to review when investigating problems. For example, deep learning is only possible with continuous training, humans need to correctly plant the data and teach the software, and then test the software to see what did it learn from the trainings. I would mention two problems with learning, first it is a very time-consuming task, both from human and AI side. For humans it requires a lot of attention and time to teach AI recognize the information. Also, AI learns slowly, sometimes we have to teach the same task several times. Today, there are service providers on the market that try to simulate human work and try to teach AI programs. However, these researches are not yet fully successful, for now humans are the most thriving in teaching AI. [12]

4 Using AI software to solve Customer Service problems

The focus of the examination was an artificial intelligence software implemented on the customer service department of a healthcare company. Why Customer Service problems are so important to be solved? What roles the Customer Service play in the chain?

Many companies do not realize the importance of customer service even though it affects many things beyond the customer: for example, logistics, delivery, invoicing, product availability and planning.

Customer service can be seen as a bridge between logistics and marketing, its success determines the company's long-term viability and effective customer service can be one of the best ways to gain a competitive advantage. To achieve this, it is important to continuously monitor and regulate customer service and evaluate customer service levels. Customer service is an integral part of your company's strategy, and a strong, effective customer service ensures satisfied customers.

Customers can contact us through a number of platforms (phone, email, social media), whether to ask questions, inquiry about an order or make a complaint. Even if we manage to collect all the useful data, we may not be able to meet the challenge of making sense of it. Also, the preparation of the reports can take a lot of time, and the managers can also lose their trust in their team, thus the lack of supervision can also result in the lack of responsibility of the team.

The software is able to help us in two important areas, which are Order Management and Customer Inquiries Management.

4.1 Experiences of testing AI, as a customer service problem-solving tool

In the following the circumstances of the research will be presented. The case study was actually prepared at one of the biggest healthcare multinational companies, where we examined the potential effects of using AI at the customer service team on the most important chain member, the customer. In our case, the customer service team was in our center, as the research was corroborated with depth interviews within the team. The questions were carefully structured and composed as follows: what challenges do we face on a daily basis for which we would like to find a solution, then they were asked about the advantages and disadvantages of the software, and what they think about the effect it will have on customer satisfaction. Last but not least, we asked them questions about the future of AI, and its danger on our jobs.

Information was collected from different sources during the case study, as we were using the depth interviews, as well as internal company documents.

Now we would like to introduce the practical research, which we obtained during software testing. Before the new software goes live, it has to be preceded by a test phase. Why testing is necessary? The testing period is important from several points of view, on the one hand, the employees get a first impression of the new interface. On the other hand, they can assess the problems that arise in time, generally testing provides visibility on both strong and weak points. The test environment consists of an artificial intelligence-controlled process automation software.

In the test environment Customer Service Representative teach AI where the location of the information is, and AI will remember from where the information was taken. During testing several problems were highlighted concerning the handling of documents, such as purchase orders:

- errors due to inadequate administration, important identification numbers were missing, which hindered the processing of documents, it automatically ran to an error;
- the software was not taught to read handwritten text, so it could not read them;
- the software could not read the correct data from the document;

- customers sent their requests with incomplete data, it was unidentifiable for the software.

Part of the listed problems is a data administration problem, since the data from the company's ERP system was not correctly transferred to the new system, therefore a synchronization error occurred, and as a result of the incomplete data, we were unable to approve the order registration where essential information was missing. Also, as the software cannot read handwritten text, special characters or blurred fax, the customer service employees must ask and educate customers to send their documents in a readable format for us, thereby facilitating the processing of their orders.

The second major workstream for the customer service team is handling customer inquiries. It involves complex tasks, such as tracking the status of orders, answering emails, customer calls, handling customer complaints. The software not only enables communication with both internal and external customers, but we reach a platform where we are able to answer and solve all type of customer requests in the shortest possible time. All information, history, previous request can be reachable through one platform, thanks to a simple IT environment. During testing, we did not measure any problems regarding the customer inquiries handling.

We don't have to work harder, we have to work smarter. It is necessary to create the settings that support the work of the employees, so that we can achieve greater efficiency with fewer measures.

At the moment, the development of the software is not yet at the point where it does not require human supervision, for example for certain processes the software needs human approval.

5 Suggestions based on case study

While artificial intelligence becomes a tool infiltrating the lives of all companies and organizations, it will inevitably transform our economy and society as well.

Companies in the healthcare sector, hospitals, public health institutions have invaluable data, they will most likely use the advantages of AI technologies. Data is key to the effective application of AI, and the first step necessary to develop an AI strategy is to focus on the construction of data collection and data management systems, this is essential as AI softwares work with huge amounts of data. [13]

Based on implementation experience, to introduce AI in the supply chain I recommend using the following flowchart:

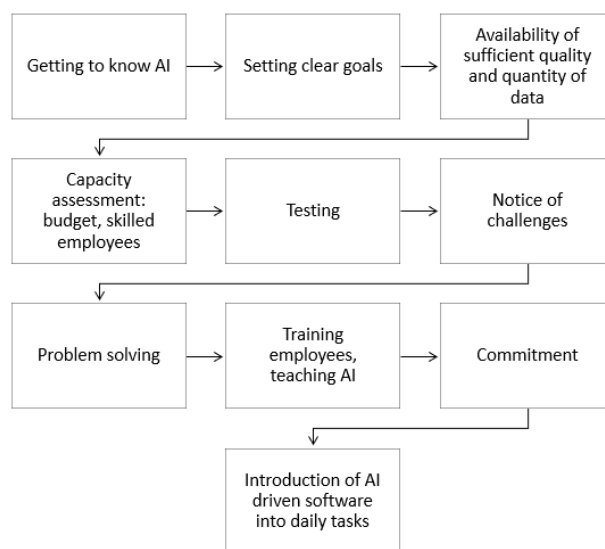


Figure 1.
AI strategy
source: own editing

By developing the right AI strategy, all problems can be prevented, thereby making the difficulties and challenges associated with change smoother.

It can be stated that the introduction and use of AI software have more advantages than disadvantages. The first and most important advantage is that the manual order entry activities will be automated, thus the order processing will be faster and the lead time will be reduced. The customer will receive the order sooner, thus there will be fewer complaints about delivery delays. Also, one of the biggest problems we deal with every day is the lack of products, with the help of the new software, planning will be much easier, but there is a short-term disadvantage which is the change management. The results of the research clearly proved that it has a positive effect on customer satisfaction. Since the software can record an order up to 5x faster than an employee, the processing time of orders is reduced. The customers will receive their package sooner, thus they will be satisfied. Post-correction will also be reduced, as the software reduces errors resulting from human inattention (recording a misspelled order number, recording the wrong quantity, recording the wrong phone number).

Overall, the customer can enjoy a more positive, problem-free customer service. And a happy customer will be a returning customer, which is essential for the company's success.

In the following table, we can see the comparison of benefits and potential pitfalls of implementing and using AI driven software:

Benefits	Potential pitfalls
✓ Increases speed and accuracy of document processing	✗ Data errors due to insufficient amount of data
✓ Errors due to human inattention are reduced	✗ Data errors due to inadequate data quality
✓ Real-time tracking of orders, customer inquires	✗ Time management – AI learns slowly
✓ Simplified IT environment	✗ Time management - Employee needs to spend time on teaching the AI
✓ Immediate analysis results, statistics	✗ Does not recognize special character recognition characters, or handwritten text
✓ E-archiving	✗ There will still be manual tasks to do, the system will not be completely independent

Despite many positive aspects we can experience through this innovation we can we face potential pitfalls too. However with the availability-, and right implementation of data, as well as continuous, correct teaching of AI, we can achieve excellent results.

To achieve even better results and reduce problems in other areas of our chain, it would be worthwhile to introduce AI-driven software to all other supply chain members that work with larger data sets, for example invoicing, warehousing. Automation is the future, so it is likely that innovation will soon be necessary for other members of our chain as well.

Conclusion

In summary, based on the case study and the experiences we gained during the use of the AI driven software, we can state that the company can experience much greater customer satisfaction thanks to the integration of AI software as it takes over tasks from human, but still remains under the control of humans throughout. However, as we saw in the article, several questions arise when using AI. From my perspective, the future of AI in healthcare supply chains is promising. As our future holds more and more automation, AI will help to reduce risks and make the change smoother, most importantly will help the company stay competitive. What will happen to the relationship between humans and AI? Human intelligence should be augmented by AI, as humans should teach artificial intelligence. We hope that we cannot teach AI enough to be smarter than us and that the final decisions and power remain in the hands of humans.

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