Journal for Business Education and Management
ISSN (Print): 2790-7848 ISSN (Online): 2790-7856
Volume 1, Issue 2, Page 21-34, December 31, 2021

THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE SUPPLY CHAINS OF TEXTILE INDUSTRIES

Habibullah Khan
Ph.D. scholar
University of Karachi

Abstract

The need to wear the latest fashions, be in style, and look modern is not just limited to a few regions; people all over the world have the same demands in this regard. With globalization taking over the world by storm, people's awareness and knowledge of fashion and good clothing have taken an even stronger grip. In such circumstances, textile and garment manufacturing companies have a huge demand to meet; for that to be overcome, they must increase their production capacities, enhance their processes and work on their efficiencies. Global firms are making great use of artificial intelligence and its various tools and branches to improve their processes. This research explores how artificial intelligence is beneficial for organizations and goes on to establish significant relationships between artificial intelligence and demand forecasting, decision-making, and product deliveries. The study is based on Pakistan's textile sector. The methodology used in this research is a quantitative model; for data collection, a questionnaire was formed and distributed to over 100 employees working in various textile and garment manufacturing companies across Pakistan. The data collected was then analyzed using SPSS, and several tests were performed. Furthermore, regression analysis was also performed. A reliability test was also done to see how the scale items under each variable were interrelated and consistent with each other. The results of the test reveal that all the variables had a positive Cronbach alpha value, stating that the scale items are consistent, and most of them were above 0.7, which shows that the consistency is strong. The correlation test results show that artificial intelligence is very much related to all the dependent variables. Lastly, the regression tests also prove that Artificial intelligence has a very significant influence on decision-making, demand forecasting, and product deliveries of textile firms.

Keywords: Application, Artificial Intelligence, Supply Chain, Textile Industries

Introduction

As the computing world is on the boom today, scientists are emphasizing implanting all human capabilities into computers. Solving this problem is basically Artificial intelligence (Dong et al., 2020). This branch of computer science works by incorporating data into machines to make them work like humans. This results in many forms, for example, speech recognition, resolving problems, learning, forethought, and decision-making. There is a dire need for systems that support decisions and artificial intelligence in the cloth manufacturing supply chain networks. Since the trend of globalization and international cooperation is rapidly increasing, all companies in the textile sector are pushed to develop their supply chains as strongly and responsively as possible in order to be efficient and effective in providing the best value to the customers. Now, since the supply chain network comprises a number of organizations

This work is licensed under a Creative Commons Attribution 4.0 International License.

that start by converting raw materials to finished goods and then transferring them to the distributors and the end consumers (Blanchard, 2021), such a great network can only add value to their products if they enable information sharing and increase coordination.

The ever-growing demand for the quality of clothing and rising awareness of customers has led to the use of artificially intelligent tools in the textile industry, recently. With every passing year, cloth manufacturing industries are deploying automated processes in order to speed up their production and enhance the quality of their products (Nayak & Padhye, 2011).

Globally, the use of Artificial intelligence and all its branches is being incorporated heavily in the textile industry, which will be seen later in this research. The Pakistani textile and garment manufacturing industry is, however, lagging in this regard and mostly still uses manual procedures. The adoption of artificially intelligent machinery and automation tools will greatly help the Pakistani textile industries pace up their operations and increase quality, which will ultimately help them compete with global giants (Niinimäki et al., 2020).

The textile industry has always been focused on high-volume production, but this is changing now. Recently, the focus has been more on improving quality, cutting down costs, managing great amounts of data efficiently, and just-in-time manufacturing, all in addition to volume production. This is due to the rising global competition. (Nayak & Padhye, 2014).

Computers have several limitations. For instance, computers are not intelligent and have no self-awareness or a general understanding of our environment (Nayak et al., 2016). Conversely, humans are slow in their work and not as precise and reliable as computers, but they have the intelligence to improvise and solve different kinds of problems. Artificial intelligence is basically the amalgamation of both as it simulates human intelligence and works. The intelligent and robust nature of artificially intelligent systems helps to provide better solutions than the old traditional techniques.

The garment manufacturing procedure has grown over time and has seen many technical changes. The technological advancements in this industry globally have witnessed the use of computerized equipment in designing and pattern making, 3D scanning, transport systems, and finally, the use of robots or artificial intelligence. The most recent vital advancement in the textile industry is the use of artificial intelligence and its other branches to transport material to improve production. Sewing technology has also been automated (Bongomin et al., 2020).

Supply chains have become more complex, and there are many organizations associated with making a single product. From the sourcing of raw material to making it available for the consumer, there are many stages and people in the chain. In the globalized world of today, firms and their supply chain networks are getting bigger. This causes the inclusion of various stakeholders and other internal/external factors as well (Gharaei et al., 2020). Among all these, the role of decision-making is the most crucial. Making the right decision at the right time can take any firm to great heights, and failure to do so can have adverse effects. In past times, firms have suffered due to decision-making only done by humans and traditional methods. However, now, with

ISSN (Print): 2790-7848 ISSN (Online): 2790-7856
Volume 1, Issue 2, Page 21-34, December 31, 2021

the advent of automation and artificial intelligence, decisions are made timely and without errors. Hence, organizations are flourishing.

Dependent Variables: Product delivery (PD), Demand forecast (DF) and decision-making (DM)

Independent Variable: Artificial intelligence (AI)

H_{o1}: There is not any real relationship between artificial intelligence and decision-making

H_1: There lies a significant relationship between artificial intelligence and decision-making.

H_{o2}: There is not any significant relationship between artificial intelligence and demand forecast.

H_2: There lies a clear relationship between artificial intelligence and demand forecast.

H_{o3}: There is not any significant association between artificial intelligence and product delivery.

H_3: There lies a significant association between artificial intelligence and product delivery.

H_{o4}: There is no significant impact of artificial intelligence on decision-making.

H_4: Artificial intelligence has a significant impact on decision-making.

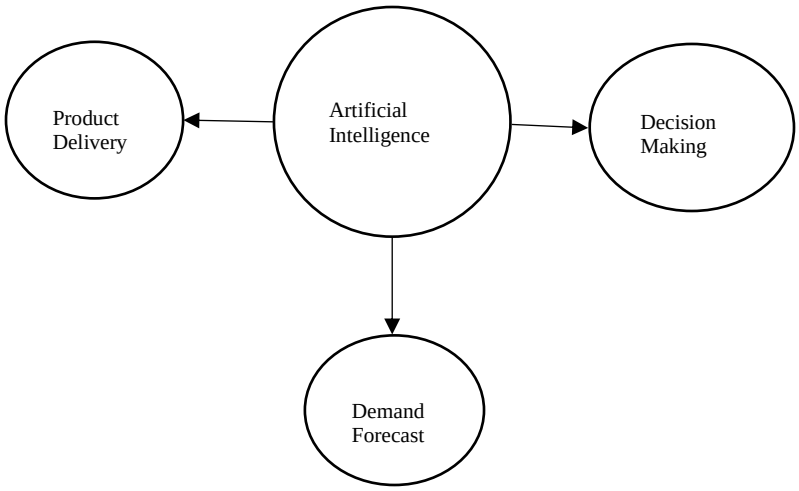
H_{o5}: There is no significant influence of artificial intelligence on demand forecast.

H_5: Artificial intelligence has a significant impact on demand forecast.

H_{o6}: There is no significant impact of artificial intelligence on product delivery.

H_6: Artificial intelligence has a clear impact on product delivery.

Theoretical Framework



Technological advancements have changed the fate of many industries, and automation in the garment industry is becoming a general phenomenon. Having artificial intelligence helps you make agile and timely decisions by reducing human error to the best possible degree. Globally, artificial intelligence has been widely incorporated and has proven to be extremely vital, but in the studies in Pakistan, there is still a big void. Artificial intelligence is not as widely used in the supply chains of Pakistani firms as it is globally. The reason is that people lack the necessary knowledge and the ability to function with technology. With the use of artificial intelligence, Pakistani firms can significantly cut down on human errors, make informed decisions, and improve forecasting. This research aims to fill in these gaps in the Pakistani garment industry to improve their decision-making process and forecasting and ensure an efficient flow of work. In contrast to that, international investors prefer not to invest in industries that are way behind time. Therefore, it is vital to incorporate all the beneficial and globally used automation techniques.

Questions Investigated

1. Is there any notable association between Artificial intelligence, Decision making, and product Delivery?

2. Does Artificial intelligence have a significant impact on Product delivery?

3. Does Artificial Intelligence play an important role in decision-making?

4. Does Artificial Intelligence have a significant influence on Demand Forecasting?

The major objective of this study is to find the role of artificial intelligence in several areas of the supply chain of textile industries: decision-making, demand forecasting, and product delivery. However, the sub-objectives of this research are studying the relationship of Artificial intelligence with each variable (Demand

ISSN (Print): 2790-7848 ISSN (Online): 2790-7856
Volume 1, Issue 2, Page 21-34, December 31, 2021

forecast, decision making, and product delivery) separately and then finding the influence Artificial intelligence has on Demand forecast, decision making, and product delivery in the supply chains of textile industries.

The main aim of this paper is to find the impact of artificial intelligence on three variables: the decision-making process, demand forecast, and product delivery process. Artificial intelligence is the independent variable, and the remaining three, the decision-making process, demand forecast, and product delivery, are the dependent variables. Since the prime focus is to find the effect of artificial intelligence on garment industries operating in Pakistan and to fill the gap, our data collection is bounded to Pakistani industries only. This research will have a life of 2 months, starting from April 2020 and extending till June 2020. Therefore, taking these dependent and independent variables into account, data from garment industries operating in Pakistan will be gathered.

Literature Review

The purpose of this study is to discover the 4th version of this industry along with its components: big data, smart-working factories, cyber systems (CPS), the Internet of things, and artificial intelligence in Pakistan's production and service sector. This is quantitative research with data collected through questionnaires from 224 respondents in textile and logistics firms, respectively. The data is hence analyzed using smart partial least square structural equation modeling (PLS-SEM); the results prove how Industry 4.0 has a prominent effect on Pakistan's producing and serving industries as a whole. The keywords of this research are Industry 4.0, big data, smart factory, cyber-physical systems, internet of things, artificial intelligence, logistics, textile, production, and services industry. The future direction is to analyze the impact Industry 4.0 has had on Pakistan's production and services sector in a timeline pattern (Imran et al., 2018).

The study uses the words NANO materials, artificial intelligence, fashion, textile, design, creativity, sustainable and insect resistant, with the aim of finding their effect on the fashion, design, and textile sectors. Being quantitative research, the data was gathered through questionnaires from respective industry representatives. The results show how the changing technology has a significant yet positive impact on the sustainability of these sectors and how the incorporation of these tools is better not just for humans but for the environment as well. (Waheed & Khalid, 2019)

This study shows how decision enhancement and Artificial intelligence impact the garment, fashion, and textile sectors. To collect data, 77 articles were published in 35 different journals, each article categorized into three areas: textile making, cloth manufacturing, and allocation of sales. This was then divided into 16 sub-categories on the basis of their operations and managing procedures. This research states how the incorporation of ERPs, RFID, and AI enhances the overall performance of textile and apparel manufacturing firms. This research also focuses on the integration of decision support systems and AI in areas like design development, fiber-to-yarn, garment production, and making. In the future, the incorporation of AI can ease the handling and flow of information. The keywords used are decision support, intelligent systems, and textile and apparel supply chain. (Ngai, Peng, Alexander, & Moon, 2013)

The purpose of this research is to find how artificial intelligence affects the determination of the cotton properties of the yarn. The advantages of Artificial intelligence are deduced after carrying out the tests. The data is collected from the spinning plant in Slovenia. The keywords used in this research are artificial intelligence, spinning technology, cotton yarn properties, the textile industry, and machine learning. The final result shows that any problem incurred within the defined boundary can be easily identified, analyzed, and then solved. The reliability of the study can be improved by adding more data to it. The future direction is to improve the accuracy and the information produced by these systems, to add larger values in order to increase accuracy, and lastly, to evaluate more areas of the supply chain (He et al., 2021).

This research provides a framework for managing the production outputs in textile industries, with its main focus being on the master production scheduling problem. The keywords used are master production scheduling problem, decision support systems, production planning, and textile industry. The author has analyzed the relationship each module has with different production requirements. These technologies have an impact on the production schedules in the textile industry. The advantages of these technologies are represented graphically. The future direction stated is to work more on the remaining aspects of the supply chain, decision-making and demand to forecast. Hence, by feeding more data into the system, the accuracy will, in turn, improve (Tareque et al., 2020).

This research focuses on the use of certain computer models with the aim of determining the properties and performance of textile structures. The study shows how different tools predict different properties of fibers. (FEM) The finite Element Method facilitates the textile industry by helping them predict the behavior of certain textile structures when under mechanical pressure (ANN). Artificial Neural Networks are used to help ease the classification issue raised. At the same time, (CBR) Case-Based Reasoning is used where (ANN) and (FEM) fail to facilitate. The keywords used are textile engineering, artificial intelligence, and case-based reasoning (S. et al., 2016).

This study explains that the textile industry is one of the most profitable and leading industries in any country, and identifying errors manually, which also includes human error, can be a time-consuming and tiring task. Any defect can be a great threat to the whole industry; therefore, to tackle this, an automatic defect detection system is introduced. This reduces not just the time taken and human error but is also economically efficient. (ANN) An artificial Neural Network is used in order to detect the defects in the fabric. For future researchers, further work is needed on how artificial neural networks can be installed and used in other areas of garment manufacturing other than detecting defects (Raut & Singh, 2020).

This study focuses on improving the quality of yarn. The three areas focused on are yarn mass parameters, which are hairiness, diameter, and mass. The independent variables are Image processing (IP) and artificial intelligence (AI), and their impact is seen on the dependent variables – yarn mass, yarn production, and yarn fabrics. The results prove that by using image processing and artificial intelligence, the textile industry enjoys benefits: better levels of parametrization, higher product quality, and increased efficiency, all of which contribute to economic recovery. The future directions are to develop technological solutions that automatically characterize yarn

ISSN (Print): 2790-7848 ISSN (Online): 2790-7856
Volume 1, Issue 2, Page 21-34, December 31, 2021

properties and predict the appearance of fabrics before they are made. Therefore, artificial intelligence and data analysis are important in the fields of decision-making and demand forecasting (Saxena, 2020).

This research focuses on the benefits of artificial intelligence in the textile industry. The paper discusses the history of garment manufacturing and how the use of artificial intelligence, expert systems, and big data has improved all the processes and procedures. Artificial intelligence, expert systems, neural networks, artificial immune systems, genetic algorithms, fuzzy logic, and other artificial intelligence approaches are discussed in detail. The results show how artificial intelligence has a direct impact on these areas with improvements in the work processes. The future direction is to focus on the use of artificial intelligence in optimizing supply chain networks to help in decision-making, inventory management problems, or product deliveries. (Nayak & Padhye, 2018)

The author emphasizes the use and implementation of artificial intelligence in the garment manufacturing industries. The potential areas for artificial intelligence in the fashion industries are design support systems, fashion recommendation systems, sensory evaluation, intelligent tracking systems, textile quality control, forecasting for fashion, improving decision-making in supply chain networks, and establishing a relationship of artificial intelligence with fashion e-marketing. Future researchers are to work on how artificial intelligence can be used to enhance decision-making and forecasting across the whole supply chain networks and provide better visibility. (Thomassey & Zeng, 2018)

This research is based on how artificial neural networks can be applied to predict the thermal insulation in children's school uniforms in Kuwait. Multiple techniques for data analysis were used, and the results suggested that artificial neural networks are able to give an accurate prediction of how to make thermal insulation in school uniforms, as compared to other techniques like regression equation and the standard tables methods. The findings show the use of artificial intelligence and artificial neural network models to forecast clothing thermal insulation accurately. For future findings, there is room to investigate the use of artificial intelligence in improving decision-making to see how the systems can impact the role of managers in textile firms (Xu et al., 2021).

This research aimed to investigate how artificial neural networks can predict the dimensional properties of a double cardigan structure that is produced from 100% cotton yarns. The main areas studied are yarn count, structural cell stitch length, course, wale density, and stitch density, and how these areas can be improved with the use of artificial intelligence. Moreover, the artificial neural network model and the U-values found using a test set of inputs were compared, and the prediction of dimensional properties of double cardigan structure using artificial neural networks was found to be very reliable. The keywords used in the research are the artificial neural network, double cardigan, course and wale density, fabric relaxation, and prediction (Berenguer, Miró i Martínez, & Díaz-García, 2020).

The paper investigates the influence of Artificial intelligence in garment manufacturing. The research talks about the use of AI techniques in the textile sector.

The research is categorized into three parts: production planning, control, and scheduling. The use of AI in enhancing garment quality control and inspection, along with garment quality evaluation, is also investigated. The keywords used in the research are Artificial intelligence, Garment manufacturing, and decision-making survey. The findings of the study show that artificial neural networks, genetic algorithms, fuzzy logic, and machine learning techniques are widely used branches of AI technologies that are incorporated in garment manufacturing industries. For future researchers, AI experts and textile industry workers need to work in coalition to discover the benefits of AI in decision-making problems (Jelil, 2018).

The literature review proves that Artificial intelligence and its tools are used vastly in the textile industry. The textile sector comprises areas ranging from yarn manufacturing, yarn parametrization, cotton manufacturing, fabric designing, and garment manufacturing to other areas of the supply chain network: storing, warehousing, logistics, and managing resources. Following globalization, supply chains have become more complex. To compete globally, firms strive to increase production, reduce costs, increase volume and increase efficiency and effectiveness, for which AI has become a necessity. Though Artificial intelligence has its advantages, work needs to be done on the application of AI in demand forecasting, decision-making processes, and product deliveries in all of the supply chain networks of Textile industries. By incorporating AI, firms can improve production planning, factory scheduling, procurement of raw materials, and meeting demands. Secondly, AI aids in decision-making; textile firms can eradicate all chances of human error. Lastly, with AI in product delivery, textile firms can improve visibility across all areas of their supply chain networks, enhancing their storage warehousing, inventory management, procurement, logistics, transportation, and company-wide coordination. This research has worked on the future directions mentioned in the literature review: decision-making, demand forecasting, and product delivery. These dependent variables will be tested to find whether or not they have a significant effect and relationship with AI.

Methodology

The purpose of this research is to find the effect of artificial intelligence on demand forecasting, decision-making, and product deliveries in the supply chains of textile firms. One hundred two people collect the data from the textile industry through questionnaires. The effect of the independent variable, artificial intelligence, is determined by the dependent variables: Demand forecast, product delivery, and decision-making. The statistics include the analysis of the demographics, regression, correlation tests and reliability analysis. Demographics are tested through descriptive statistics; reliability analysis shows how interrelated the variables are, whereas regression and correlation were carried out to test the hypothesis, whether or not they have any relationship or impact on each other.
A deductive approach is used in this research with a top-down approach, where existing literature review is taken into consideration. The research and results, in return, show which hypothesis is to be accepted. A quantitative approach is used for this research, with SPSS software used to sort and analyze the data collected through the questionnaires. The entire hypothesis made in this research based on previous research was tested. The data collected is for one time only, from 102 respondents working in the textile industry. The time horizon is cross-sectional because the whole data

ISSN (Print): 2790-7848 ISSN (Online): 2790-7856
Volume 1, Issue 2, Page 21-34, December 31, 2021

collection process was completed within 2-3 weeks. The target population was all the employees working in Pakistan's textile industry. The sampling technique is convenience sampling due to COVID-19 and the shortage of time. The questionnaire consists of questions made on a 5-point Likert scale. The units of analysis are individuals who are employed in textile/garment manufacturing firms in Pakistan.

Several dimensions are considered in the study, and different tests are applied to see the working of these dimensions; regression and correlation tests are major tests applied. The major aim of this research is to study the effect of Artificial intelligence, the independent variable, on the dependent variables: demand forecast, decision making and product delivery. The tests start with a descriptive analysis of the demographic variables, followed by a reliability analysis, after which correlation and regression tests were conducted. The whole analysis is done through SPSS. The purpose of these tests is to prove any significant relationships among the variables and also to check their strength. The validity and reliability of these variables are showcased through Cronbach's values. SPSS software helps consider all the minute details in large sets of data, and therefore, testing primary data through SPSS is very convenient. Since the data was collected online, it was extracted through SPSS, with tests conducted more than one time in order to minimize any error and improve accuracy. The values of Cronbach's Alpha for Artificial intelligence, demand forecast, decision making and product delivery are 0.795, 0.513, 0.264 and 0.786, respectively, which suggest that most variables have a good internal consistency. Since all the values are positive, it shows that scale items within each variable are interrelated to each other. The survey questions answered by the people are purely a reflection of their thinking and opinions. No results have been manipulated; neither was any respondent coerced to fill out the questionnaire. The questionnaire was only filled out by people employed in garment manufacturing firms in Pakistan. In order to keep their anonymity intact, the question for names is not added, and the option to enter their company name is also left at their will. Lastly, the citations added are all valid.

Data Analysis

A questionnaire was formed on a five-point Likert scale and was filled out by 102 individuals working in Pakistan's textile industry. A descriptive analysis was done, which consisted of demographics like job title and experience. Further on, a reliability test was run to check if there was internal consistency among the variables. Lastly, a correlation test was run to check if there was any relationship among the variables, and regression was used to check if the independent variable had any impact on the dependent variable. Out of 102 respondents, 31 were top-level managers, 26 were middle-level managers, 15 were lower-level managers, 16 were team leads, and 14 people had no managerial role in their respective organizations. From a total of 102 respondents, 16 had 1-2 years of experience, 30 had 3-5 years of experience, 26 people had served for 6-8 years, 15 people had 9-12 years of service, and 15 people had experience of 12 plus years. Now, in order to check the relationship between the demographics, cross-tabulation is done. The cross tab showed how only 13 out of 31 top-level managers had 12 plus years of experience, while 10 had 9-12 years of experience, and the remaining had only 6-8 years of experience. Meanwhile, for the middle-level managers, only 1 had 12 plus years of experience, 4 had 9-12 years, 14 had 6-8 years, 5 had 3-5 years, and 2 had 1-2 years of experience. Of the 16 team leads,

only 1 had 6-8 years of experience, 11 people had 3-5 years of experience, and 4 of them had been in their respective organizations for 1-2 years. Four people who were not in any managerial position also filled out our survey, and out of these 14, 1 had been in the organization for 12 years or above, 5 of them had 3-5 years of experience, and eight people had served for 1-2 years. The Cronbach's alpha value for AI is 0.795, which is above 0.7, which states that all items are correlated to each other. The Cronbach's alpha value for demand forecast is 0.513, less than 0.7, which states that though it is not as strong, there is internal consistency. The Cronbach's alpha value for decision-making is 0.264, which is very weak and shows that there is no internal consistency. Lastly, Cronbach's alpha value is 0.786, which is strong and depicts there to be internal consistency.

Correlation analysis is carried out to test for a significant relationship between the dependent and the independent variables. The range is from 0-1; the closer the value to 1, the stronger the relation and vice versa. However, if the value lies between -1-0, the relation is negative. The Pearson correlation for AI and demand forecast is 0.578, the alpha value is 0.01, and the calculated significance is 0.00, which falls under the rejection region of the graph; the relation between the two is said to be positive and moderate. The Pearson correlation between AI and decision-making is 0.667; the relation is, hence, moderate. The Pearson correlation for AI and product delivery is 0.431, which shows that there is a positive yet weak relation among the variables. The value for demand forecast and decision-making is 0.576; there is a moderate and positive relation. The value for demand forecast and product delivery is 0.192, a positive yet weak relation. The value for decision-making and product delivery is 0.438, a positive yet weak relation.

A regression analysis is done to check the impact of the independent variable (AI) on the dependent variables (Demand forecast, decision-making, and product delivery).

The R^2 value for AI and demand forecast is 0.335; AI has a 33.5% impact on the demand forecast. The R^2 value for AI and decision-making is 0.445; AI has a 44.5% impact on decision-making. The R^2 for AI and product delivery is 0.186; AI has an 18.6% impact on product delivery. The significance is 0.00, and the alpha is 0.005; results reveal that the Alpha came out to be greater than the tabulated significance, and so it lies under the rejection region. Therefore, AI has a prominent impact on decision-making, demand forecasting and product delivery.

The three hypotheses that are to be tested are;

H_1: AI has a notable effect on demand forecast.

H_2: AI has a notable effect on decision-making.

H_3: AI has a notable effect on product delivery.

All hypotheses are accepted based on the findings and results of regression and correlation analysis. The tests show there to be not just internal consistency amongst the variables but also a positive yet significant relationship and a significant impact of the independent variable (AI) on the dependent variables (Decision-making, demand

ISSN (Print): 2790-7848 ISSN (Online): 2790-7856
Volume 1, Issue 2, Page 21-34, December 31, 2021

forecast, product delivery). This proves that textile firms can improve their supply chains by installing artificial intelligence that helps improve demand forecasting capabilities and effective and efficient decision-making as well as product deliveries. The whole process of inventory management, warehousing/storage, logistics, transportation, companywide coordination, and end-to-end visibility across the whole supply chain is enhanced with the incorporation of Artificial intelligence.

Discussions

Regression and correlation analysis were carried out, which further stated that the hypothesis would be accepted, showing there to be an association between the independent and the dependent variables. Therefore, the incorporation of AI can significantly improve the decision-making process, product deliveries, and forecasting in the textile industry. Previous research has shown how those who implemented such advanced IT infrastructure managed to compete and take their business to a global level. Therefore, the findings of this research are supported by previous research, providing consistent evidence of reliability. The literature provides vast evidence of how the different branches of AI– expert systems, neural networks, artificial immune systems, generalized regression neural networks, genetic algorithms, fuzzy logics and other AI tools are used in various areas in textile firms. The installation of the IT infrastructure might be expensive, but the benefit overshadows the cost. Hence, it is viable for those who want to go global to incorporate these tools and systems. This untouched area has been studied and investigated thoroughly in this research. The results of the study reveal that AI has a direct influence on all three dependent variables considered. This study shows how the incorporation of artificial intelligence has a positive effect on the supply chain networks in the textile industry. This study also shows how the incorporation of AI in the supply chain of Pakistan's textile industry, along with its variant, not only helps meet the demand effectively but also helps cut the overall cost. The motive of this research was to analyze the overall impact AI has on the supply chain networks to see which areas of textile firms are still pretty much not using AI and, subsequently, how all of this can be applied in the Pakistani textile industry.

The textile industry of Pakistan is improving every day, but they are yet to make it to global labor; the reason for the delay is the failure to implement these advanced infrastructural tools and artificial intelligence. Through the survey, it was deduced that 78.5% of firms agree with the advantages of AI in the supply chain of the textile industry, in contrast to 76.5% of the firms show a willingness to incorporate it.

Limitation of Research

In order to conduct this research, the study faced some limitations; final-year students did not have enough resources, time, or appropriate tools to collect the data from a considerably larger sample size. The sample size was limited to 100 people working in different textile industries in Pakistan. Due to the ongoing global pandemic, COVID-19, the study could not manage to approach several textile firms. The time frame of this study is that of 2 months.

Conclusion

The tests carried out show how there is a relationship between the dependent and the independent variables, which in turn fulfills the purpose of the research. Though some areas need work, the sample size does not include the whole population. The R square values for demand forecast, decision making and product delivery were 33.5%, 44.6% and 18.6%, respectively. The weak and moderate values are a result of a smaller sample, so future researchers can work on a bigger sample and improve these values. Since the cost of incorporating AI tools is very high, researchers can investigate and study how much a textile firm can benefit from installing such expensive systems. There needs to be empirical evidence for textile firms to see that the benefits extracted from installing AI will exceed the high costs. Many studies have shown the benefits of AI's different tools and branches. This study also focuses on how AI as a whole will benefit the textile industry. Future studies can be done to compare the benefits and performance of different AI tools and techniques. Although this research has studied in detail the effect of AI on decision-making, the topic of decision-making can be studied in more detail by breaking it down into more classes like uncertainties, dynamic features, how optimization helps in complex decision-making, and much more.

With the growing population and changing trends, it has become viable for textile industries to cope with the increasing demand in order to sustain and survive in the competition. In order to meet the demand and compete at a global level, it is viable for companies to enhance their production capacities, improve their overall efficiencies, lower costs, hike up volumes by eliminating errors and mistakes, and improve their supply chain networks. The objective of this research was to establish a relationship between AI and demand forecast, decision making and product delivery, which has been achieved. Four dimensions were made to test the objectives. Firstly, the reliability analysis revealed that all the scale items were interrelated and consistent. Secondly, correlation tests answered the question, "Is there any significant relationship between artificial intelligence, Decision-making, and product delivery?" The study concluded that there is a significant relationship among all the variables. Lastly, regression analysis was done to compare the variables and to see the influence of AI on all the dependent variables. The R^2 values of all coefficients were 33.5%, 44.6% and 18.6%, which means that the independent variable, AI, can only predict these variables to this extent. The remaining void can be improved by running tests on a bigger sample.

References

Berenguer, J. L., Miró i Martínez, P., & Díaz-García, P. (2020). Modeling loop length in weft-knitted fabrics with an interlock structure after the dyeing process with a stitch density, wales and courses per centimeter analysis. *The Journal of The Textile Institute*, *111*(7), 934-940.

Blanchard, D. (2021). *Supply chain management best practices*. John Wiley & Sons.

Bongomin, O., Gilibrays Ocen, G., Oyondi Nganyi, E., Musinguzi, A., & Omara, T. (2020). Exponential disruptive technologies and the required skills of industry 4.0. *Journal of Engineering*,1–17.

ISSN (Print): 2790-7848 ISSN (Online): 2790-7856
Volume 1, Issue 2, Page 21-34, December 31, 2021

Dong, Y., Hou, J., Zhang, N., & Zhang, M. (2020). *Research on how human intelligence, consciousness, and cognitive computing affect the development of artificial intelligence*. Complexity, 1–10.

Gharaei, A., Karimi, M., & Hoseini Shekarabi, S. A. (2020). Joint economic lot-sizing in multi-product multi-level integrated supply chains: Generalized benders decomposition. *International Journal of Systems Science: Operations & Logistics*, 7(4), 309-325.

He, Z., Tran, K. P., Thomassey, S., Zeng, X., Xu, J., & Yi, C. (2021). A deep reinforcement learning-based multi-criteria decision support system for optimizing the textile chemical process. *Computers in Industry*, 125, 103373.

Imran, M., Hameed, W. u., & Haque, A. u. (2018). Influence of Industry 4.0 on the production and service sectors in Pakistan: evidence from textile and logistics industries. *Social Sciences, 7(12)*, 246.

Jelil, R. A. (2018). Review of Artificial Intelligence Applications in Garment Manufacturing. *Artificial Intelligence for Fashion Industry in the Big Data Era*, 97–123.

Nayak, R., & Padhye, R. (2018). Artificial intelligence and its application in the apparel industry. *The Textile Institute Book Series*, 109-138.

Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T., & Gwilt, A. (2020). *The environmental price of fast fashion. Nature Reviews Earth & Environment*, 1(4), 189-200.

Ngai, E., Peng, S., Alexander, P., & Moon, K. K. (2013). Decision support and intelligent systems in the textile and apparel supply chain: An academic review of research articles. *Elsevier*, 81-91.

Raut, V., & Singh, I. (2020). Digital Image Processing Based Automatic Fabric Defect Detection Techniques: A Survey. In *Electronic Systems and Intelligent Computing* (pp. 1029–1038). Springer, Singapore.

S., O., A., S., G., B., P, S., E., N. I., A., G. J., & J., B. (2016). Distributed Computing and Artificial Intelligence. *Advances In Intelligent Systems and Computing*, Sevilla.

Saxena, L. P. (2020). Fibers Image Analysis: A Review of Fibers Processing Techniques.

Tareque, A., Islam, N., & Roy, S. (2020). Increasing Efficiency: Case Study of Ready Made Garments in Bangladesh. *International Journal of Engineering And Computer Science*, 9(6).

Thomassey, S., & Zeng, Z. (2018). *Introduction: Artificial Intelligence for the Fashion Industry in the Big Data Era.* Spain: Springer.

Waheed, M. F., & Khalid, A. M. (2019). Impact of emerging technologies for sustainable fashion, textile and design. *International Conference On Intelligent Human Systems Integration*. San Diego, California: Intelligent human systems integration.

Xu, Y., Thomassey, S., & Zeng, X. (2021). Machine learning-based marker length estimation for garment mass customization. *The International Journal of Advanced Manufacturing Technology, 113*(11), 3361–3376.