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Upgrading Mechanism of Digitization and Intelligence in Supply Chain of E-commerce Enterprises

-- Taking the Case of JD.com

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Abstract

With the development of digital technology and the wide application of intelligent equipment, a new mode with the connotation of "digitization and intelligence" is rising rapidly. It has become an important strategy for enterprises in the future to reform the supply chain with digitization and intelligence. Against this social background, this paper chooses JD.com as the case study. By analyzing action and practice of JD.com in the process of supply chain digital intelligence, and collecting relevant data and information, this paper discusses the method and mechanism of supply chain digital intelligence upgrading of E-commerce enterprises. It is expected to provide some theoretical guidance for other enterprises to upgrade and optimize the supply chain.

Keywords

E-commerce Enterprise; Supply Chain; Digitization and Intelligence.

1. Introduction

1.1. Research Background

The concept of supply chain was put forward in the 1980s, and it was widely developed in the 1920s. Nowadays, more and more enterprises realize the important role of supply chain in the core competitiveness of enterprises, and regard supply chain management as a powerful competitive weapon. Therefore, how to establish a new and efficient supply chain has become an important issue for enterprises to consider. At the fifth plenary session of the 19th Central Committee of the CPC, it was proposed that during the 14th five-year plan period, we should speed up the construction of a new pattern of development in which domestic and international circulation are the main body, and both domestic and international circulation promote each other, and promote the industrial chain and supply chain modernization level, as well as accelerate digital development. Focusing on the optimization of efficiency, quality improvement and service upgrading of digital intelligent supply chain management, has become the new era of industry development of the main vane. It has become an important strategy for enterprises in the future to reform the supply chain with digitization and intelligence and to build new supply chain competitiveness.

1.2. The Meaning of Research

The construction of supply chain system has great significance to the construction of new development pattern. Therefore, the transformation of supply chain digital intelligence, as an important strategic task, can provide a strong support for the construction of new development pattern. The digital intelligence of supply chain can not only shorten the construction cycle of supply chain system, but also reduce project investment, resource occupation, improve manufacturing efficiency, and finally realize lean delivery of finished products. Exploring the

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process and mechanism of digital intelligence of E-commerce supply chain can provide some reference for enterprises to improve their own supply chain structure. Enterprises can more deeply and intuitively understand the importance of digital intelligent in supply chain, examine the problems existing in their own supply chain, and make improvements to establish the core competitiveness of enterprises, for the future survival and development of enterprises to lay a good foundation.

2. Theoretical Basis

2.1. Supply Chain

The concept of supply chain, originated from abroad, has entered China with the development of the distribution of foreign-funded enterprises in China. The supply chain is a very complex net chain module. It covers the entire process from the raw material supplier, the parts supplier, the product manufacturer, the distributor, the retailer to the end user.

At present, the term "Supply chain" has not formed a unified definition. Many scholars have given different definitions from different angles. Although their respective statements are not completely consistent, but everyone believes that the supply chain is a system and the objective existence thing in the human production activity and the social economic activity. The necessities of human production and life have to go through the process, from the initial production of raw materials, parts and components processing, product assembly, distribution, retail to the final consumption. Recycling and returns have been included in recent years. This integrated supply chain system includes the production and consumption of both material and non-material products [1].

The early view was that the supply chain was an internal process in a manufacturing enterprise. With the development of the concept of supply chain, some scholars associate the concept of supply chain with purchasing and supply management to express the relationship with suppliers. Later supply chain concepts paid attention to linkages with other enterprises and the external environment of the supply chain. They see it as a process of converting raw materials into finished products and then into end users through manufacturing, assembly, distribution, and retailing. It's a broader and more systematic concept [2].

2.2. Smart Supply Chain

The concept of "Intelligent supply chain" was first put forward by Luo Gang, a postdoctoral fellow of Fudan University, at the 2009 Shanghai Conference on the integration of informatization and industrialization. It refers to the high-tech IOT technology and modern supply chain management theory, methods and technologies for organic integration of the supply chain system. The system builds digitization, intelligentize, networking and automation among the nodes in the supply chain, and realizes the perfect combination of technology and management. It is the core of constructing intelligent supply chain to connect the fund flow, information flow and logistics in supply chain seamlessly. In this way, the negative influence of asymmetric information on supply chain can be eliminated to the greatest extent, and the operation efficiency of internal and external supply chain can be improved. Compared with traditional supply chain, "Intelligent supply chain" has stronger technology penetration, stronger information integration, stronger collaboration and extensibility. The intelligent supply chain combines the advanced internet of things technology and the theory, Method and technology of modern supply chain management. It realizes the digitalization, networking and intelligentization of the supply chain, and is the inevitable direction of the development and transformation of the supply chain in the future.

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3. A Case Study of JD.com

3.1. Supply Chain Analysis in JD.com

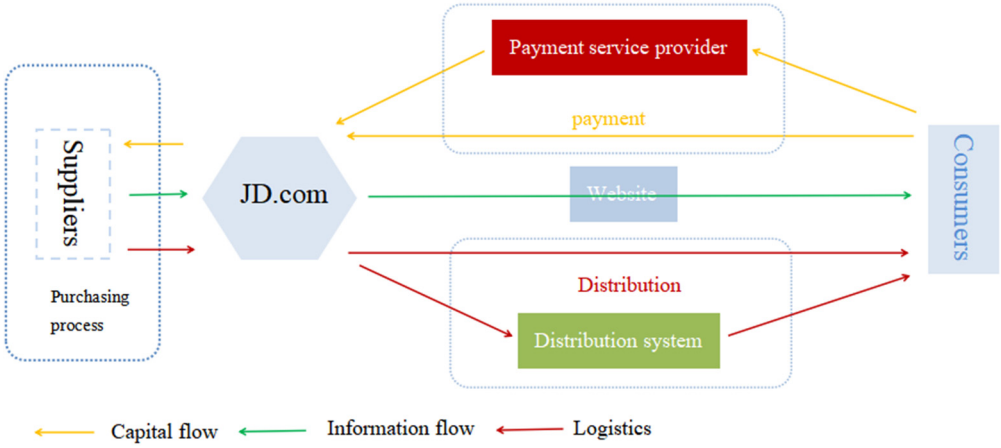

Fig 1. Supply chain framework of JD.com

JD.com is a leading integrated E-commerce company and one of the top 10 internet companies in the world. It has been building its own logistics since its launch in 2004. And it focuses its operations on self-managed commodities and self-built logistics. By developing new technologies and new businesses, JD.com has successfully built a self-built supply chain that includes everything from purchasing, warehousing, logistics, distribution, sales and consumer after sales. JD.com has consistently integrated new technologies such as cloud computing, artificial intelligence, drones and driverless cars into its supply chain since 2012. It has made efforts to upgrade its supply chain with digital intelligence, which has created its own unique competitive advantage and enabled JD.com to gradually move from annual losses to profitability. It officially announced its Smart Supply Chain Strategy in March 2017—Over the next few decades, companies will combine high-tech with supply chains around technology-driven, data-mining, process reengineering and artificial intelligence, form an intelligent supply chain solution including five fields of "Commodity, Price, plan, inventory and coordination", and promote the development of supply chain intelligence, visualization and coordination

3.2. Demand Forecasting

With the help of high and new technologies such as artificial intelligence, big data and cloud computing, JD.com's intelligent demand forecasting system focuses on five core issues: What to sell, how much to sell, how to sell, how much, how much to invest. It can respond quickly and make the right decisions in the face of rapidly changing markets and consumer demand.

First, it uses operations research and artificial intelligence models to select intelligent products and determine the types and prices of products. Compared with the traditional model, the intelligent choice decision platform can evaluate the characteristics and value of products from the perspectives of current trends, market competition situation and product life cycle by using artificial intelligence algorithm, and predict in advance what the customer might buy and at what price, which allows it to select potentially valuable explosives from a vast array of commodities.

Then, it uses intelligent replenishment system to realize automatic replenishment and optimize inventory. When the enterprise produces the demand for supply, automatic replenishment refers to the use of intelligent inventory system to automatically send procurement information to replace the traditional manual labor. According to the lead-time, sales forecast, safety stock, supplier's warehouse support relationship and delivery time, JD.com intelligent replenishment

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system can forecast the sales of goods in the next 28 days, and maintain no less than 90% of the goods spot rate. It can also analyze the impact of price changes on merchandise sales and find the relationship between price factors and product stocks. It will adjust prices and optimize inventory management as market conditions change.

3.3. Realize the Digital Intelligence Upgrade of Logistics

The supply chain management with logistics as the core is the key research content of E-commerce enterprises. Through independent research and development of sorting and distribution system, warehouse control system, warehouse management system and customizing small container, JD.com has improved the efficiency of sporting goods and automated warehouse management. Through big data and cloud computing to get consumer profiles, JD.com forecasts the daily delivery volume of each office building and each community, optimizes the distribution network, improves delivery efficiency, and saves delivery costs. And it uses GIS (Geographic Information System) Information System and innovative collaborative vehicle management System to realize the intelligent planning of transportation path. 211 time-limited and night-time services enable 85 percent of JD.com's own-account orders to be delivered on the same day or the next. Using modern logistics infrastructure such as unmanned vehicles, drones and warehouses, JD.com has automated more than 90 percent of its operations successfully and achieve the goal of intelligent operation. The Big Data Sensing Network and artificial intelligence algorithm can greatly improve the efficiency of logistics, such as more digital logistics and more intelligent decision-making, which achieve a comprehensive intelligent logistics.

3.4. The Whole Visual Supply Chain

Information technology displays supply chain information in a graphic way, which realizes the whole process visualization of supply chain and improves the transparency and controllability of the whole supply chain. The survey showed that an improvement of 5% in requirements visualization could improve order execution by 10%. JD.com uses technologies such as GIS (Geographic Information System), EDI (Electronic data interchange) and RFID (Radio Frequency Identification) to achieve end-to-end supply chain synergy. It also uses intelligent storage management system to improve the efficiency of storage operation and realize the visual management of warehouse. Through the GIS system, customers can also know the order process and status at any time.

4. Research Finds

4.1. The Path of Digital Intelligence in Supply Chain of E-commerce Enterprises

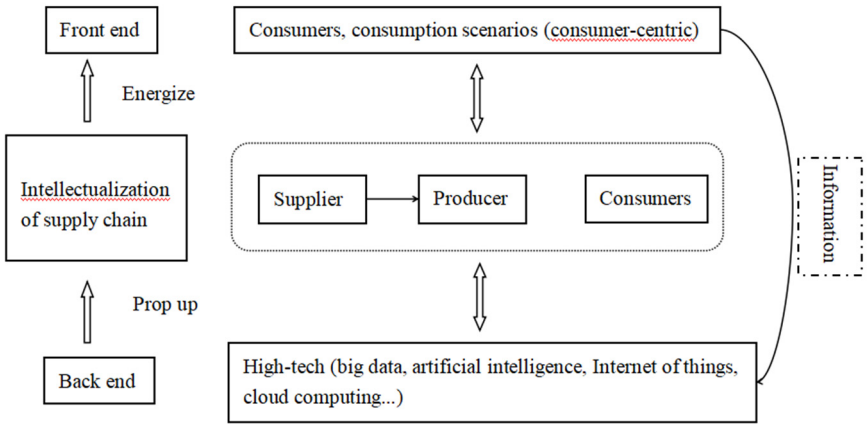

Fig 2. Digital intelligence of supply chain based on high and new technology

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Through analyzing and summarizing the process of JD.com supply chain intelligence, we can see that JD.com is mainly based on a variety of high-tech to support the supply chain of digital intelligence. The entire supply chain is consumer-centric. Therefore, the paper divides the path of supply chain's intellectualization into the following three parts.

4.1.1. Technical Support

In today's social context, big data, the Internet of things, artificial intelligence, cloud computing and other high-tech have laid a solid foundation for the supply chain upgrading of E-commerce enterprises and provided many new development opportunities. But at the same time, it also breaks the boundary between time and space in the original consumption scenarios, which puts forward higher requirements for enterprise supply chain. JD.com's strategy of building a smart supply chain was first proposed in 2017 in response to the fast-changing and increasingly diverse demands of consumers. This strategy is a typical supply chain upgrade strategy to improve the efficiency of the supply chain through the digital and intelligent upgrade. JD.com has succeeded in improving the efficiency of its supply chain logistics by building smart unmanned warehouses and developing technologies such as drones and unmanned vehicles. Therefore, integrating with various high-tech is the only way to drive the transformation and upgrading of supply chain.

4.1.2. Digitalization and Intelligentization of Infrastructure

Under the support of advanced technology, upgrading the infrastructure of enterprise supply chain with digital intelligence can lay a foundation for supply chain. Upgrade is mainly divided into two aspects of information flow and logistics. In terms of information flow, JD.com has made it possible to share business information on the web in real time by building online information platforms and upgrading business processes intelligently, which improves the efficiency of information flow in supply chain. In terms of logistics, in order to shorten the time from ordering to receiving, JD.com has built an intelligent logistics base to reduce the error rate of warehouse sorting and improve the efficiency of logistics distribution.

4.1.3. Digitalization and Intelligentization of Supply Chain

Under the support of high and new technology, the supply chain service ability of enterprises has been greatly strengthened. The most obvious performance is that the management efficiency of logistics and information flow has been improved. In the aspect of logistics, the improvement of supply chain capability can be divided into three stages. The first is a quick response to demand. In this case, JD.com has improved the timeliness of logistics delivery by introducing a time-limited delivery service, which can respond quickly to customer needs. The second is to provide alternative logistics services. Enterprise information system through the order logistics for high-precision matching, launched the night delivery and timing services. The third is supply chain visualization. According to the collaborative data in the system network, the whole process of logistics can be traced and the whole process of supply chain service can be provided to those who need it. In the layer of information flow, the integration of data resources is realized mainly through the intellectualization of infrastructure. JD.com is building an open platform for smart supply chains to enable end-to-end information sharing and deepen supply chain collaboration.

4.2. Digital Intelligence Mechanism of E-commerce Enterprise Supply Chain

Through the analysis of the case and the combination of existing information, this paper constructs the theoretical framework of digital intelligence of E-commerce enterprise supply chain. As shown in the image below:

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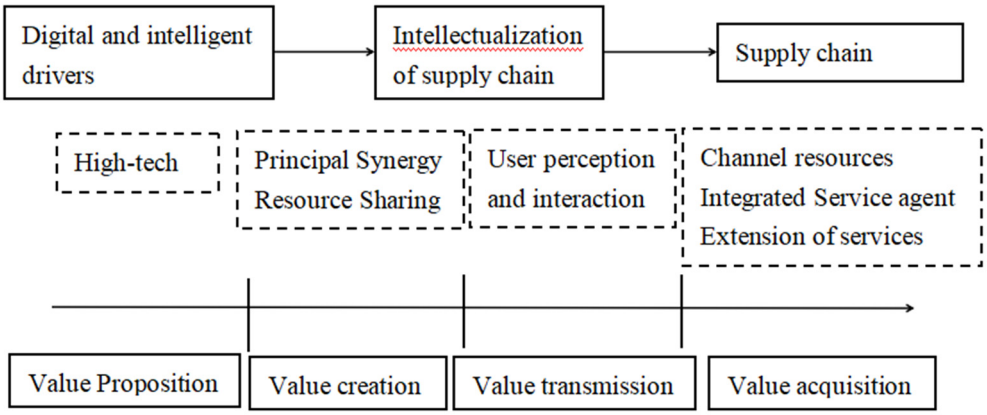

Fig 3. Theoretical framework of supply chain digital intelligence

Based on this, the paper analyzes the process of E-commerce enterprise's supply chain intellectualization, and refines the upgrade mechanism of E-commerce enterprise's supply chain intellectualization as follows:

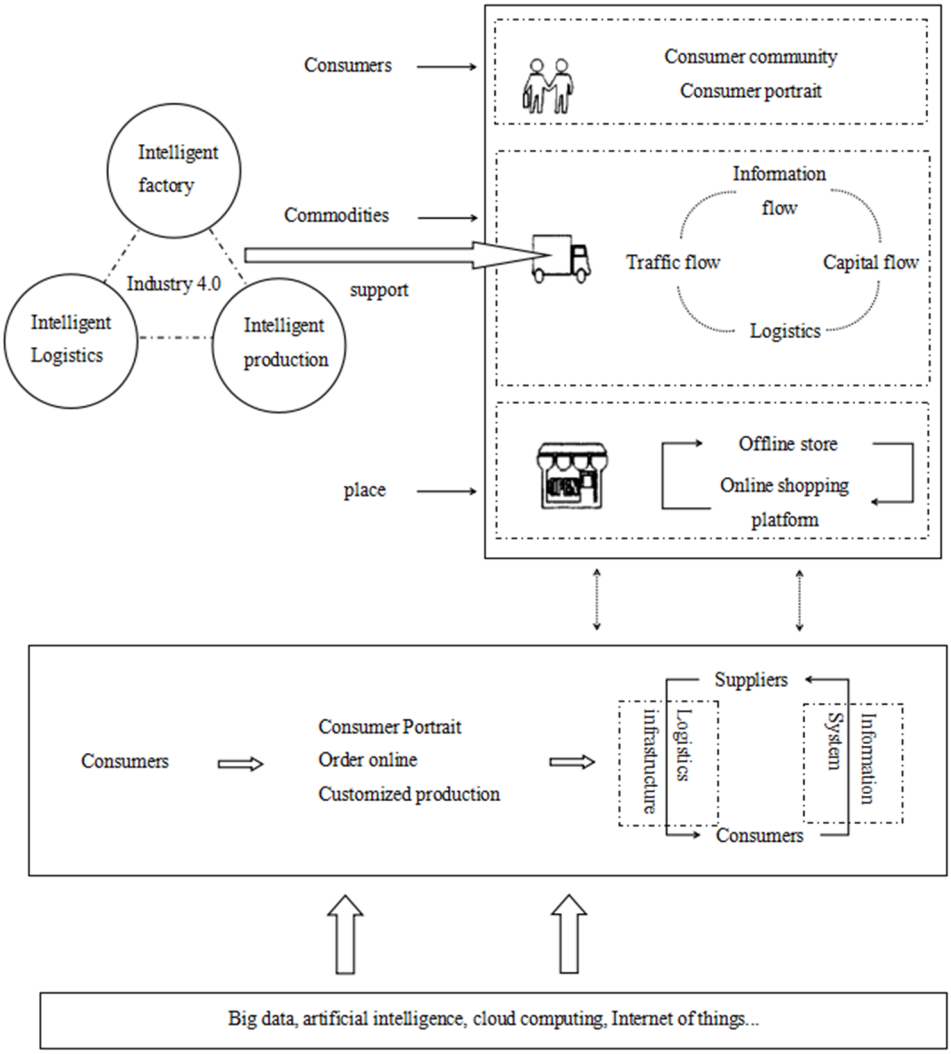

Fig 4. Digital intelligence upgrading mechanism of supply chain

Among them, the most important is customer portrait and the construction of intelligent supply chain.

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4.2.1. Demand Forecasting: Customer Profiling

American scholars Jeff Zabin and Gresh Brebach (2004) said, "In order to improve and promote the achievement of marketing performance objectives, it is necessary to provide the target customers with some services or information to influence their purchase intention and decision-making." [3] It's called Precision Marketing. In order to achieve the goal of accurate marketing, the first condition is to predict the customer demand correctly. And E-commerce itself has accumulated a large amount of data, which makes them in the forecast has a natural advantage.

Through the summary and the analysis, I thought that the enterprise to the customer demand forecast should divide into the following several links: First, enterprises need to collect all kinds of customer information to set up customer database management system. By building a model to analyze the data in the system, the customer portrait is formed and the consumer group is subdivided according to the portrait. Second, according to the information analyzed by the data system, the enterprises select and price intelligently, and formulate the corresponding marketing plan. In the implementation of the program, enterprises also need to evaluate the marketing effectiveness, and cost effectiveness. Third, through the evaluation results and customer feedback content, the enterprise needs to modify the customer portrait in time, and further segmentation of consumer groups, so as to develop more realistic sales strategy. Through the continuous cycle of the above steps, the enterprise can achieve the goal of subdividing the customer demand and providing precise service. Through online network platform, E-commerce enterprises collect and analyze customer consumption data, which ensures the reliability and real-time of the data. With big data and the Internet of things, companies can collect global data that capture the full picture of consumers today, avoiding the biases of sampling surveys in traditional data collection. To ensure accuracy, the client's portrait must include the following aspects: First, feature analysis. It mainly includes some basic information of customers, such as gender, education, occupation, region and so on. After collecting these natural attribute data of these customers, the enterprise can send the aid of cloud computing to carry on preliminary classification to the customer. Second, consumer tendency analysis. Although consumer demand in today's market is changing rapidly, these changes are not sudden and unwarranted. Consumers'propensity to consume is usually fixed in a short period of time. Therefore, the analysis of consumer propensity to consume can help enterprises find potential customers and business opportunities in time. Third, consumer behavior analysis. The consumption behavior mainly refers to the customer's consumption goal, consumption frequency, consumption ability and so on. These data play a great role in guidance to business to identify key customers and the main profit point. In the concrete application, in order to get the customer portrait, we first need to establish the analysis model with the complete data algorithm and criterion on the basis of the data system. Then in the follow-up, through machine learning, we update the iteration and optimize the analysis results. After the successful establishment of the algorithmic model, companies also need to combine the offline scene of the data on the portrait for proofreading and supplement deficiencies, so that the portraits of the customers are in line with the actual situation.

Through customer portraits, E-commerce enterprises can obtain different types of customer demand conditions, which also provides a basis for E-commerce enterprises to use on-demand customized sales strategy. The core idea of on-demand customization is differentiation, which can provide different services according to the different demands of customers. It can not only improve customer satisfaction, but also form its own unique competitive advantage.

4.2.2. Construction of Intelligent Supply Chain

The most important link in the intelligent supply chain is to realize the visualization of the supply chain. To visualize the supply chain, E-commerce companies must learn to take full

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advantage of the Internet of things. In the manufacturing process, EPC (Electronic Product Code) is used to solve the problem of identifying and tracking individual products. Through EPC technology, enterprises can track the items they need in real time. The technology avoids the shortcomings of high error rate, low efficiency and high cost. It also improves the efficiency of the whole supply chain, and realizes just-in-time production. In addition, EPC technology can also be based on intelligent system to achieve self-replenishment, to avoid out of stock or excess raw materials lead to waste of enterprise resources.

In the warehousing link, when goods affixed with EPC label, RFID reader can automatically scan the label, complete inventory, and merchandise data into the central database of the total control system. Any subject with demand in the supply chain can query the goods information through the central database. It realizes the information sharing. In addition, the intelligent storage system can design the best combination of goods placement through calculation. This can not only improve the space utilization rate of the warehouse, but also obtain the inventory information of the goods in real time, and reduce the inventory cost. At the same time, the system can ensure that the sourcing circumstances, and reduce the loss caused by distribution errors.

In the transportation link, because the product carries the RFID tag, anyone in need can inquire about the shipping status of the products at any time. Even after loading, both the shipper and the receiver can query the logistics information of the product at any time. By tracking the products in transit, the shipper can receive the signal at the first time of the accident and take measures to minimize the possible loss. Through inquiring the transportation of the products in the system, the consignee can prepare for receiving goods in advance. They also can confirm whether the product is damaged by external force after leaving the factory, and improve the efficiency of product acceptance.

Reasonable inventory planning is also an important part of the construction of intelligent supply chain. E-commerce companies can use digital tools and artificial intelligence to make a reasonable inventory plan. Under the transparent and visible collaborative network of the whole supply chain, E-commerce enterprises can make the most suitable inventory decision in time according to the inventory information given by the system. Enterprises can improve the turnover rate of inventory management by introducing an inventory management system, such as ERP (Enterprise Resource Planning), which is in line with their own scale. And the inventory management system can also combine inventory data and sales data, timely detection of unsalable goods, and accurate prediction of future sales. Through the rational use of artificial intelligence technology, such as the use of intelligent sorting robot, enterprises should establish unmanned automated warehouse as soon as possible, in order to improve the accuracy and speed of sorting, while reducing labor costs.

5. Research Perspectives

In this paper, JD.com is selected as a case study to analyze the process of supply chain digital intelligence and extract the path and mechanism of E-commerce enterprise supply chain digital intelligence. However, due to the limitations of research conditions and other aspects, the research still has many shortcomings. Future research can explore and improve the following aspects:

(1) The number of selected cases and the scope of the study could be further expanded. In the case analysis of this paper, due to the constraints, only a typical E-commerce enterprises are selected for the study. So, the generality of the conclusions may appear errors. Future research can further expand the scope of the case study and improve the generality and credibility of the findings.

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(2) Explore other aspects of the supply chain. This paper only studies the transformation, upgrade and construction path of digital intelligence supply chain of E-commerce enterprises. The intelligent transformation and upgrade of traditional supply chain, the change of supply chain under the green economy, the agile supply chain, the Internet of things supply chain and so on are not studied deeply. The future research can study other aspects of digital intelligence upgrading of enterprise supply chain.

(3) The research conclusion of this paper has certain timeliness. As the conclusion of this paper is from the JD.com in recent years of enterprise information and data analysis, the conclusion of the study has time-limited and certain limitations. The later research needs to adjust and correct the out-of-date content according to the change of the development background.

6. Conclusion

Supply chain management is an important foundation and guarantee for enterprises to improve inventory turnover efficiency, reduce commodity circulation cost and operational risk, and ensure user experience. Under the background of the new era, enterprises must carry on the transformation and upgrading of supply chain.

Under the active exploration of JD.com, Amazon, IBM and other pioneers, the value of intelligent supply chain in promoting information sharing in every link of supply chain, improving enterprise's risk control ability and realizing visualization of supply chain process has been fully embodied. They have produced the good demonstration effect in the global scope. It has become a mainstream trend for enterprises to promote the transformation and upgrading of supply chain management by building intelligent supply chain.

In the new consumer-led era, all enterprises need to return to meet the needs of users and create value for users of the business nature. In the consumer upgrade driven, user needs become more personalized, diversified, and in a dynamic change. The traditional supply chain management mode has many links and emphasizes ex-post control, which will lead to supply and demand dislocation. On the one hand, there is a serious overcapacity problem in various industries. Enterprises fight price wars in order to sell products. On the other hand, the majority of consumers cannot buy goods that really suit their own. Therefore, they will look to the overseas high-quality brand goods. Smart supply chains that emphasize flexibility and agility can effectively solve this problem. By constructing agile supply chain, enterprises can respond to the dynamic market demand in real time. The agile supply chain model emphasizes that enterprises should carry out process transformation by optimizing management structure. It can also build information systems that achieve a high degree of integration and sharing of information, thus giving enterprises the ability to respond quickly and handle customer orders. This can streamline the circulation of products, significantly reduce operating costs, and bring the ultimate shopping experience for customers.

In the digital age, the important value of big data has been fully reflected. Its role in smart supply chain management is also critical. The big data supply chain can reconstruct the supply chain management system and integrate the internal and external data resources. Through data analysis, it makes accurate prediction of market change and customer demand, improves the decision-making ability of enterprises, opens up all links of the supply chain, and realizes multi-party cooperation.

The Internet of things provides a powerful support for building an intelligent supply chain. Its significance is not only reflected in the technical level, but also has brought a major change to the enterprise supply chain management mode of thinking. In the manufacturing process, for example, manufacturers embed electronic tags into raw materials, parts, semi-finished products and finished products, and use RFID technology to scan and identify them, which can

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realize the real-time monitoring and tracking of the production process. It also enables the enterprise to build an automated, visual, flexible product line.

However, the lag of cognition greatly limits the layout of enterprises in building intelligent supply chain. Blindly promoting the construction of intelligent supply chain not only has little effect, but also brings many problems such as waste of resources, break of capital chain and brain drain. Building a smart supply chain is not simply about introducing new technology, nor is it likely that blindly following the trend will actually solve the problem. It needs enterprises to make all-round adjustment from organization structure, business process, management mode and so on, and take the user demand as the guide, so as to find the proper path of intelligent supply chain.

At a time when crossover and subversion have become the norm, the market competition is no longer a simple enterprise competition, but an ecosystem war based on supply chain. All enterprises need to strengthen their own supply chain management capabilities, actively build intelligent supply chain, and strengthen cooperation and exchange between upstream and downstream enterprises. Through multi-party cooperation with the lowest cost, the highest efficiency to fully meet consumer's personalized needs, that's how enterprises bring the ultimate shopping experience to the consumer. By creating more value for users, companies want to ensure that they can stand out from the fierce competition in the market.

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