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Emerging technological trends in supply chain management: A trend analysis based on the fresh connection simulation.

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ABSTRACT

This paper explores emerging technological trends in supply chain management and evaluates their potential applications within *The Fresh Connection* simulation. As supply chains evolve in response to digital transformation, innovations such as the Internet of Things (IoT), Big Data Analytics (BDA), Artificial Intelligence (AI), and Blockchain have become critical tools for enhancing efficiency, transparency, and strategic decision-making. Drawing from recent literature and simulation insights, this study identifies how these technologies can be leveraged to improve operational performance in virtual supply chain environments. The analysis highlights the benefits and limitations of each technology, with specific recommendations for integrating them into *The Fresh Connection*. Although implementation challenges such as cost remain, the findings underscore the importance of embracing innovation to maintain competitiveness in a rapidly changing global logistics landscape.

Background

It is a fact that innovation is crucial to supply chain management. These innovations have been helping us for years. A hundred years ago, shipment and order was an issue for every person on planet Earth as the speed and accessibility of information were scarce. Nowadays, customers can just simply click and scroll on a specific website, or simply check their mailbox in order to be informed about their current shipment. The supply chain has had an enormous development since the moment humanity invented the Internet, and quickly after, IoT, Tracking System, etc. (Pagano & Liotine, 2019). On the second hand, the production line workers also witnessed a huge leap in their workload: first is the machinery line with the whole automated process, and then the simplification of their document handling. Technology has put its hand in every aspect of the logistics section.

The topic that I had chosen for the individual paper is technology trends in the supply chain. The main reason for selecting this particular subject is my enthusiasm for automation, machinery, and robotics. Since I was a child, I have always been eager to look for innovations. By observing how the world has changed in my daily life, I think that innovations are improving our living standard step by step, from the entertainment industry to international businesses. Supply Chain

Management is not an exception. By utilizing these advancements, humanity can greatly enhance the supply chain, simplify the process, and create more ROI (return on investment).

Methodology:

The main methodology is desk research, which summarizes findings from trustable sources. I used Google Scholar and HAN Quest to find the sources, with five main keywords: Logistics, Supply Chain Management, Technology, Trends, Applications.

In this individual paper, the ultimate goal is to indicate current logistics' trends and discuss how could it benefits The Fresh Connection simulation. The data from this report is retrieved and analyzed by reviewing articles to indicate rising technologies in Supply Chain Management. Furthermore, I will consider which trend could be applied to The Fresh Connection game and proceed to discuss them.

Literature Review

Overview of current technology trends in Supply Chain Management.

It is advisable that corporations and logistics service providers should remain updated with the current waves of technological innovation (Angeleanu, n.d.). By tracking and following the world's trends in the supply chain industry, companies should achieve benefits such as reducing operating costs, enhancing process efficiency, utilizing assets, and gaining competitive advantage while outperforming competitors. (Speranza, 2016) emphasized the importance of operational research as the author considers the economic pressures on companies' efficiency and effectiveness. Below, I will proceed to analyze the current logistics' trends and select the potential applications for The Fresh Connection.

There are 4 megatrends listed in the lecture notes *Next Generation Supply Chain* (Fornasiero, Sardesai, Barros, & Matopoulos, 2021), which are: Digital transformation, Technology development and automatization, Electrification of transport, and Renewable energy sources. The writers forecast the future of this industry with a PESTLE analysis by conducting a systematic literature review from November 2017 to January 2018. Meanwhile, (Pagano & Liotine, 2019) categorized technologies in Supply Chain Management into 4 sections: Maturing Technologies, Growth Technologies, Emerging Technologies, and Exponential Technologies. The authors mentions 17 innovations which are:

- Maturing Technologies: Optimization Software; Sensors/telematics; Cloud computing; Data warehouse and integration; Automated storage and retrieval.
- Growth Technologies: Mobility; Wearability; Data analytics; Social media.
- Emerging Technologies: 3D Printing; Drones; Autonomous vehicles.
- Exponential Technologies: Blockchain; IOT; Virtual reality; Machine learning.

It is mentioned that these technologies were found to have a promising role for the future of the supply chain and logistics landscape. By reviewing this article, we can have a clear vision of the current states of these technologies, and implications of the innovations' readiness for applying to the industry.

Furthermore, an analysis of the technology trends' impact on freight transportation, (Dong, Akram, Andersson, Arnäs, & Stefansson, 2021) reveals 9 technologies' key characteristics of the current findings. These innovations and traits are:

- 3D printing: Main actors are shippers on a global scale, while most studies are theoretical and lack of statistical validations.
- Automated robots: Main actors are operators and shippers in locations such as warehouses, ports, etc. Outside these locations, most studies are theoretical.
- Autonomous vehicles: The main geographic scope are cities with various actors. Most studies are theoretical.
- Drones: Main actors are authorities and operators, with the city logistics as the geographic aim. The drawback of this technology is expensiveness; however, it can be used to deliver urgent items to remote locations.
- Artificial Intelligence: The technology is mainly conducted by authorities and IT service providers in urban areas. It is successfully applied with various theoretical analysis.
- Big data analytics: The technology has diverse actors and research topics, which mainly applied in routing, maintenance, and predictions. It has mature empirical applications.
- Internet of Things: With multiple purposes and geographical scale, the technology is widely applied in transportation.
- Blockchain: Mainly conducted by shippers with no geographical scope, the innovation requires much theoretical work. It can be combined with supply chain management.
- Electric vehicles: Mostly available in city deliveries in small vehicles. Although it is greener, electric vehicles have higher cost and require promotion and support from all authorities.

In 9 innovations analyzed by (Dong, Akram, Andersson, Arnäs, & Stefansson, 2021), Big Data Analytics (BDA), Artificial Intelligence (AI), Blockchain, and Internet of Things (IoT) are rated as four significant emerging technologies. However, the authors indicates that even though AI is useful when solving difficult issues, the machine seems like a "black box" to researchers as its perspective is hard to comprehend and requires further analysis in the future. Big Data Analytic is beneficial as precious statistics is retrieved from information and helps new models, algorithms, and applications. IoT is based on the radio-frequency identification (RFID) tags to build the dataset. Despite of the ability to track real-time transportation movements, the technology is facing a cost barrier, which prevents it to be adapted in commercial usage. Last but not least, blockchain is considered as a trustworthy solution for users' data security, and open up a new opportunity for decentralized trust, which is crucial to the transportation sector as the supply chain often involves multiple partners across the globe.

Analysis of selected technology trends for The Fresh Connection

In this part, I will further my literature reviews with the investigations of 3 main technologies: IoT, BDA, AI, and Blockchain. These innovations are categorized as exponential trends by (Pagano

& Liotine, 2019) and indicated as significant emerging technologies by (Dong, Akram, Andersson, Arnäs, & Stefansson, 2021). As the Fresh Connection company does not have their own delivery and outsource the transportation to a reliable partner, I will only analyze the megatrend Digital Transformation.

IoT and Big data analytics:

IoT: According to (Sun, 2012), IoT can have various impacts on the supply chain: utilizing the supply chain management, enhancing the chain's effectiveness and efficiency, improving the logistics' transparency, and controlling the system in real-time. The author explains the system as a computerized recognition method by using RFID tags or RFID transporters to obtain and store data. It benefits companies as it provides more real-time accurate information of inventory systems than data retrieved by conventional method. The technology reduces labor costs by simplifying the business's processes and preventing errors. Furthermore, the second generation of IoT integrates with RFID to manage products while anti-counterfeiting them, enhancing the management of supply chains.

This technology can be applied in the Fresh Connection company to minimize the risks arise from wrong managerial decisions. However, it is mentioned by (Dong, Akram, Andersson, Arnäs, & Stefansson, 2021) that the RFID tags' high cost is still an issue when implementing this technology advancement in commercial use.

Big data analytics: By analyzing 13 articles, (Wamba, Gunasekaran, Papadopoulos, & Ngai, 2018) have concluded that BDA is a potential topic which can be implemented by academic and management practitioners. With the availability of not only data generated from traditional equipment such as POD, RFID, and GPS but also information retrieved from digital clickstreams, camera, and surveillance footages. The author indicates that the supply chain is being assisted by a vast network of technologies to acquire data on a real-time basis, enhancing the visibility of the end-to-end logistics chain. (Fornasiero, Sardesai, Barros, & Matopoulos, 2021) points out that companies in the pharmaceutical industry have already been utilizing this technology for detecting demand spikes, stocks, and delivery resources beforehand. The trend is mentioned suitable to be applied for route optimization and real-time tracking resources.

With the power to minimize forecast errors (Wamba, Gunasekaran, Papadopoulos, & Ngai, 2018), BDA can benefit the company if combined with the RFID tags and the IoT innovation. The implements of these technologies will greatly enhance the prediction and management of pallet locations for The Fresh Connection, which is a promising prospect for the company to utilize their operating process in the future.

Artificial Intelligence (AI):

(Toorajipour, Sohrabpour, Nazarpour, Oghazi, & Fischl, 2021) describe AI in the logistics industry as a system which generates better outputs when problem-solving with higher accuracy, higher speed, and a capability to process more input information. The technology is defined as an emerging competitive advantage for enterprises in the supply chain management industry, and many companies are switching from remote monitoring to an AI-based system which gives access to more control, optimization, and functionality. By systematically reviewed 64 research articles, the authors conclude that 3 AI techniques which are being used widely in the supply chain industry can be Artificial Neural Networks (ANNs), Fuzzy Logic (FL), and Urgent-based System/ Multi-agent System (ABS/ MAS). ANNs is considered as the most prevalent technique, which are mainly used for finding complex patterns, approximation, classification, optimization, etc. The second position belongs to FL technique which used as a modelling tool and creating hybrid AI systems. Last but

not least, the ABS/ MAS technique has numerous applications in SCM, which is being processed to solve problems in supply chain planning, design, and stimulation of supply chain systems, etc.

The article recommends that further research and applications of AI is required for the development of the SCM industry, and it is promising about the future of this technology for utilizing our supply chain. (Toorajipour, Sohrabpour, Nazarpour, Oghazi, & Fischl, 2021) mentions that with the AI tools, operations will be transformed from reactive to proactive, manual to autonomous, standardized services to personalized, and forecasting to prediction. Computer chips to track transportation information, data analyzed and utilized by innovated tools, these technologies are all beneficial to the four Vice Presidents of The Fresh Connection.

Blockchain:

Supply Chain Management is considered as the most promising non-finance applications for blockchain technology, according to (Gurtu & Johny, 2019). The technology reduces the paperwork and enhances the speed of tracking items and transactions by approximately 85 percent when combined with IoT technology, skipping administrative and logistics timeline in transportation. (Tijan, Aksentijević, Ivanić, & Jardas, 2019) explains that the technology's system is transparent as each action is captured in one block, and the data is transmitted via many nodes (computers). The authors mentioned that the system would then be decentralized as the network is totally run by its members, without relying on any central third-side contract. The data stored is verified by individuals, and every transaction required to be recorded in all member's device. In the article, four main benefits are described:

- Easier to process paperwork: Shipping companies using the technology can easily upload and share their document instantly and securely. For example, rose delivery from Kenya to the Netherlands consumed 25-centimeters high pile paperwork would be deleted by blockchain (Gurtu & Johny, 2019).
- Detect counterfeit products: Replica products in the pharmacy supply chain is an issue. However, with the transparency of the system, the problem will be solved.
- Facilitate origin tracking: This is a huge step for the food industry as the foodborne outbreak is a problem for suppliers. With the system customers will be able to acquire the origin of their products immediately.
- Operate the IoT: The data of IoT requires to be stored in an immutable, accessible way (Tijan, Aksentijević, Ivanić, & Jardas, 2019). Logistics objects will be shipped with sensors that generate data along the journey.

The application of this technology for The Fresh Connection is promising as big players like Walmart and Nestle has already using it to provide digital trace of authenticate food products from suppliers to consumers (Tijan, Aksentijević, Ivanić, & Jardas, 2019). This means with the help of blockchain, The Fresh Connection can deliver a safe, sustainable, and transparent products to their customers. Reducing paperwork, independent from a third-party contractor, enhance the tracking systems, these are some improvements that the company will benefit from the application of blockchain technology.

Discussion and recommendation

The individual paper considers trends in supply chain management and proceed to pick suitable innovations which could be used by The Fresh Connection in the company's growth. According to (Fornasiero, Sardesai, Barros, & Matopoulos, 2021), there are 4 megatrends happening on the world at the moment: Digital transformation, Technology development and automatization, Electrification of transport, and Renewable energy sources, and these technologies can be categorized by their growth: Maturing Technologies, Growth Technologies, Emerging Technologies, and Exponential Technologies (Pagano & Liotine, 2019). Meanwhile, (Dong, Akram, Andersson, Arnäs, & Stefansson, 2021) analyzes 9 key trends and estimate its characteristics. From the key trends, I proceed to consider the applicable innovations for The Fresh Connection, which are: Internet of Things and Big Data Analysis, Artificial Intelligence, and Blockchain. After analyzing the benefits of these promising innovations, I have come to recommendations and solutions for the game TFC:

- Build an IoT database and implement RFID/GPS/POD tags for traceable transportation of product. This can lead to higher cost; however, the technology can enhance the delivery system and combine with the storage management system of the company.
- Adapt AI tools to transform the operational system, in particular, the ANNs system. The tool is likely to solve complex problems and support the managers in stock forecasting and managing, and it also able to synchronize with the company's database. The AI tool will reduce the workload for the Supply Chain Management Department with its calculations.
- Join the blockchain network. This can enhance the transparency of the company's supply chain and reduce paperwork. While enhancing the IoT network of the company, the technology also help our Operation and Purchasing Department to make decision for a cleaner, more sustainable final product to the customer.

Conclusion

To conclude, there are many technology innovations which bring benefit and competitive advantage to the supply chain management industry. By analyzing these trends, I realized that it is important for enterprises to understand and develop their company based on the world's current technology advancements. These machineries are not only assisting the Vice Presidents in making managing decision but also reducing the operational cost, improving effectiveness and efficiency, and outperforming the competitors. As a player in the Operation Department, I acknowledge and value the affect of these trends, and eager to implement them into the company's supply chain. However, the high expenses of these devices are still a problem that need to be taken into consideration. The paper's recommendations are optional, as the boxes in the game TFC, and the decisions are up to the next player of the simulator.

Reference List

Angeleanu, A. (n.d.). New Technology Trends And Their Transformative Impact

On Logistics and Supply Chain Processes. *Conference.ase.ro website: https://www.conference.ase.ro/*, 328. From https://conference.ase.ro/pdf/44.pdf

Dong, C., Akram, A., Andersson, D., Arnäs, P.-O., & Stefansson, G. (2021, January 12). The impact of emerging and disruptive technologies on freight transportation in the digital era: current state and future trends. *Emerald Insight Journal*. From https://www-1emerald-1com- 1u6qzer1a1be0.stcproxy.han.nl/insight/content/doi/10.1108/IJLM-01-2020-0043/full/pdf?title=the-impact-of-emerging-and-disruptive-technologies-on-freight-transportation-in-the-digital-era-current-state-and-future-trends

Fornasiero, R., Sardesai, S., Barros, A. C., & Matopoulos, A. (2021). Next Generation Supply Chains - A roadmap for Research and Innovation. *Lecture Notes in Management and Industrial*, 9. Retrieved from https://library.oapen.org/bitstream/handle/20.500.12657/46112/2021_Book_NextGenerationSupp lyChains.pdf;jsessionid=B93EC0FD3B22B060C214DE139F08FC36?sequence=1

Giaglis, G., Tatarakis, I. M., & Zeimpekis, V. (2004, April). Minimizing logistics risk through real-time vehicle routing and mobile technologies. *Emerald Insight Journal* . From https://www-1emerald- 1com-1u6qzer1a1a4e.stcproxy.han.nl/insight/content/doi/10.1108/09600030410567504/full/pdf?title=minimizing-logistics-risk-through-realtime-vehicle-routing-and-mobile-technologies-research-to- date-and-future-trends

Gurtu, A., & Johny, J. (2019, July 10). Potential of blockchain technology in supply chain management: A literature review. *Emerald Insight Journal*. From https://www-1emerald-1com- 1u6qzer1a1a4c.stcproxy.han.nl/insight/content/doi/10.1108/IJPDLM-11-2018-0371/full/pdf?title=potential-of-blockchain-technology-in-supply-chain-management-a-literature- review

Pagano, A. M., & Liotine, M. (2019). *Technology in Supply Chain Management and Logistics: Current Practice and Future Applications.* From https://books.google.nl/books?id=OASuDwAAQBAJ&dq=logistics+trends+technology&lr=&so urce=gbs_navlinks_s

Speranza, M. G. (2016, August 17). Trends in transportation and logistics. *European Journal of Operational Research*, 832-835. From https://pdf.sciencedirectassets.com/271700/1-s2.0-S0377221717X00192/1-s2.0-S0377221716306713/main.pdf?X-Amz-Security Token=IQoJb3JpZ2luX2VjEG0aCXVzLWVhc3QtMSJGMEQCIEDcZ3xVBwH2uf%2BgRiJIos qJlM4wfFVs7QXC5U2n2AGaAiAKComwukCcbSUH1bHHXl18TLWFFl2IS8PZtGyahEMQKS

Sun, C. (2012, August 23). Application of RFID Technology for Logistics on Internet of Things. *Science Direct*. From https://www.sciencedirect.com/science/article/pii/S2212671612000200

Tijan, E., Aksentijević, S., Ivanić, K., & Jardas, M. (2019, February 23). Blockchain Technology Implementation in Logistics. *Multidisciplinary Digital Publishing Institute Journal*. From https://www.mdpi.com/2071-1050/11/4/1185/htm

Toorajipour, R., Sohrabpour, V., Nazarpour, A., Oghazi, P., & Fischl, M. (2021, January). Artificial intelligence in supply chain management: A systematic literature review. *Journal of Business Research, 122*, 502-517. From https://www.sciencedirect.com/science/article/pii/S014829632030583X?via%3Dihub

Wamba, S. F., Gunasekaran, A., Papadopoulos, T., & Ngai, E. (2018, May 14). Big data analytics in logistics and supply chain management. *The International Journal of Logistics*

Management. From https://www.emerald.com/insight/content/doi/10.1108/IJLM-02-2018-0026/full/html