A Perfect Triangle with: Artificial Intelligence, Supply Chain Management, and Financial Technology

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ABSTRACT

In recent years, artificial intelligence has seen increasing interest and popularity in the financial services and the other areas like supply chain management. Since the late 1970s, artificial intelligence has been developed to improve human decision-making processes and productivity in businesses, due to the ability to understand patterns and businesses phenomena, to search and analyze information and automating tasks repeatedly by humans. According to Tungsten Network, that valuable time and money are wasted on trivial supply chain related-tasks that are conducted operationally by humans. So, a business could automate some tasks to reduce wasting time with the robotic process, and machine learning algorithms are being integrated into analytics and CRM platforms to uncover information on how to better serve customers. In addition to using artificial intelligence in the supply chain, its presence in financial technology can be noted, including advanced machine learning software and expert systems that are capable of learning and performing intelligent analysis, as well as the automation of some business processes in financial. Meanwhile, given the focus on supply chain finance, which includes solutions for suppliers, manufacturers, vendors, and customers that improve financial processes in the supply chain, the industry is moving toward a revolution and a massive transformation in this approach. This paper gives an overview of artificial intelligence and the application areas of this technology and the current use in financial technology and supply chain management. This paper will also explore the benefits using Artificial Intelligence technologies in the Financial Technology and Supply Chain Management businesses.

Keywords: Artificial Intelligence; Application of Artificial Intelligence; Supply Chain Management; FinTech; Financial Technology.

INTRODUCTION

Using various methodologies of artificial intelligence can be used to solve complex problems such as: searching for information, supply chain management, changing customer demand that creates uncertainty in the whole supply chain. Also, the use of artificial intelligence is increasing for companies active in financial services because they are no longer worried about analyzing larger volumes of their system important information. In the meantime, the use of a financial instrument, practices, and technologies to optimize the management of the working capital and liquidity tied up in the supply chain process for collaborating business partners [1].

Now, with the presence of artificial intelligence on one side, financial technologies and the supply chain on the other side of this perfect triangle, it can be thought that their application in a process from start to finish can be important and lucrative for the businesses.

Here's a quick overview of the concept of artificial intelligence, financial technologies, and supply chain management, and then focused on the main subject of the applications of these three sides of the triangle in each other.

Artificial intelligence

According to Russel and Norvig [2], Artificial Intelligence is the intelligence of machines and software, a branch of computer science designed to create this intelligence. Artificial intelligence is trying to understand intelligent entities. Table 1 below shows several definitions of Artificial Intelligence provided by Russel and Norving [2].

Table 1. Definitions of Artificial Intelligence

Thinking Humanly	Thinking Rationally
"The exciting new effort to make computers think... machines with minds, in the full and literal sense." (Haugeland, 1978)	"The study of mental faculties through the use of computational models." (Charniak, MC Dermott, 1985)
"[The automation of] activities that we associate with human thinking, activities such as decision-making, problem-solving, learning..." (Bellman, 1978)	"The study of the computations that make it possible to perceive, reason, and act." (Winston, 1992)
Acting Humanly	**Acting Rationally**
"The art of creating machines that perform functions that require intelligence when performed by people." (Kurzweil, 1991)	"Computational Intelligence is the study of the design of intelligence agents." (Schalkoff, 1990)
"The study of how to make computers do things at the witch, at the moment, people are better." (Rich, Kinght, 1991)	"AI ...is concerned with intelligent behavior in artifacts." (Luger, Stubblefeild, 1993)
Note. These are eight definitions of AI, laid out along two dimensions. On the top are concerned with thought processes and reasoning, whereas the one on the bottom address behavior. The definitions on the left measure success regarding fidelity to human performance, whereas the ones on the right measure against an ideal performance measure, called rationality.	

Various methodologies of artificial intelligence are used in computer science, some of which are:

Machine Learning

According to Chagani [26], Machine Learning is a method of data analysis that automates analytical model building. He added that it is a branch of artificial intelligence based on the idea that systems can learn from data, identify patterns and make decisions with minimal human intervention.

Neural Network

Neural Networks emerged from this drive for biologically inspired intelligent computing. Neural networks are already at the heart of everyday technology - like automatic car number plate recognition and decoding handwritten postcodes on your handwritten letters [3].

Machine Vision

Mallawaarachchi [27] stated that Machine Vision the technology and methods used to extract information from an image on an automated basis, as opposed to image processing, where the output is another image.

Expert System
An expert system is a computer program that represents and reason with knowledge of some specialist subject to solving problems or giving advice [4].

Neuro-linguistic
Neuro-linguistic programming is a way of changing someone's thoughts and behaviors to help achieve desired outcomes for them.

Genetic Algorithm
Genetic Algorithm is a search heuristic that is inspired by Charles Darwin's theory of natural evolution. This algorithm reflects the process of natural selection where the fittest individuals are selected for reproduction to produce offspring of the next generation.

Robotic
Robotic is an interdisciplinary branch of engineering and science that includes mechanical engineering, electronics engineering, information engineering, computer science, and others. Robotics deals with the design, construction, operation, and use of robots, as well as computer systems for their control, sensory feedback, and information processing.

Agent-based system
The Agent-based system is one of the distributed problem-solving techniques that divides a decision problem into sub-problems and solves those sub-problems using independent entities called agents. Each agent can use different methodology, knowledge, and recourses to process given tasks [5].

Financial Technology
Financial Technology or FinTech refers to companies that are using technology to make financial services more efficient. The FinTech term's origin can be traced to the early 1990s with the "Financial Services Technology Consortium." However, only since 2014 has the sector attracted the focused attention of regulators, consumers, and investors.

FinTech industry refers to the group of companies that are introducing innovation into financial services through the use of modern technologies. Some FinTech firms compete directly with banks, while others have partnered with them or supply them with good or services. What is clear is that FinTech companies are improving the financial services world through introduction innovative ideas, allowing for a speedy delivery and increasing competition. The financial technology integrates various types of financial services into the day to day lives of customers. Millennials, as well as the generations coming up behind them, are used to technology and want to manage their money easily and quickly, instead of walking to physical branches to perform transactions and other operations. FinTech is referring to financial services in the 21st century. Originally, the term applied to the technology used in the back-end of established trade and consumer financial institutions. It has expanded to include various innovations in technology, including cryptocurrencies, machine learning, and the Internet of Things.

About FinTech history we can say, the 1950s are a good reference point for financial technology began. The 1950s saw the introduction of the credit card. ATMs were introduced in the 1960s. In the 1970s, firms began to trade stocks electronically. In the 1980s, banks started using mainframe computers and other state-of-the-art recordkeeping and data system. In the 1990s, e-commerce business models and the internet thrived [6].

Global investment in financial technology increased more than 2,200% from $930 million in 2008 to more than $22 billion in 2015 [7].

Supply Chain and Supply Chain Management

The supply chain is a collection of all individuals, organizations, resources, activities, and technologies related to the creation and sale of a product, such as:

- A supplier is a person that supplies goods or services. A company needs material for manufacturing; the supplier provides the materials.
- A manufacturer is a company that uses raw materials to create finished products.
- A distributer is an intermediary entity between a manufacturer of a product and another entity in the supply chain, such as a retailer and reseller.
- A customer is a person or company that purchases goods and services that can be a retailer.
- Consumer Is a person who ultimately uses a product.

The supply chain so that a supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain includes not only the manufacture and suppliers, but also transporters, warehouses, retailers, and even customer themselves. Within each organization, such as a manufacturer, the supply chain includes all function involved in receiving and filling a customer request. These functions include, but are not limited to, new product development, marketing, operations, distribution, finance, and customer service [8].

Supply chain management involves all movements and storage of raw materials, inventory during production and finished product from the starting point to the end point. According to Supply Chain Management guide that published 2013, In commerce, supply chain management (SCM), the management of the flow of goods and services.

Also, Cerasis [28] found the following:
Over the last 100 plus years of the history of supply chain management has evolved from an initial focus on improving relatively simple, but very labor-intensive processes to the present day engineering and managing of an extraordinarily complex global networks.

APPLICATION OF ARTIFICIAL INTELLIGENCE, SUPPLY CHAIN MANAGEMENT, FINANCIAL TECHNOLOGY

Figure 1 shows a conceptual framework for a perfect triangle. In a complete chain of operations, each of the spheres artificial intelligence, financial technology and supply chain management have an influential presence to make the operation chain more profitable for the businesses process.

Figure1. A conceptual framework
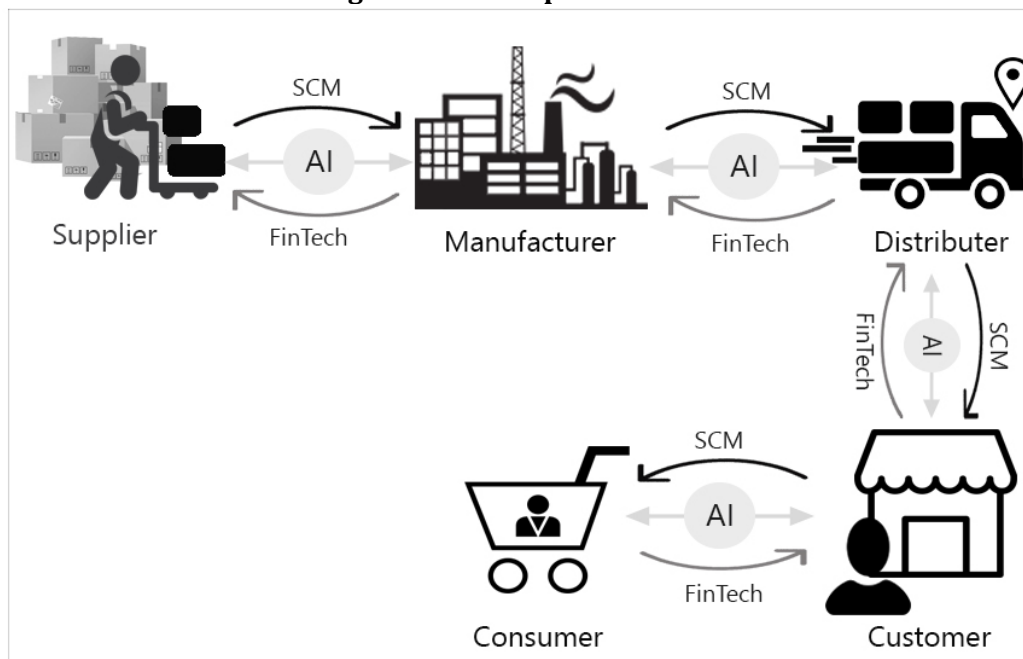
Businesses estimate they spend on average per week around 55 hours doing manual, paper-based processes and checks; 39 hours chasing invoice exceptions, discrepancies and errors and 23 hours responding to supplier inquiries. They also spend five hours on compliance-related challenges such as handling international taxes and three hours tackling invoice fraud. The sources of friction identified by the reported amount to 125 hours per business per week or 6,500 hours per year. When multiplied by the average hourly pay ($26.36) this means companies are losing as much as $171,340 a year resolving payment issues [9].

Application of Artificial Intelligence in Supply Chain Management
The perfect coordination in supply chains is ideal if partner companies are working to achieve it. However, several factors prevent real progress in this direction. For example, in the absence of complete information on the demand of other partners, it is necessary for the partners to anticipate the demand. AI is based on four identified attributes in supply chain models that include:
  o optimization
  o prediction
  o modeling and simulation
  o decision support that can be used to supply chain management

Each of these attributes can use one of the techniques in artificial intelligence.

Application of AI for Supplier and Manufacturer
One of the important points for businesses in the supply chain is choosing an appropriate supplier and having a good relationship with them because providing raw materials for the business is done by the supplier. A problem can bring bad effects for businesses. Hence, the use of artificial intelligence techniques can play a very important role in choosing the best supplier.

Two of the many benefits machine learning in collaborative supply chain networks are:
  o Improving supplier delivery performance
  o Minimizing supplier risk

An expert system can be designed for selecting suppliers in the supply chain management area. A supply chain management system can be designed, and an expert system tool can develop for supplier selection process [10].

Major companies including GE, Siemens, Intel, Funac, Kuka, Bosch, NVIDIA and Microsoft are all making significant investments in machine learning powered approaches to improve all aspects of manufacturing. The technology is being used to bring down labor costs, reduce product defects, shorten unplanned downtimes, improve transition times, and increase production speed [11].

Machine vision is one of the key technologies in manufacturing because of increasing demands on the documentation of quality and traceability of products. It is concerned with engineering systems. Such as machines or production lines. [12]

Application of AI for Distributer
Genetic Algorithm is one of the AI's methodology, GAs have been applied successfully to a variety of challenging supply chain network design problems. These problems include: vehicle routing and scheduling [13-16]. The vehicle routing problem (VRP) is the problem of finding a set of minimum cost vehicle routes which start at a central depot, serve a set of customers with known demands, and return to the depot without any violation of constraints [17]. Beyond automation, robotics can provide a way to turn standard equipment into self-driving vehicles, according to a show-floor panel at MODEX 2018.

Logistics companies depend on networks both physical and increasingly digital which must function harmoniously amid high volumes, low margins, lean asset allocation, and time-sensitive deadlines. AI offers logistics companies the ability to optimize network orchestration to degrees of efficiency that cannot be achieved with human thinking alone. AI can help the logistics industry to redefine today's behaviors and practices, taking operations from reactive to proactive, planning from forecast to prediction, processes from manual to autonomous, and services from standardized to personalized [18].

Application of AI for Customer and Consumer
Inventory represents idle resources that are required to maintain high levels of customer service but which incur substantial costs. The annual cost of holding a single unit of inventory might range from 15% to 35% of its producttion value [19]. Thus, the firm's success in a competitive market often hinges on its ability to control and plan inventory at minimum cost, while making inventory constantly available for customers when needed. A tool such as an expert system, which can replace the sound judgment and intellect of experienced inventory managers and deal with the unexpected, is better suited to handling inventory control and planning decisions. Customers can improve their predictions by analyzing their consumer behaviors [5].

CRM is referred to as the business practice that is intended to improve service delivery, build social bonds with customers and secure customer loyalty by nurturing a long-term, mutually beneficial relationship with valued customers selected from a pool of more than a few customers [20].

Baxter et al. (2003) proposed an agent-based model that simulated the interaction between members of customer populations and business environments in which they were contained [5].

Application of Financial Technology in Supply Chain

The supply chain as a whole is made up of both the physical supply chain and the financial supply chain. The physical supply chain consists of the physical movement of goods from supplier to the customer; the financial supply chain runs in the reverse direction and consists of the movement of financial flows from customer to supplier. The financial supply chain is a concept that has only recently become topical [21]. Financial technologies (FinTech) are internet companies with new technology and innovation that streamline financial systems and make funding the supply chain more efficient.

Many FinTechs functions as cloud-based software platforms and can enable "procure-to-pay" systems that incorporate both purchasing management and accounts payable functionality as per research conducted by Rogers, Leuschner, and Choi [29]. The same research add that, they provide an integrated solution that supports a process that begins with a purchase requisition and terminates with payment to suppliers. Also added, these integrated systems enable buying firms to greatly reduce the burden of administering these functions because they close the loop between procurement and accounts payable and provide a structure that streamlines these processes. For suppliers, joining the platforms can be nearly as simple as adding an app to a smartphone.

Financial technology companies that act as intermediaries in facilitating transactions between a company and its suppliers. They enable both the buyer and supplier to improve their working capital by making it possible for the former to extend its payables and at the same time accelerate payment to the latter. This provides both sides with benefits, including greater liquidity and less variability in the timing of payments [22].

According to the Euro Banking Association [1], the use of the financial instrument, practices, and technologies to optimize the management of the working capital and liquidity tied up in the supply chain process for collaborating business partners.

Supply chain finance is becoming an increasingly popular topic in treasury. Supply chain finance is discussed and evaluated with the focus on FinTech provider as opposed to a bank view. FinTech providers have caused a major disruption within the industry in recent years, and are rapidly expanding their scope of influence and garnering a greater market share. However, there remains relatively low market awareness of these solutions and the capabilities they provide, as their role in the SCF landscape is still evolving [23]. The treasurer has an important part to play in financial supply chain management. In recent years, the treasurer's responsibility has increased from a payables/receivables focus to encompass the entire financial supply chain. A financial supply chain approach to treasury entails looking beyond specific areas and considering the whole chain to gain an understanding of the impact each process has in order to identify where savings can be made [21]. Currently, over 12% of all Supply Chain Finance programs in Europe are managed through FinTech platforms, according to a recent research from PwC [24].
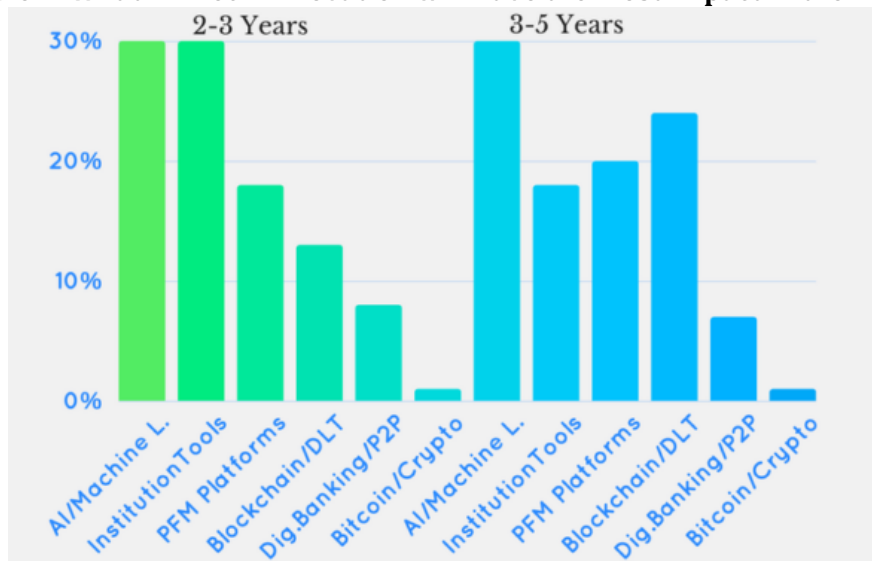
Application of Artificial Intelligence in Financial Technology

Artificial intelligence in recent years represents that can have a great potential in the financial services. Artificial intelligence can improve customer experience and reduce the operating and business costs of a business, and in this way, businesses can enter new markets and earn more.

In a survey conducted by Trends in FinTech in which brokers and financial experts were asked what innovation will be the leading one in the further development of financial technology.

Figure 2 shows the trends in FinTech and investor communication provided by Mediant in 2017.

Figure 2. What FinTech innovation will have the most impact in the five years?

As per Maruti Techlabs [25] below are the potential use cases of artificial intelligence for FinTech:

o Accurate Decision-making
o Automated Customer Support
o Automated Virtual Financial Assistants
o Predictive analysis in Financial Services
o Wealth Management for Masses

The above shows that great opportunities are available and all benefits from the new technology and science.

CONCLUSION

Technology means that we can set aside human mistakes and tedious tasks that prevent business operations and increase productivity. Artificial intelligence can help humans perform their daily tasks to reduce human mistakes and loss of time. Financial technologies can also serve as an intermediary in facilitating transactions between different departments in a supply chain and reducing payment time. Using the concept of a complete triangle comes from the fact that in a supply chain that has many factors from supplier to consumer, there is a need for a complete platform for managing and communicating between each department. The output of each department can have a positive or negative effect on the performance of other participants in this chain, which indicates the sensitivity and importance of their performance.

A business can use methodologies of artificial intelligence to improve its internal processes and can also use financial technologies to manage its financial resources. Artificial intelligence and financial technology are not only used to communicate with other departments in the supply chain. A business can use artificial intelligence technology to improve its internal processes and can also use financial management technologies to manage its financial resources.

Each of the corners of this perfect triangle is a huge and widely used world for businesses, and their relationship can create a complete process. Identifying a supplier, manufacturer,

distributer, and customer in the supply chain by artificial intelligence creates the need that payment operation which is reverse flow, must be done well, till to stay in a tight relationship. Also, the financial management of the supply chain, which can be very complicated, using financial technology can automatically record some of the financial processes and use the data recorded using artificial intelligence to analyze financial flows. This flow can continue to be complete!

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