# THE USAGE OF LEARNING MACHINES FOR DECISION MAKING PROCESSES IN FINANCIAL MANAGEMENT AND SERVICES

**Cüneyt Dirican**

Istanbul Arel University, Turkey

cuneytdirican@arel.edu.tr

**Abstract**

*The Fourth Industrial Revolution has been started with the latest technological developments. A new age has begun after the failure of Lehman Brothers. To sustain the profitability and to keep the existence of companies are getting harder for all professionals and shareholders. The technological developments and its implementation in business look like to the beginning of the last century when humanity with steam series had entered to the First Industrial Revolution. Many items related to finance, financial management and financial services will face serious change, exposures as well as opportunities with the improvements in Artificial Intelligence, Big Data, Cloud Computing, Semantic and Robotics, in the near future by space explorations. These impacts could be summarized by asking some questions: Should we consider the robots and smart machines as company's head counts or intangible assets even they are able to be mobile. What will be the new name of human resources department? How World Bank and World Trade Organization structures will be shaped after human colonisation in other planets? This paper is aiming to discuss the future of finance and financial management and services combined with the artificial intelligence and/or smarter machines usage for decision making.*

*Keywords: Financial Management, Financial Services, Learning Machines, İntelligent Devices, Behavioural Finance*

## INTRODUCTION

Since the invention of money, paper and monetary systems, individuals and companies have looked for profit and benefit maximization as well as better decision making enablers to do so. Starting with the bankrupt of Lehman Brothers investment bank in 2008, "Global Financial Crisis" showed that humanity is nowadays in the beginning of a new era and there is a strong

need to revise many economics, money, banking and finance theories, books on the academic and on the business sides. With almost zero policy interest rate implemented by Central Banks since 2008, the world witnessed Keynes' "Liquidity Trap Theory" (Baydur and Süslü, 2011). The zero level interest rates are used as one of the most prior monetary policy tool by Central Banks which have the duty of managing the value of their own money and sustain the prices levels. Central Banks and bankers are using this policy instrument hoping to recover the local and global economic growth, to reduce unemployment. By the injection of money supply to the credit channel of the banking system, the main aim of the governments, pushing the Central Banking systems to "zero interest rate" despite their independencies, is to target and to bring into life new private investments and new consumer demands which will boost economic growth. If this aim occurs, there will be more corporate tax returns to governments and export revenues to Balance of Payments that lead to minimize the government and foreign trade deficits. One of the main economic indicators of this phenomenon is inflation rate increase which since 2008 none of these Central Banks and governments could be able to see. It can be easily told that monetary policies of 2008's are failed for economic recovery.

Capital flows, exchange rate systems, balance of payments, derivatives, behavioural finance, portfolio management and its theories, Basel and capital adequacy, internet banking, distribution channels, credit cards, digital money, monetary and fiscal policies, open market transactions, stock exchanges, deposit, letter of credit, foreign exchange are some of the headlines and products of the financial system. Balance sheet, income, profit, cash flow forecasting, audit, finance, loan, equity, financial ratio, capital injection, asset and liability management, risk management, working capital, EBITDA, fraud, tangible assets, receivables are the other face of the moon on the companies' financial management side. Both sides have seen many changes since Bretton Woods and Smithsonian Agreements. Transformation of money in electronic forms and liberalization of its supply, Central Banks' new liquidity strategies to stand strong against global financial crises and development of new payment systems and nonbank financial institutions forced the companies and the whole financial system to adapt themselves to today's new technologies. Profitability and sustainability, especially after 2000s, are the most important topics of professionals and decision makers and knowledge management became much more important. Efficient usage of knowledge and information systems requires more depth analysis, integrations, intelligence and investments (Liebowitz, 2001). In particular, globalization, digital developments such as internet and mobile, developments in CRM technologies, financial services with the new computer systems were the most important reasons to look from different angles to economic and financial activities in the new age. After the 2008 global crisis, financial services and other industries' companies are

looking forward to have more profits, to reach more markets. With the help of marketing functions, they try to make customers loyal with predictive analysis (e.g. churn, attrition), to respond to the competition with new innovations and to reduce operational costs, increase sales and sustain revenues. These pressures on industries and on the companies are making the finance and the marketing more important. The new agenda of companies' management boards is generally busy with marketing and sales for the expansion of customer base and with managing earnings more accurately and efficiently in the markets or borrowing at acceptable cost levels.

Globalization after 90s and with the changes of customer expectations and needs, depending on the convergence of internet and mobile technologies, developments in social media, changes in communication forms and methods push companies towards faster adaptation of these technologies. And lately, artificial intelligence (AI), semantic studies, robotics and mechatronics, big data, cloud computing, neural networks, data mining, wearable electronics, nano and genetic sciences, hologram, 3D and 4D printers, drones, virtual reality, space technologies are the new main technological trends that will have direct effects and impacts on industries, companies, decision makers and workers. Such disruptive changes will conclude with new business models, economic doctrines, socio-economic life styles, even beyond the earth with the colonization on different planets. Despite Stephen Hawking criticized the risks of artificially working smart machines and search for alien life in space, tremendous news in business pages regarding on these topics are gaining more space and columns every day. On the business side, Elon Musk, Bill Gates supported Hawking's claim that such smart machines and devices could end the humanity existence. But, obviously it is too late to prevent such risks and its side effects.

To be more sustainable and to keep the same level of profitability, financial management and finance are still the most important function in management discipline and in companies. All the management functions such as production, operation, sales, marketing, human resources management are important, but all of these are serving to one conclusion called "Return on Equity" which is directly related with profit and inflation and correlated with better decision making in financial management. Thus, finance and financial management become more important due to all of these developments in the past recent years. Predicting the future in finance is called cash flow forecasting and management. For a better cash management within a company or bank, the company's budget and Performa financial tables are the first starting point. But, as we are in a beginning of a new age after 2000s, they will not be enough for decision makers, finance managers, top management or shareholders and investors. Financial

management and financial services should be ready or should use more new technological developments in order to respond today's challenges and competition.

The aim of this hypothetical paper is to emphasize the new technological developments impact on finance and financial management and financial services, to discuss possible effects on business, banking and economics in related fields. Finally, it is also aiming to make conclusions and suggestions to professionals and decision makers as well as for further academic researches and works. In the second section, the literature is examined, in the third section the arguments and hypothesis are discussed and in the last section conclusions are made together with suggestions.

## LITERATURE ANALYSIS

Lots of developments in the internet and mobile technologies, electronics, advances in medicine, nano and genetics, the researches on smart machines and devices integrated with digital applications, space explorations and its sub-technologies speed up innovative studies nowadays. The usage of computers, of analytical models and smart technology solutions in management, in marketing and in finance (in financial services) is not a new agenda for industries and markets (Zopounidis, Doumpos, & Matsatsinis, 1997). Many in-house software or ERP (Enterprise Resource Planning) and core banking systems are based on latest technology. The software developments are accelerated by the chip based hardware developments when the machines and computers are getting more powerful and processors are able to respond more queries and transactions. But, within this paper, the literature analysis considers especially after 2008 and internet and mobile technologies are considered as given and will not be repeated in details due to the limitation of the length of the paper and to explain more the expectations of disruptive changes in high tech industries.

First, Gordon argues that new technologies could not effect and represent economic and social impacts as existing ones (e.g. electricity, computers, television) within the calculation of GDP, gross domestic product (Gordon, 2016). But, economists like Hal Varian (Google chief economist) believes and argues that digital economies are not well counted within the GDP (WEF, 2016) and Silicon Valley does not believe the slowdown of US economy (Aeppel, 2015). Many of the voluntary or zero-priced services in digital environments such as YouTube video sharing platform, online consultancy web sites, digital advertorial activities and especially cross borders virtual platforms (e.g. Facebook, Twitter, EBay) are not counted within GDP (Coyle, 2016). This dark side of the digital economy should be explained by Moore, Gilder and Metcalf laws which are also the basis of understanding the market cap of new digital companies like

Facebook, LinkedIn and so on among old-fashion production companies (Pinto, 2012). They pretend that digital technologies will shape the future and economics at light speed.

**Moore's Law**

Formulated by Gordon Moore of Intel in the early 70's: The processing power of a microchip doubles every 18 months; Corollary, computers become faster and the price of a given level of computing power halves every 18 months.

**Gilder's Law**

Proposed by George Gilder: The total bandwidth of communication systems triples every twelve months.

**Metcalfe's Law**

Attributed to Robert Metcalfe, originator of Ethernet and founder of 3COM: The value of a network is proportional to the square of the number of nodes; So, as a network grows, the value of being connected to it grows exponentially, while the cost per user remains the same or even reduces."

These laws are directly linked with "Digital Economy" and the impacts of mobile and internet on business, management, marketing, finance and financial management. In recent years, more developments gain importance among digital innovations. These developments are beyond web and mobile technologies but are correlated in most cases. It can be pretended that most of them are for space exploration and interstellar travellers and residents of new colonies in other planets. To discover more resources in space in order to boost world (or colonies) economic growth and individual prosperity as well as creating new markets for companies' sustainable profitability as foreseen by the discipline of economics, these developments will definitely help for such assertions. These new developments are called as the Fourth Industrial Revolution.

Definitions of robotic, mechatronic, big data, semantic, neural networks, cloud computing technology and artificial intelligence are quoted and explained below from different studies to understand related discussions on the Fourth Industrial Revolution and its effects on finance.

Robots are introduced in 1921 in Prague for the first time (Bischoff & Guhl, 2010) and cited from Persian – Turkish philosopher Avicenna (in Arabic/Persian Ibn Sina), expressed as humanlike, anthropomorphic. And the description of robotic is presented as (Murphy, 2000): *"Robotics is an intelligent robot or an autonomously operating mechanical creature."*

Yu and Kodama, presents the mechatronic branch as (Yu, 2008; Kodama, 1986; Algaç, 2010): *"As a term which is invented in late 1960s, sensitive mechanical engineering, electronic, software engineering unifies production design process and opinion systems under the name of mechatronic. "Mechatronics is the unification of mechanics and electronics."*

Data mining is widely used in analytical CRM works. Predictive analytics is the end to end process for predicting future outcomes by analysing facts and figures based on historical and current data. Volumes are relative and vary by factors in big data, such as time and the type of data. Laney in 2001 defined volume, variety and velocity as the three dimensions of challenges in data management and Gartner, Inc. company in IT industry defines big data as Laney suggestion in their IT Glossary (Gandomi & Haider, 2015): *"Big data is high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making."*

In Lolli's article, artificial intelligence and Charles Morris' book "Foundations of the Theory of Signs" which defined semiotics are mentioned. Semiotics, used by computer engineers or software developers, consists of three components: syntax, semantics, and pragmatics. Semantic is a word for the web searches especially used in search engines such as Google and Yahoo and understands the core reason and needs with artificial intelligence (Lolli, 2013).

"Neural Networks" can be defined as the combination of bid data, semantic search, artificial intelligence and cloud computing which can produce valid and prioritized answers from huge amount of data. (Taylor, 1993;1996).

National Institute of Standards and Technology of USA explained the cloud computing technology briefly and officially defined as: *"Cloud computing is the system that has a storage space in different virtual networks which eases the share of information, data, document or source."* (Mell & Grance, 2011). *"Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction." (NIST Special Publication 800-145).*

Artificially intelligent computers and applications are described as smart software and learning machines that can deal with many issues at the same time that human beings are good at and non-static. (Rich, 1985). Artificial Intelligence (Pau, 1986) and Robotics are the latest headlines that have been discussed during the World Economic Forum (WEF) 2015 in Davos.

In today's highly volatile markets, risks and financial issues could be analysed interactively and simultaneously and the most efficient answers could be achieved by the

combination of all these smart technologies in learning machines. This achievement can be briefly described as the combination of neural networks (Hawley, Johnson & Raina, 1990), big data, analytical CRM, data mining, semantic search, artificial intelligence and cloud computing. "Artificial Neural Networks" can respond to many business issues and conclude solutions by self-learning and memorizing the previous works and searches. (Taylor, 1993). Earlier stages of the smart usage of these intelligent systems and machines could be seen in money and capital markets. Special software and solutions in financial markets are used by taking into consideration many finance and risk management theories e.g. portfolio theory of Markowitz, RAROC (Risk-adjusted return on capital), MACD (Moving average convergence/divergence) or VAR (Value at risk). They can calculate the portfolio risks and based on the commands and instructions implemented to the software and to the intelligent machines and can also respond to market moves, can follow up stop loss and stop gain price levels for any financial or commodity contracts or products and can automatically execute transactions 7/24. The developments in artificial intelligence technology will help investors, decision makers, bankers, finance managers to calculate risks and exposures, to make adjustments based on current conditions of the situation and to evaluate new opportunities. Furthermore, robotics experts predict that robots and other smart machines with artificial intelligence technology will have achieved to the equal processing power of a human brain in the very near future (AMA, 2015).

Some example of how AI changes the financial services especially in investment banking can be summarized in following literature reviews: Wealth management company Charles Schwab in US launched a new service in 2015 called "Schwab Intelligent Portfolios" which is an algorithm, codes in binary system programmed into a computer that help investor's decision making process. In 2015, the Chicago Mercantile Exchange Group also cannot resist to changes and closed most of its trading pits after 167 years and replaced them with computers. But, there are also side negative effects of faster decision making tools and of tough rules hard coded in the algorithms. In 2012, Knight Capital in US lost over $400m in half an hour because of a computer glitch. In 2015, trading was halted at the New York Stock Exchange. They gave a brake and trading stopped due to a software problem (Fleury, 2015). Wall Street hedge funds are using Ufora which is a supercomputer to analyze extremely large sets of big market data and to write analyst reports once produced by humans (Wang, 2015). It can be argued in here that behavioural finance hypothesis and theories should be revised and be enhanced by the development of learning machines, intelligent devices and smart robots that act as a financial advisor, an investor or a decision maker. And Z generation and new graduate will compete with human-like robots or an artificially learning machine in a job application or in an interview. Hence, a new definition in Human Resources Management could be proposed

theoretically to be put in the glossary of the Fourth Industrial Revolution: "Binary Collar". White and Blue Collar will face serious changes in coming years as the business agenda will be replaced by more of these technologies. The binary system (0 and 1) is the basis of computers and coding which software, chipsets and devices are all built on that mathematical system. Basically the whole universe is working on mathematical systems.

Artificial Intelligence is also an important tool for "Financial Forecasting" in financial market and in companies. Cash flow forecasting and predictive econometrics and financial modelling are leading indicators of the risk management and economy. Artificial intelligence and smart learning machines could help finance managers and economists to predict more precisely the future and by less working. There are also some early academic researches and papers issued in the field of financial modelling, econometrics and investment theories together with AI. (Binner, Chen & Kendall, 2004; Selvi & Wonga, 1998). One example is the Artificial Intelligence techniques of Matthew Butler, and Dr. Vlado Kesel as stated in Dalhousie University, Faculty of Computer Science web page. (Dal.ca, r. 2016). They have developed a model that use machine learning to predict the performance of stock prices in a month to year term range. The experiments run on the stock market data have shown that their model is accurate. Another example is again cited in Dalhousie with an artificial intelligent novelty. It can read, analyse and interpret non-numeric information provided in the annual reports submitted to the Securities and Exchange Commission (SEC) to the publicly-traded companies and give insight to the senior management team for company direction. It is also pretended that artificial intelligence usage in investment decisions will help to expand the capital markets and will have an "Uber Effect" on traditional wealth group, financial advisors which will be able to reach and serve to more clients (www.bobsguide.com, 2016). And more debates are also pretending that it will have a huge effect in retail and investment banking if it is combined with learning and mobile machines, i.e. robots. Suppose that Aiko Chihira, the female-looking robot produced by Toshiba Corporation, offers guidance to any bank customers as she (or it?) does at department store at the Mitsukoshi store in Nihonbashi (Hongo, 2015). The idea is not a fiction because Bank of Tokyo Mitsubishi UFJ has already implemented (or recruited?) robots named as Pepper that can make conversation or respond to spoken questions of bank customers.

The Company DDIQ (Due Diligence Intelligence Quotient), based in Toronto as an artificial intelligence (AI) startup OutsideIQ, launched in April 2014 "The Brain" which is the first AI solution for fraud investigations, anti–money laundering, anti-bribery and anti-corruption compliance. (McLaughlin, 2015).  A bank creditworthiness and performance could also be assessed by artificial intelligence systems (Fethi & Pasiouras, 2010). AI could also be used for bankcrupty predictions. (Han, Kwonc, Leea, September 1996). A Japanese investment banker

and ex-Lehman Brothers' staff has developed a financial modelling with artificial intelligence for predicting the Japanese markets direction and most of its predictions are accurate (Hasegawa & Redmond, 2016). The project costs and return on investment of a project could also be calculated by cash flow predictions via artificial intelligence techniques (Cheng, Tsai & Liu 2009) Despite the claims of Stephen Hawking such as "Artificial Intelligence or search for alien life may bring the end of humanity" (Lewis, T. LiveScience.com, 2015), importance of robots and AI is increasing. Together with the technological developments, more news about the effects of mechatronic, digital, mobile, robotics, artificial intelligence will be heard and be seen in 2025 in a report published by Bank of America and Boston Consulting Group. Their combination and smart usage of them within industries and companies will surely help today's professionals, managers and investors for better decision making in finance and managing their risks and portfolios. Hence, possible effects and impacts should be discussed for further steps and related activities.

## METHOD AND DISCUSSION

The main goal of this paper is to be a path for new studies in this era and to give a new perspective to these hypothetic subjects (for the time being). The method used in is the literature analysis and discussion of hypothesis, deriving from that to suggest solutions and investigation points for companies' professionals to implement in their financial modelling and decision making processes. It should definitely be supported with surveys, analytical and statistical modelling and empirical works when more data is available in the markets and economies. As it is the early stages of these industrial and technological developments and most of them are just at the R&D or implementation phases in many industries and companies, some arguments could be transformed in the future. Given so, many companies, professionals, industries and academic researchers in the related fields including us are still not aware what could be the consequences of such developments and most of their value-add are not discovered yet in many fields and disciplines. For example, the banking industry still does not use drones for its operations or hologram as a contact center with customers.

As discussed in the Literature section, Moore's Law and Metcalfe's Law describe the importance of the new technological forces. The tremendous acceleration of binary number scheme pushes the growth and the depth of the web. In a capitalist economic environment, Adam Smith's "invisible hand" redirects investors where the capital is highly valued and return on equity is above the inflation rate and expectations regarding the portfolio investment requirements are also met efficiently. Companies that have a strong ability for generating positive cash flow and future revenues attract investment more easily which are the case of web

based companies (e.g. social media companies) and as listed public companies in stock exchanges, it can be seen in their stock prices rise and market capitalization. But, it can be argued that until now what is explained is version one of the new technological developments after 90s. In the first decade of the new century (2000), based on these three laws and on the power of the processors and the enablers (e.g. fiber optic) behind them, the digital economy changes many business models. But, the fail of Lehman Brothers investment bank in US broke this digital economic wave. Held at Davos in February 2016, World Economic Forum's main agenda was "The Fourth Industrial Revolution" and soon will be called as "Space Economy" by new explorations and colonization in space (Seedhouse, 2014).

Lehman Brothers caused the financial global crisis in 2008 that leads companies towards more financial issues to be resolved. Operational costs, hedging of risks, sustainable cash flow and income are the biggest issues of today's companies besides the governments' growth and budget problems. Therefore, decision makers in companies and in financial institutions consider Porter's "Value Creation and Competitive Advantage Theory" more and more to keep the same profitability level of their organization and sustain in turmoil. First, decreasing costs and increasing productivity are put in the first rank of the management agenda among sales and customer relationship management as Porter suggested (Porter, 1991). By optimizing the work processes and reengineering the company's business functionality, they target to achieve the scale of economics within the company. Decision makers' aim is to maximize the marginal utility of resources which will help to minimize the operating costs and will help profit maximization with the same level of resources usage. Then, by using research and development (R&D) and innovative marketing methods, they try to find new way of increasing the price of goods and services they produce which will have an impact on profit margin. This can be summarized as the case of Apple's IPhone. Apple produces IPhone in China for around 100 USD and sell them in US and all around the world for around 800 USD. By the help of marketing and advertising, they create a different perception and consumer beliefs that all other smart phones are behind IPhone capabilities and its brand's value. The choice of customers moves up the market capitalization of Apple in the first rank and Apple was the most valuable company by the end of 2015 (Until Google passed in 2016 because of its technological investments in robotics, artificial intelligence, driverless car).

At this point, it can be pretended that apart from digital platforms and online financial services, other scientific improvements such as genetic, nano, medicine, semantic, 3D printers, hologram, e-money are going to have huge positive impacts on banks' and financial instutions' growth and sustainability. But on the other hand, financial companies that are not ready for such improvements will be at systematic business risk. In a competitive market, companies must

constantly invest and innovate or risk to losing out to competitors. Capon and Glazer have mentioned the importance of creating technology portfolios and using optimum technology sets for companies (Capon and Glazer, 1987). Before getting into the details of its relations with finance and financial management, the first and biggest impact will be seen in labour which is one of the production factors and in its costs in company's balance sheet. Primitive robots are operating in the mass production especially in the producing process of home appliances. These non-intelligent robots are doing the simple mounting works already. But with using mechanic, electronic and computer technologies together, it's possible to see more robotic solutions and artificial intelligence in companies' business environments and human resources planning (Algaç, 2010). The decision of Volkswagen for replacing retired workers with more robots could be taken as an example. Its effects will be seen on entrepreneurs and on capital as well as GDP growth rates and purchasing power parity. The expectation of replacing human workforce in production layers could also be seen in finance and treasury departments which have been already the cases as mentioned below.

In institutional world, today new jobs and its descriptions could be seen such as digital marketing and social media manager, computer operator, analytic CRM operator, network specialist. But in the last years, business environment recognizes extreme examples such as drone users of Amazon.com. But is that all? It is possible to detain this question. In big companies with high population, for example in retail, there are thousands of workers and job applications. Artificial intelligence could replace recruiters and human resources staff by analysing the big data and by digging more details of the company workers and their performance figures. Without workers, there will not be salary payments, retirement and social insurance premium. In this direction, there won't be a need of hiring someone to explain work acts, calculate salaries and business policies within a company. By the elimination of most jobs and departments, the job description is not written but hard coded in new worker's (i.e. robots) chipsets. Besides, it can be argued that finance managers will no longer exist in small medium size companies and IT professionals should have a finance master degree due to the convergence of the finance and information technologies. This could be one possible effect on finance and financial services.

It is clearly proved that technological improvements and innovation, internet, mobile and CRM systems have changed the global banking sector. Financial services are getting faster thanks to online banking systems. G20 countries are insisting on mobile banking, e-payments and mobile insurance through their Financial Inclusion Strategy. Banking and financial services have reacted to these devastating changes and customer needs with quantum splash in the first decade of 2000. Banks have been using electronic banking systems to get robust responses for

customers' requirements and inquiries and to solve their problems as soon as possible. CRM systems started to manage the quality of information and are used more intensely to have more loyal customers. Chief Digital Officer (CDO) and Chief Information Officer are new definitions used in many companies. In the near future Chief Executive Officer position will be fulfilled by CDO or by CIO. In banking, instead of treasurers, credit and marketing assistant general managers, General Manager position will be fulfilled with candidates having IT background in coming years.

Such technological improvements are going to change production lines when personal production starts with 3D or 4D printers. For example, at the point of the future of IKEA's, board of directors and top managers should use the stress tests and calculate the financial impacts of mass personal production. Suppose that in ceramic and glass productions, when the cartridges for any chemical material could be used cheaply and be found easily, the bi ggest issue to be answered is that what will happen to production lines, storages, logistics, supply chain management and inventory costs. Inventory and supply chain finance probably will have new issues to be resolved by personal production. Finally, income statement and sales are the biggest and tough questions which have to be answered among the final rows e.g. EBITDA, net profit. These impacts on financial management could be summarized by asking some last questions: Should we consider the robots and smart machines as company's head counts or intangible assets even they are able to be mobile. Shall we continue to calculate severance pay or amortization / depreciation for artificially intelligent human-like robots and/or learning machines.

## RESULTS

Drucker described in 1993 that information is the most precious element among the production factors. In this direction, in 21st century, different technologies and sciences are converged. Independently and together, human and business life are effected with different dynamics and improvements which for example was an entirely different topic in WEF 2015 e.g. AI and robots. As discussed and reviewed in previous sections, today's valid norms and hypothesis are going to be shaped with future trends and developments and more is expected to come. The results and arguments can be summarized as below in financial management and financial services.

- Until today, CRM capabilities in most companies can present the "Next Best Product" to the customer with the measurement of "Life Time Value". Segmentation, churn and attrition analysis could be easily done and the tendency could be calculated with CRM capabilities.
- Big data has already become a strong headline in IT and CRM environments.

- On the other hand, finance, production, operations, logistics are integrated via Supply Chain solutions and mid or front end software in ERP systems used especially in corporates for such integrations.

- Accounting and finance can interact in ERP systems e.g. SAP, Oracle and cash flow management is available if necessary modules are implemented which help for decision making processes. The reconciliation of bank account transactions to the accounting systems via SWIFT MT940 or system integrations support also these processes.

- One of the biggest gain on the company's side is the combination of "CRM and Finance" inputs and outputs and processing big data by huge semantic data mining tools for risk and asset & liability management.

- In customer segmentation, with predetermined rule sets, customer migrations between segments can happen right after selling the product and with integrated processes the customer and portfolio risk and profit can be calculated simultaneously. Interpreting the real time campaign management results through the Net Promoter Score which is kept in Cloud system.

- Activity based cost calculation and cost per product, channel can be calculated easily. One to one customer pricing could become available during direct sales activity. Processing the channel based pricing and sold product cost with real time speed can be calculated easily.

- By interactive tools and screening, considering the receivables, the collaterals, past behaviours of customers and current status of the balance sheet, the sales and finance managers can make decision more efficiently and accurate.

- Downloading simultaneously the customer tendency analysis with the support of robotic to distribution channels could help to increase cross sell ratio

- Measuring the customer behaviours while shopping in the supermarket and offering discounts and special coupons during the payment at cashier desks could be an option.

Other possible effects and visualised impacts are:

- Depending on financial forecasting, calculating the effects on balance sheet and next year's strategic planning according to variable economic data could be done and presenting as a dashboard to decision makers would be an easy task.

- By reducing labour costs after using robots in production lines, implementing the positive effects on product and services prices could be achieved.

- As mentioned before, there will be need of changes on titles of employees, and managing robots and artificial intelligence would be another department's responsibility rather than human resources.

- Fusion of social media applications with financial services, e.g. Facebook Banking, Loan Application via Twitter could be combined with other systems i.e. CRM and risk management for behavioural segmentation and finance.

- Via face recognition systems and GPS systems finding an NPL customer having moral hazard problem could be facilitated.

- Universities are going to be affected and there will be increasing necessity of describing new sciences and sub-branches in finance and administrative sciences.

- Academic staff could be replaced with robots with artificial intelligence in some disciplines for explaining how the sales and loan assessment processes work in learning machines.

- From the accounting perception, International Accounting System should decide whether companies keep setting aside severance pays or there should be depreciation for human-like robots and learning machines.

- Briefly, International Financial Reporting Standards must be revised with direction of how robots will be considered. Under the active part or passive part of balance of payments.

- The government finance ministry also should answer the question whether companies are going to pay taxes for this new workforce.

- There must be new Key Performance Indicators and Balance Score Cards, new financial analysis ratios and Net Promoter Score for analysing the customer experiences in companies which directly affects the Performance Systems and sales performance premiums.

- Impacts of production, communication, marketing and staff expenditures on funding and costs should be visualised and be calculated online while offering value propositions to customers. With this method, it will be easier to control such risks on balance sheet.

- Flexibility during sales and delivery hours and robotic changes at channels where companies reach customers will make positive impact on companies to work more productive and efficiently. The operating costs will minimize and economics of scale will be achieved with the same amount of resources.

- There will be instant communication with customers via hologram technology. Especially sales and distribution costs will decrease by hologram technology and it may become the new communication channel for staff and management meetings and a new way for sales and service delivery (Murray & Keevil, 2014). By using Hologram Banking, financial institutions will be able to interact with its customers anytime anywhere.

- In financial institutions, especially in banks, investment and forex companies the integration of blotters, money or capital market transactions, mid and back offices, payment and clearing systems are mostly achieved by in-house or outsourced treasury systems. Due to

their nature of efficient risk and cash management need, the information technology investments are in general in front of other industries' spending. The competitions on the customer side also affect the banks and financial institutions' usage of high tech products (e.g. kiosks, CRM systems, mobile and web branches, contactless cards, etc.)

- Big Data will be mined within short period of times and simultaneously triggers a robot teller where a bank customer wait an offer of a tailor made value proposition. This can be achieved by using "Customer Lifetime Value - Life Time Value (LTV)" analysis performed by artificially calculated "Next Best Product" in the cloud system.

- By lowering the operating costs as well as funding costs and minimizing the effects on the balance sheet and income statement and maximizing working hours by the robotic or hologram based distribution channels or cloud computing, financial institutions will be able to manage sustainable profitability and risks more efficiently.

- Automated financial (robo) advisors that assist customers in making financial decisions will be increasing especially in retail banking. Wealth management advisory services could be offered to lower net worth customer segments (Power, 2015).

- New technologies will be resulting with lower fee-based commissions to customers.

- For insurance and pension industry, AI systems automate the underwriting and actuary processes and portfolio risk could be managed more precisely.

- Big Data-driven AI systems will facilitate and accelerate lending decisions.

- AI systems and tools could easily identify anomalies and warning signs of fraud attempts Future banking and insurance manager will use learning machines rather than human experts for their questions.

- Robots will be capable of analysing massive volumes of information linked to Big Data via Cloud Computing systems, will be providing customized financial services. They can also develop financial plans and strategies e.g. in pension systems and track the progress of a portfolio set.

- Big Data-driven management decisions at lower cost could lead to a new style of management as early mentioned in the paper.

- Personal and family financial planning would be much more easier (Gaoa, Xub, Wanga & Wanga, 2007).

- The portfolio management thesis and hypothesis should be revised.

- Many papers on behavioural finance should be revised or be changed with new ones.

**CONCLUSION**

Last World Economic Forum agenda in 2016 was called "The Fourth Industrial Revolution" and in the previous one in 2015, Robotics and Artificial Intelligence were highly discussed. Roubini, Stiglitz issued his paper and article on innovation, robotics (Stiglitz, 2014; Roubini 2014) Robots which are welcoming customers in banks, software with decision making capacity about the investing conditions, using drones for product delivery, Google's driverless car, wearable technological textile, are the examples of this new era. Its advantages and disadvantages are going to be experienced. There is going to be rising need for researches in psychology and sociology disciplines on human behaviours and interactions with these new technologies. Many theories in economics and finance will be replaced by new ones in coming years due to the serious impacts of these disruptive changes on business life and on world economics. Australian School of Mises, Keynesian Theories, Harvard Business School's articles, Marx's famous Das Kapital, Adam Smith's "Laissez faire, laissez passer", Ricardo's Comparative Advantages Theory, many books on banking, finance, business, marketing, economics should be revised or make no sense by becoming invalid due to their nature that all are related and valid within the boundaries of this world.

Financial management and financial services are two main issues of business life and became much more important after 2008. Alternative financing methods i.e. property sales and lease back, crowdfunding, fundraising, direct lending, nonbank financial institutions are gaining importance due to credit crunch and the proportion of bank loans in investments. On the other hand, information and digital technology converged in mobile and web applications. After 2015, more improvements are developed faster and exponentially on the other tech based engineering. Companies are discovering them for enhancing their efficiency and for their existence in the market. In coming years, all will be combined and be converged in the same platforms. By the internet of things, mobile learning machines provides more data than today's big data. By artificial intelligence they will connect to the servers in cloud and will compute remotely by processing huge amount of information and will transact among different neural networks. Finally, having the ability to sense, think and act like a human by the algorithms and binary coding systems and conclude with a precise decision among other alternatives. Let us suppose that this story can be applied for decision making process of finance. Personal finance, corporate finance, investment decisions will be affected by these abilities and most critical decisions could be easily done or most complex issues could be easily solved. But, there should be some check or stop points or control systems. If human decision makers want to halt the transactions or to continue manually the process, it should be. Not only for various business reasons but for chaotic or risky situations. Stock exchanges are good examples for such needs.

To prevent market failure risk, bankruptcy for investors, to trigger some other exposures there should be a "in emergency push the button" control. Besides, the asymmetric information between human and chip based processors could have an effect of "Crowding out" which means "fast decisions drives out slow decisions", even they are good or bad, right or wrong.

As a result, by the convergence of digital and semantic applications, mechatronic – robotic improvements and intense usage of artificial intelligence, we are going to see revolutionary changes on finance in the academic and professional world. There will be more new words and terms in finance glossary and terminology. The effects and impacts on finance could be divided in sub-titles; Financial management and financial services. Most of the arguments are related with both of them but by its nature their priorities or processes could be different. Systems like Experian, FICO, EMV of VISA and Mastercard, Basel capital accord on the banking side, IAS, IFRS, SAP, Oracle, SCM systems on the company side and their shared cluster (e.g. card collection) will be affected. It can be easily said that they are just the beginning.

This study will lead following researches and studies about similar subjects and will be a source for detailed empirical analysis and survey based academic works. The hypothesis and discussions could vary in time due to its nature. Therefore, it is aimed to make new researches on the new developments of these technologies and their impacts on business and economics. A survey methodology shall be planned to realize with finance managers and bankers for their perceptions and opinions of their usage of these technologies in their business. Later, the impacts on jobless ratio and economic growth will be planned to consider in other papers. Finally, with different industries and companies available data, a further empirical research on their effects to profitability shall be issued. But obviously, these works will take time due their dependencies.

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