Department of Business and Management

Machine Learning & Object Driven Marketing

"The Platform" the New Business Model of the Digital Era

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I INTRODUCTION

Digital technologies have significantly changed our economy, but most of all in how we think about data. According to the traditional way of making business, data was expensive to obtain, costly to store and utilized in organizational silos. Just managing data for companies required a huge IT system be purchased and maintained. Today, data is being generated at an unprecedented rate not just by companies but by everyone. IDC (International Data Corporation) estimates that by 2020, business transactions on the internet business-to-business and business-to-consumer will reach 450 billion per day. Consequently, one of the biggest challenge of the twenty-first century is turning this enormous amount of data we have into this valuable information. That's why the last years we have seen the rapid growth of new companies, born just to extract potential data from businesses and use it to optimize: industrial production processes, to provide indications to consumers preferences, to control workers and of course to create new products and services. However now with cloud-based system store and analyze data is becoming cheaper, promptly available and easy to use. This technological dynamic framework generated a new business model: “the Platform”, developed to satisfy this huge need of manipulate, extract and analyze in an efficient way data that companies are storing all over the value chain. This business model ended up to expand in all the economic sectors with many companies that integrate platforms as central assets; just to make examples: big tech companies (such as Google, Facebook and Amazon), start-ups (Airbnb, Uber), big industrial firms (General Electric, Siemens), agriculture giants (John Deere, Monsanto) just to title some of them. Digital technologies and the connected platforms business models are also forcing us to think differently about how we understand and create value for our customers. If electrification back in the industrial revolution was revolutionary because changed the fundamental constraints of manufacturing, the impact of digital it's even bigger because it changes the constraints under which practically every domain of business strategy operates. The aim of this thesis is to show from a practical business development point of view the several competitive advantages of adopting the platform business model that integrates the new tech solutions. Shifting the capitalistic mentality, from a profit-

oriented business to data-oriented business. The analyses will start by showing the most important digital technologies revolutions starting from: artificial intelligence followed by the machine learning paradigm. Later with the description of the digital ecosystem we will collocate IoT in a framework together with artificial intelligence and machine learning. All these new technologies created a breeding ground that facilitated the analysis of data and the implementation of the platform model which integrates and maximize the value of all these new tech innovations. The platform model and the new digital drivers of the business strategic vision will be then carefully explained in the second chapter. Indeed, the platform business model is the only one that can integrate the digital ecosystem together with a data customer centric business strategy and face the current competition. Later we will go through the different type of platforms business models (*Advertising Platform, Cloud Platform, Industrial Platform economy 4.0, Product Platform and Lean Platform*) with real business cases. In last chapter instead there will be the full implementation of a platform model together with the new technologies of internet of things in an healthcare business case directed followed by me during my internship with KPMG team in Toronto. The platform model will have healthcare data framework that include: data gathered from traditional EMR sources integrated with CRM system and IoT platforms including cloud computing.

IITHESIS

1. The rise of the new technologies in business

1.1 Artificial Intelligence, history and applications

In this first paragraph we will try to define artificial intelligence (AI) following the most important historical milestones and of course trying to understand the most prominent subfields of this discipline: robotics, computer vision, speech recognition and natural language processing. Historically the memorable event in AI that captured the public's imagination was the designing of the intelligent program, Deep Blue, which beat Garry Kasparov, the Russian world chess champion, in a six-game tournament in 1997. The program, was developed by some former Carnegie Mellon University researchers hired by IBM and was named after the company's corporate and color "Big Blue". In any case, this victory, received great attention about what it meant for human supremacy over machines. Chess game was not a casual choice for IBM researchers, because was considered a game of intellectual achievement likely to resist to any attempt to automatization.[1] However the first use of the term "artificial intelligence "can be attributed to John McCarthy. He was assistant professor of mathematics at Dartmouth College in Hanover, New Hampshire, and can be considered the father of this discipline. In 1955 he described AI as "the process of a machine to behave in a way that would be called intelligent if a human were so behaving"[2]. He proposed with three other colleagues and more senior researchers a summer conference based in Dartmouth in 1956 on the topic, on the idea that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer. The original conference funding the proposal to the Rockefeller Foundation stated, "The study is to proceed based on the conjecture that every aspect of learning or any other feature

[1] Feng-Hsiung Hsu,Behind Deep Blue: Building the Computer That Defeated the Word Chess Champion(Princeton, NJ: Princeton University Press, 2002)
[2] J.McCarty,M. L. Minsky, N. Rochester, and C. E. Shannon, "*A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence"* 1955,

of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problem now reserved for humans, and improve themselves"[3]. McCarty and many Dartmouth colleagues were deeply interested in symbolic logic, the branch of mathematics that that deals with representing concepts and statements as symbols, then defines various transformations to manipulate these symbols to reason deductively from hypotheses to conclusions or vice versa inductively from conclusion back to hypothesis. For instances "Socrates is a man" and "All men are mortal" you can formally derive the statement "Socrates is mortal".[4] Placed in this historical context, Dartmouth conference could be seen as an attempt to expand the use of computer beyond crunching numbers and processing data to manipulating symbols. McCarty himself after that conference went on to design several innovations in the field, most notably the programming language LISP, which stood for "list processing"[5]. LISP is a very remarkably functional programming language. It is not an imperative programming language like C, C++, Python, R, Basic. In LISP you can express all things as function computation. After the Dartmouth conference, interest in the AI field grew very quickly. Researcher started to work on different tasks, from proving theorems to playing games. Allen Newell and Herbert Simon (who later won a Nobel Prize in economics) created the Logic Theory Machine, proving most of the Theorems of Whitehead and Russell's 1910 formalization of mathematics, Principia Mathematica[6]. A few years later, the same team built the General Problem Solver, which was designed explicitly to mimic the observed behavior of human subjects in trying to solve logic and other problems.[7] Another important contribution was given by Arthur Samuel's checkers player in 1959.[8] This impressive program showed to the world the idea that a computer could be programmed to learn to play a game better than its creator. It could improve its performance by playing against itself to

[3] *ibidem*
[4] Kaplan.J.,*Artificial Intelligence.What everyone needs to know,* Oxford,Oxford University press,2016
[5] *ibidem*
[6] Allen Newell and Herbert A.Simon, *"The Logic Theory Machine: A Complex Information Processing System*",June 15,1956, report from the Rand Corporation, Santa Monica,CA
[7] Allen Newell and Herbert A.Simon,*"GPS: A Program That Simulates Human Thought," in Lernende automaten,* ed. H. Billings (Munich: R.Oldenbourg,1961),109-24
[8] Samuel Arthur*,"Some studies in Machine Learning Using the Game of Checkers"*,IBM Journal 3, no 3(1959):210-29

practice and eventually reaching advanced amateur status. Another development that illustrated the significant progress was made by Terry Winograd's MIT PhD thesis. His demonstration program named SHRDLU after the second column of letters on a typesetting machine, answered questions in natural language(plain English) and moved blocks around in a virtual world.[9]This important work contributed to several progress in syntax, semantics, question answering, dialog, logic, knowledge representation and computer graphic to create an amazing display of apparent machine intelligence, maintain the Dartmouth promise that we might soon be able to engage in dialogue with computer as intellectual peers. Another important progression on the other hand took place around the 80s; a new class of systems, called at the time "expert systems" or "knowledge systems, "arose. The idea was to capture and duplicate scarce human expertise in a computable form, in the hope of making this capability available more widely and inexpensively. Generally, the expert systems were highly specialized or, better saying, "domain specific". These computer programs deconstructed tasks requiring expertise into two components: the "knowledge base"(a collection of facts, rules, and relationship about a specific domain of interest represented in symbolic) and a general purpose "inference engine" that described how to manipulate and combine these symbols. Representing the facts and rules explicitly had the advantage that the systems could be more easily modified as new facts or knowledge were incorporated.[10]If we go behind the historical side of the expert system, the idea of capturing expertise in "if-then" rules dates back at least to the seventeenth century BCE, when an ancient Egyptian papyrus scroll codified the knowledge of surgeons in this form. This document was found and purchased by a collector and dealer Edwin Smith from a Luxor curio shop in 1862 but lay unnoticed until it came to the attention of archeologist J.H. Breasted of the Oriental Institute of the University of Chicago who translated into English from the original hieroglyphics in 1930.[11]Several companies in the early 1980s were created, mainly by academics and researchers in AI, to sell expert systems products and services. These startups typically offered software packages called "inferences

[9] Terry Winograd, *"Procedures as a Representation for Data in a Computer Program for Understanding Natural Language"*, MIT AI Technical Report 235,February 1971.
[10] Kaplan.J.,*Artificial Intelligence.What everyone needs to know*, Oxford,Oxford University press,2016
[11]https://oi.uchicago.edu/research/publications/oip/edwin-smith-surgical-papyruse-volume-1-hieroglyphic-transliteration

engines" and related knowledge engineering consulting services to commercial and governmental organizations wishing to capture and better utilize the capabilities of their own experts. Today there are several mature examples of Expert Systems, such as the Blaze Advisor business rules management system from FICO, but it is not considered anymore an active field of research in AI.[12] The symbolic system approach instead is still alive, in a subfield of AI research called PLANNING, which is concerned with developing techniques to address problems that require formulating a series of steps to accomplish some desired goal. Examples include giving driving directions, playing games, packing odd-sized boxes into a truck, proving mathematical theorems, analyzing legal contracts and regulations, cooking recipes, laying out transistors on computer chips, assembling equipment, describing regulations and rules in computable form, and controlling air traffic. The common element of these challenges is that there is usually known initial state, one or more desired final states, a specific set of operations or "movers" available to proceed from initial to final state(s). Some measure of the value of a solution is minimizing the number of steps required. The problem in symbolic inference systems is that the number of possible sequences of steps that can be very large (called a "combinatorial explosion"), so you can't simply examine all options, consider as an example the game of chess. Except for some probabilistic techniques, most planning system engage in symbolic inference enhanced with the so called heuristic reasoning. Heuristic are algorithms without provable performances that attempts to reduce the space to manageable dimensions using a variety of approaches. For example the incremental approach is called greedy heuristic; in every step select the action that gives you the most immediate gain. Planning techniques are used in other active field of AI General such as "general game playing". A program is presented with a set of rules for playing a game that it has no previous knowledge of but is told nothing at all about how to play it well. Then it must figure out its own playing strategies by reasoning about what's likely to work well.[13]Other common planning application that use heuristic could be found in providing directions in navigation programs and what we call nonplayer characters (NPCs) in computer games. Planning systems, and

[12]http://www.fico.com/en/latest-thinking/product-sheet/fico-blaze-advisor-business-rules-management-product-sheet.

[13] http:// games.stanford.edu. The General Game Playing website of Professor Michael Genesereth of Stanford University's Logic Group

more generally the symbol systems approach, are what today are called "Good Old-Fashioned AI," or GOFAI. In general, symbolic reasoning is more appropriate for problems that require abstract reasoning, while machine learning is better for situations that require sensory perception or extracting patterns from noisy data.[14]AI today then can be seen as a set of tools for computing a variety of useful classes, that represent information extracted from raw input data, and use associated algorithms to "solve" specific tasks. It's all about models (i.e., representation), probability,statistics,optimization, and algorithms. This discipline however is generally divided into a number of subfields that require different tools or skills to solve many practical problems. We will go through some of the most esteemed ones in the field: robotics, computer vision, speech recognition and natural language processing. Robotics relate to building machines that can perform physical tasks. However the major challenge of robotic research in AI is to build devices that are capable of general classes of tasks, capable of handling a wide variety of shapes, size, weights, and fragility.[15]Environment then become an important variable because is dynamic and change frequently, meanwhile AI technology needs to enable robots to work where people can't. We are talking about all sort of tasks that are too dangerous or costly for people to do. These operations could be referred to mining or farming the sea bottom or the space, eliminating agricultural pests by targeting them with insect-specific mechanical predators, or cleaning up industrial accidents. However even more social issues such as eldercare is another area of active robot research, motivated by the demographically driven aging of many western societies. Practical efforts in this case are focused on specific tasks, like ensuring that patients take their medication or help them to move from bed to a wheelchair. In contrast, to some other, and more clear-cut applications of AI,robotics goes from simple devices that perform rote actions (as are common in factories) to complex systems that sense and gather data from their environment. Now we move to another relevant subfield: "computer vision". Computer vision is focused on equipping computers with the ability to "see", meaning interpreting visual images. Work in this field is has paralleled the transition from symbolic systems to machine learning, this more

[14] Kaplan.J.,*Artificial Intelligence.What everyone needs to know,* Oxford,Oxford University press,2016
[15] Bruno Siciliano and Oussama Khatib,*Springer Handbook of Robotics*,New York, Spring Science+Business Media,2008

modern approach often specialized types of neural nets(called convolutional neural nets, or CNNs) to build models of objects from large collections of examples. Early efforts were focused on crafting algorithms that used specialized knowledge of visual images More precisely, CNNs look for patterns in small, overlapping sections of an image, then can spread what they learn first to neighboring sections and then to progressively larger regions of the image. Using these techniques, recent progress in the field has been quite rapid.[16]Accuracy on the annual ImageNet Large Scale Visual Recognition Challenge, whose goal is to detect two hundred types of objects and localize them in 150,000 photographs containing a thousand object categories, has increased dramatically. Error rates are in rage of 5 percent, down from several times that only a few years ago.[17]The contest now is expanding to the identification of objects in videos. Video alone is projected to comprise 84 percent of all Internet traffic by 2018, according to a recent industry study.[18]The problem is that unlike textual data, which we can interpret electronically for purposes of cataloging and retrieval, we have no way to manage pictures and video unless they come labeled at the source or categorized by a human. However computer vision techniques offer the promise to manage all this automatically. Face recognition programs are already used for purposes as diverse as national security to flagging your friends in Facebook pictures. But soon the ability to interpret and label images will expand to include nearly every recognizable object, event, product, person or scene that you may care to inquire about. Computer vision technology may arrive just in time to help us in this sea of our own visual information.[19]Another subfield of AI is speech recognition which is considerably more difficult than processing written language. In a large part because of the variability and noise in audio stream of spoken language. Separating the "signal" from the "noise", and transcribing into the proper written words it's a hard task as well as understanding the break between them. Considerable meaning is also covered by how you vary your volume and tone. Most early speech recognition efforts attempted to simplify the task by limiting the vocabulary, operating in a simplified domain (like playing chess), requiring the speaker to pause between

[16] Kaplan.J.,*Artificial Intelligence.What is robotics?,* Oxford,Oxford University press,2016
[17] http://www.image-net.org
[18] Marina Lopes,"Videos May Make Up 84 Percent of Internet Traffic by 2018:Cisco,"Reuters,June 10,2014,http://www.reuters.com/article/us-iternet-consumers-cisco-systems-idUSKBN0EL15E20140610
[19] Kaplan.J.,*Artificial Intelligence.What is computer vision*?,Oxford,Oxford University press,2016

words, and either designing for a specific speaker or requiring extensive training sessions(for both the human speaker and the machine).[20]In 2009, a group of researchers at the University of Toronto collaborated with IBM Research to apply machine learning techniques to the problem, reducing error rates by a remarkable 30 percent. The improved results found a key use in smartphones as an alternative way to issue commands and enter data.[21]Once again a combination of more powerful computers, access to large amounts of training data, and machine learning techniques facilitate the solution problem. The utility of this technology for limited domains is quite impressive, for example, in Google Voice and Apple's Siri, or their home assistant version Amazon Echo and Google home.[22]Lastly we will go through computer languages; they are designed essential for one purpose: to program computers in a precise and unambiguous way. Programs that process computer languages, called compilers, are formal methods for converting a more abstract but nonetheless rigorous specification of some computational process into a form that can be executed on computing device. While earlier approaches required the hand crafting of rules, the new approach, based on statistical machine learning method, mainly required access to large bodies of text, known as "corpora" which are becoming easier to gather as more written language was available in computer readable form. Problems that occurred in field were related on practical significance, such as translating text from one language to another, generating summaries of documents, or answering questions, usually from a database of facts about some area of interest. For example taking the focus on translation, the advantage is that you can start with pairs of correctly translated text to learn from, with limited need for other form of knowledge or information about the subject matter. By automatically finding correlation between the source and target examples, statistical machine translation programs can learn not only the underlying structure of the input samples but how these correlate with the correct translation in the output samples.[23]One of the relevant accomplishment of modern AI is finding correlations between enough examples and

[20] D.R. Reddy,L.D. Erma,R.O.Fennel,and R.B. Neely,"The Hearsay Speech Understanding System: An Example of the Recognition Process",Stanford,CA,1973
[21] Jhon Markoff,"Scientists See Promise in Deep-Learning Programs",New York Times, November 23, 2012,
[22] Kaplan.J.,*Artificial Intelligence.What is speech recognition* ?,Oxford,Oxford University press,2016
[23]ibidem..*What is natural language processing* ?,Oxford,Oxford University press,2016

discover relevant insights allowing the machine to solve problems at human level, with no deeper understanding or causal knowledge about a domain. Not all the subfields of AI proceed at the same pace, in part because they build on progress in other fields. Sometimes a new algorithm or new concept inspire significant progress, or some advance in computing, storage, networking, data availability or communication and leveraging advances in hardware and software opens the opportunity to develop new AI techniques. On the other hand machine learning instead is moving quickly because the data available for training in digital form is rapidly expanding. Artificial intelligence is giving companies the ability to match information about their products with the information of the prospective buyers giving them what they need at the moment they looking for it and in a format they are most likely to consume it effectively. Unfortunately, AI with the new tech advances is accelerating the substitution of capital for labor, income inequality is already a pressing social issue, and it's going to get worse.

1.2 The machine learning revolution

In this paragraph we will go through the machine learning paradigm starting from a brief history, understanding how it works through the neural network structure and of course the major practical applications in a supervised and unsupervised learning environment. This discipline was taken seriously by important researchers around the late 1980s and early 1990s, but it dates to at least 1943, when Warren McCulloch neurophysiologist and Walter Pitts mathematician, at the University of Chicago observed that a network of brain neurons could be modeled by, of all things, logical expressions. They discovered that there is a digital signaling in the brain despite the soft consistency and wet and gelatinous masses. According to their hypothesis the signaling seemed to be binary.[24] However several following researchers continued from that initial result, an important contribution was given by Frank Rosenblatt of Cornell. He implemented his own implementation of an artificial neuron as a perceptron gaining lot of consideration not only from the academic world.[25]A perceptron is a type of a neural network organized into layers where each layer receives connections from units in the previous layer and feeds its output to the units of the layer that follow. Rosenblatt's hypothesis and works were known to some of the participants of Dartmouth conference. Especially to one of is mate at Bronx High School of Science was Marvin Minsky, who is considered one of the most opponent of Rosenblatt's theories. He was in favor of a totally different approach to AI. In 1969 Minsky with his colleague Seymour Papert at MIT, published a book called *Perceptrons* in which they discredit Rosenblatt's hypothesis. According to their hypothesis the network has at most two layers. This theory based on perceptions and artificial neural networks remained for more than a decade. Indeed, the area of deep learning, refers to the use of artificial neural networks that have many internal layers (referred to as hidden layers) became very popular. Deep learning is considered a major area of interest in machine learning and includes all the methods that are used to train models with several level of abstraction from raw input to the output.[26]After

[24] Warren McCulloch and Walter Pitts, "*A Logical Calculus of Ideas Immanent in Nervous Activity*",1943
[25] "New Navy Device Learns by Doing:Psychologist Shows Embryo of Computer Designed to Read and Grow Wiser,"*New York Times,* July 8, 1958
[26] W.Daniel Hills,*The Connection Machine,MIT Press Series in Artificial Intelligence*,Cambridge,1986

those studies and publications there was a new data centric approach to AI with several novel computational techniques that seem to mimic certain aspects of human brain. The field of Machine Learning seeks to answer the question, “How can we build computer systems that automatically improve with experience, and what are the fundamental laws that govern all learning processes?. The learning issue is central in understanding the shifting of mentality on this discipline. Generally to solve a problem on a computer, we need an algorithm. An algorithm is a sequence of instruction that are carried out to transform the input to the output. The input is a set of numbers and the output is their ordered list. For the same task, there may be several algorithms and we could be interested in finding the most efficient one, the one requiring the least number of instructions, memory or both. But there are many applications for which we do not have algorithms but just large amount of data. For example consumer behavior or differentiating spam emails from legitimate ones. Doing data mining and extracting pattern is essential for the learning process. Machine learning is programming computers to optimize a performance criterion using example data or experience. To get a feel of the innovativeness of the modern machine learning we should understand deeply the neural network approach. This theory is based on the brain structure or else a homogeneous mass of cells called neurons, which interconnect with each other through synapses that send and receive electrical or chemical signals. Neurons in an artificial neural network are organized into a series of layers. They simulate the behavior of neurons as individual elements in their programs, then develop techniques for connecting them up and studying the results. The neurons organized into a series of layers are connected at each level only to those at the level above or below them in the hierarchy. The interconnections are modeled as numeric weights and learning algorithms adjust the connection weights between neurons.

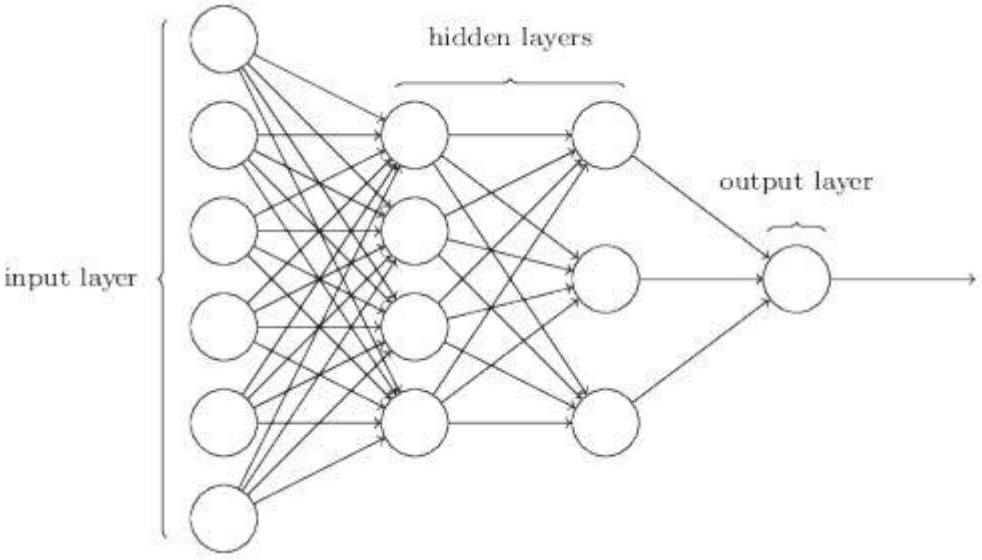

Figure 1.2 a Artificial neural network graphical representation

In the training set generally the supervisor define certain neurons in the network as inputs with their corresponding correct output values. Indeed if two neurons are active at the same time the weight between two neurons get reinforced and the synaptic weight effectively learns the correlation between the two neurons. However the learning algorithms guarantee by doing small updates on the connection weights as we see training instances one at a time.[27]

[27] Ethem Alpaydin,"Machine Learning",MIT Press,Massachusetts Institute of Technology, 2016

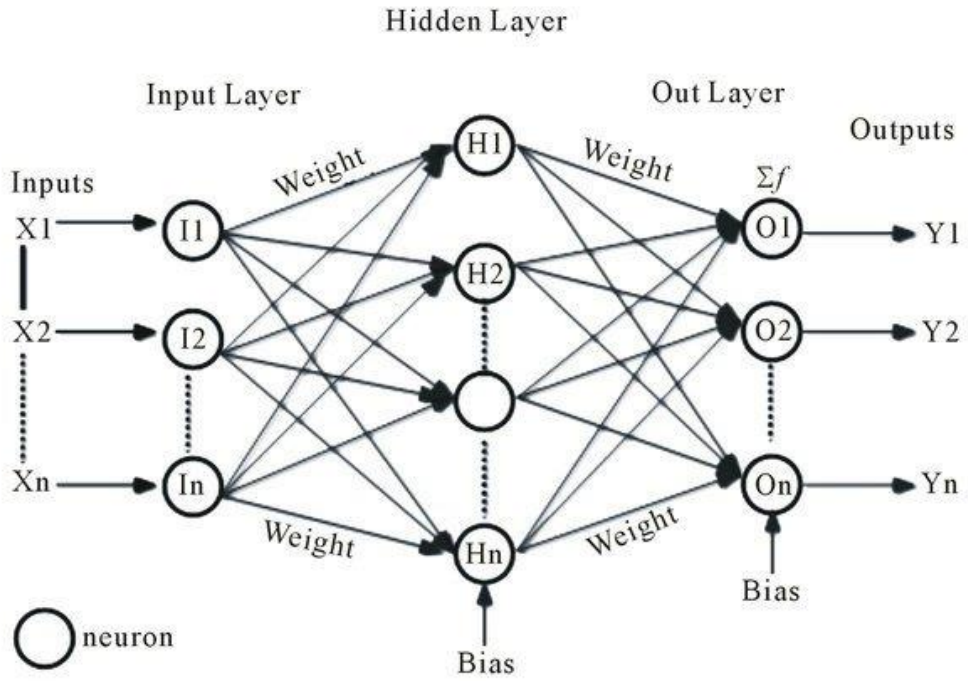

Figure 1.2 b Artificial Neural Network weights equation

On the application side you might think about training the artificial neural network in a "supervised learning" or "unsupervised learning "environment. Supervised learning is a type of machine learning where the model learns to generate the correct output for any input. The model is trained with data labeled by a supervisor who can provide the desired output for a given input. If the labels are numerical, then it is a regression problem; if the labels are categorical, then it is a classification problem. Regression predicts an outcome variable or dependent variable by using a set of independent variables the model is built on the following equation:

$$y^i = \beta_0 + \beta_1 x_1^i + \beta_2 x_2^i + \ldots + \beta_k x_k^i + \epsilon^i$$

y^i = dependent variable (wine price) for the i^{th} observation
x_j^i = j^{th} independent variable for the i^{th} observation
ϵ^i = error term for the i^{th} observation
β_0 = intercept coefficient
β_j = regression coefficient for the j^{th} independent variable

Figure 1.2 c Multiple linear regression model with k variables

The best model selects coefficients to minimize SSE(Sum of Squares due to Error). An example to show the variety of opportunities were this model can be implemented is the famous experiment conducted by Orley Ashenfelter, a Princeton economics professor in 1990. He claims that he can predict wine quality without tasting it. The wine under analysis is the famous French Bordeaux. For this product there are large differences in price and quality between years, although wine is produced in a similar way, so it is hard to tell if the product will be good when it is on the market. Only specialist like wine expert by tasting the wine can predict if the price that year would be higher or lower. Ashenfelter took the challenge and he considered as:

- Dependent variable: typical price in 1990-1991 wine auctions (approximates quality)
- Independent variables:
  - Age – older wines are more expensive
  - Weather
  - Average Growing Season Temperature
  - Harvest Rain
  - Winter Rain

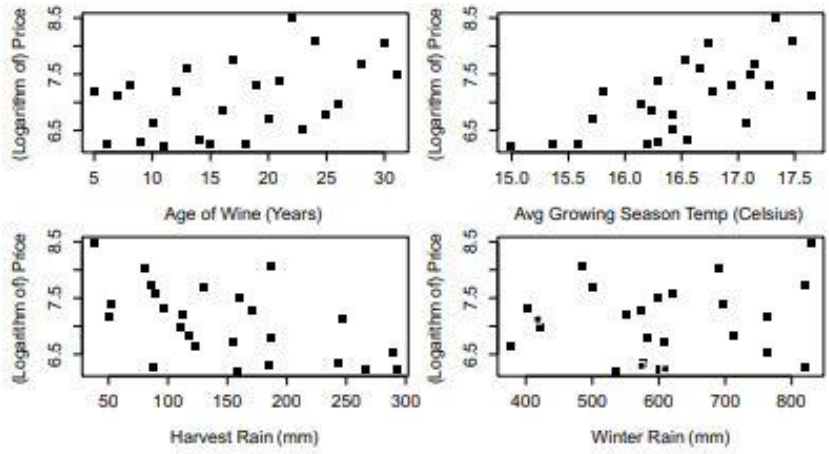

Figure 1.2 d Ashenfelter considered data from 1952 to 1978

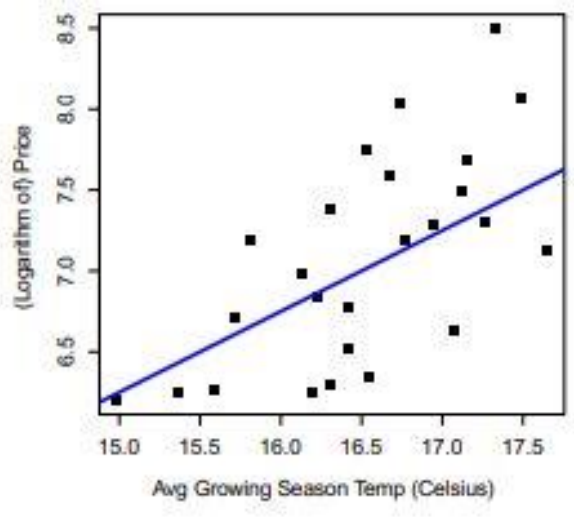

Figure 1.2 e Ashenfelter tried to select the best models

Robert Parker a famous world wine expert in that occasion considered Ashenfelter's hypothesis ridiculous and in that occasion predicted that the 1986 Bordeaux wine was very good to sometimes exceptional. On the other hand, Ashenfelter with his model said that the 1986 Bordeaux wine was mediocre. However he made the prediction that the 1989 Bordeaux would be the wine of the century and the 1990 Bordeaux would be even better. In wine auctions, the 1989 Bordeaux wine sold for more than twice the price of 1986 and the 1990 Bordeaux wine sold for even higher prices. Later, Ashenfelter predicted that the 2000 and the 2003 Bordeaux wines would be great. But in this case, Robert Parker stated the 2000 is the greatest vintage Bordeaux has ever produced, in agreement with Ashenfelter. In the end he has developed is a linear regression model, by using few variables for predicting quality of wines and it worked quite precisely. In a traditionally qualitative problem the analytics approach that uses data to build a model to improves decision making worked effectively. If the model is labeled with categorical data, we are talking about a classification problem. Classification is another type of supervised learning where the output is a class code, as opposed to the numeric value we have in regression. A class is a set of instances that share a common property. To better understand classification we can go through its application in credit scoring. It's crucial for financial institution such as a bank, to calculate in advance the risk associated with a loan. All the information related to the client need to be considered the evaluate the overall risk. The information can

include: income, savings, collateral, profession, age, past financial history and so on. Indeed in the calculation of the score of the customer, each thousand dollars of debt decrease the score of X points and each thousand dollars in salary increase the score by Y points. In the end there will be two classes of customers low risk and high risk. In terms of classes the 2 groups will share the same characteristics called discriminant. The form of the if-then rules defines the discriminant for example:
IF income < X AND savings < Y then high risk ELSE low risk
One way to better understand this rule is the decision tree.

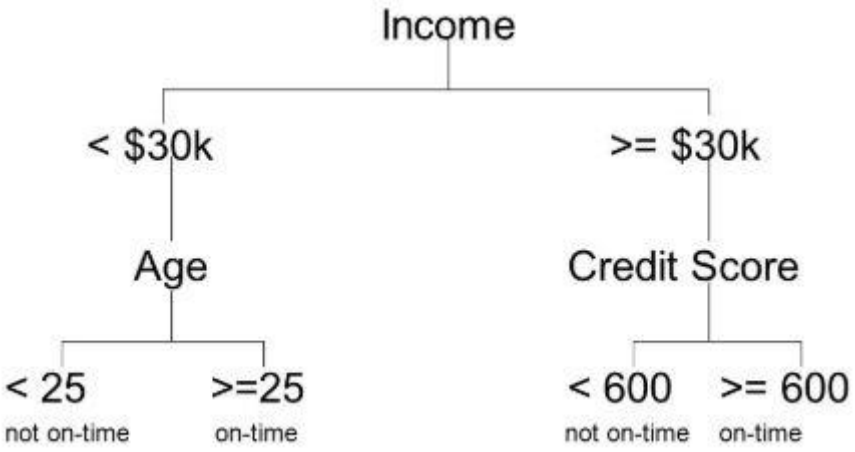

Figure 1.2 f Credit scoring decision tree graphical representation

The decision tree finds the most similar training instances by a sequence of tests on different input attributes. Nodes and leaves compose the tree, starting from the root each decision node applies a splitting test to the input and depending on the outcome we take one of the branches. When we get to a leaf the search can stop so we can understand if have found the most similar training instances. There are different decision tree models and learning algorithms, one well known is the random forest, where we train many decision trees on random subsets of the training data and we take a vote on their predictions. Trees are used successfully as basic benchmark methods before any more complex learning algorithm is tried. On the other hand artificial neural network in a “unsupervised learning “environment, we have no predefined output and so no supervisor, just the input data. The aim in unsupervised

learning is to find homogeneity in the input data and so recurrent patterns. One practical method for unsupervised learning is clustering in which the objective is to find clusters and so grouping the inputs. For example from a company perspective understanding the profile of its typical frequent customers is essential. The customer data can include demographic information, such as age, gender, zip code all the past transaction and so on.

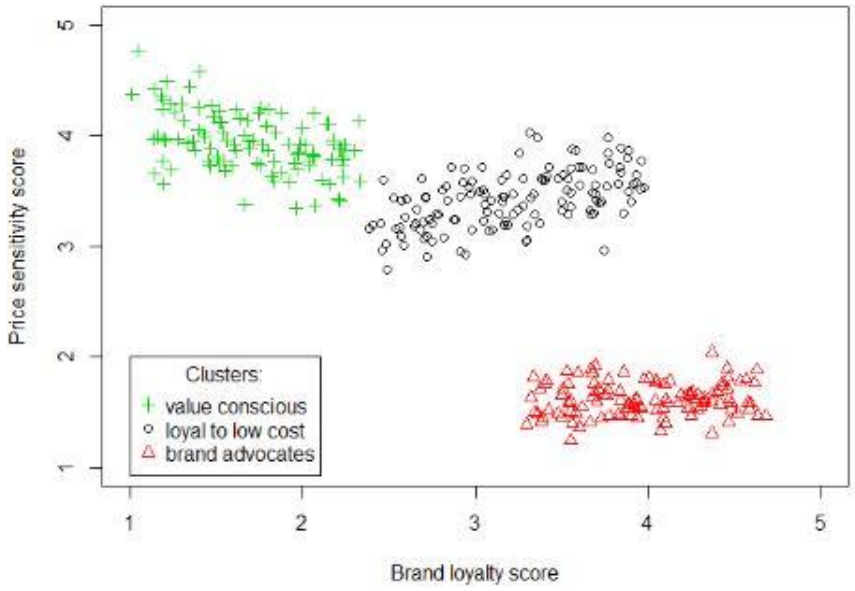

Figure 1.2 g Example of clustering for customer segmentation

Clustering model allocates customers similar in their attributes to the same group, providing the company with a precise customer segmentation reducing the size of large data sets. As matter of facts companies can decide different product or service strategies to specific groups, this is known as customer relationship management (CRM). However important distinction needs to be done between hierarchical and partitional sets of clusters:

Partitional clustering; a division data objects into non-overlapping subsets (clusters)such that each data object is in exactly one subset

Hierarchical clustering; a set of nested clusters organized as a hierarchical tree

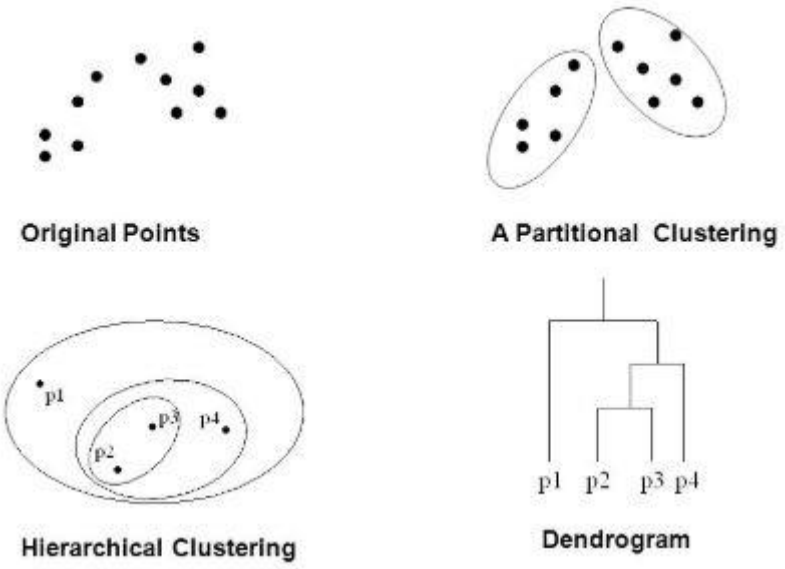

Figure 1.2 *Partitional and Hierarchical clustering graphical representation*

Unsupervised learning is an important research area because the its major aim is to find structure in unlabeled data. This kind of data is a lot easier and cheaper to find. IDC (International Data Corporation) estimates that by 2020, business transactions on the internet business-to-business and business-to-consumer will reach 450 billion per day, and together with IoT technologies this number will even increase. Machine learning has already proven to be a reliable technology, experts consider it as the new AI because its application in different domains are increasing every day. The trend of developing methods that can automatically detect patterns in data, and then to use the uncovered patterns to predict future data or other outcomes of interest is central now in companies and has no limits of expansion.

1.3 Internet of things and the digital ecosystem

In this paragraph we will analyze the technology behind internet of things (IoT) going through the historical major development. Later collocate IoT in a framework together with artificial intelligence and machine learning(describing all the components of the digital ecosystem). Finally understand the most important sectors of application. Internet of things could be seen as network of interconnected objects able to collect and share information through internet. IoT is a hot topic nowadays thanks to the digital innovations and the several applications in different fields. Web had different growing phases that allowed users to better interact thanks to technologies such cloud and mobile computing. However the first time that the idea of connecting an object capable of transmit information relating to its activities came up around the 1980s. In 1982 at Carnegie Mellon University there was a coke vendor machine capable of sending real time data on the number of cans once they have reached the proper temperature.[28] Another interesting experiment took place year later, precisely in 1990, when John Romkey together with Simon Hackett worked on a prototype of toaster capable firstly of regulating the cooking temperature remotely from an application connected to internet and later a new version was able to insert a slice of bread(instead of do it manually) with the same connected system as well. During the 1990s the major technological contribution to Iot was given from RFID sensors capable of sharing the collected information to internet. However the first time someone used the definition "Internet of things" was in 1999 when Kevin Ashton a British engineer. He was working as an assistant brand manager at Procter & Gamble and during a company presentation he came out with the idea of using RFID sensors to collect information through internet and improve supply chains and reduce waste losses and costs.[29] The concept of IoT is revolutionary because give to digital brains (computers) the capability of having sensors and gather information on the real world without any data insert by man. The RFID technology and all the other sensors and devices that allow to automatically gather data from real events are the basic sense organs of the digital systems. RFID stands for Radio-Frequency-

[28] https://www.cs.cmu.edu/~coke/
[29] https://autoid.mit.edu/

IDentification, this technology allows to identify and memories information concerning people and objects. The innovative point is based on the capacity of memorizing data through electronic labels (called tag) and on the ability that they must transmit it with airwaves if arouse from devices called reader. Charles Walton an American inventor, patent a device with the acronym of RFID in 1983.[30]However the main differences with RFID devices is related to the tag; you can have active tag or passive tag. Active ones have battery and they can send and receive answer with a range of action not less than 200 meters. The second instead are without battery indeed has a smaller range of action and is activated when the reader send the airwave. Tags are widely used in shops to identify clothing at the cash register in substitution to the bar code. Most important is that they can record the information collected and store it into the informatic system of the shop. Nevertheless in the last years NFC, that stand for Near Field Communication, an evolution of the RFID,widespread. It provides short-range bidirectional wireless connectivity up to a maximum of 10 cm.[31]You have two devices: the initiator and the target; when they interact with each other within a distance of 4 cm, a network peer to peer is created and both can send and receive information. One practical application is the so called contactless smartcard that is used in public transportation or credit cards payments. Another important innovation that contribute to IoT development are the 2D(two-dimensional) barcode but we will focus on the QR code that has become the most widespread.[32]It was designed at begging of the 1990s by Denso Wave (Toyota group) with the aim of improving the production process, labeling motor vehicles and other components. Indeed it was thought to decipher information rapidly through all the supply chain. It has been renamed quick response code, differently from the other 2D codes, it is capable to encode inside it a greater amount of alphanumeric codes and has more resistance to alterations in images.[33] RFID, NFC and barcodes allow to detect the presence of an object / subject in a precise location together with read and share related information. On the other hand positioning system and GPS(Global Positioning System) receiver thanks to the interpretation of the information received from airwaves transmitters a or satellite system they can

[30]http://lemelson.mit.edu/resources/charels-walton
[31] http://www.techradar.com/news/what-is-nfc
[32] http://www.qrcorde.com/en/
[33] Furth,B.(Ed.).(2011). *Handbook of augmented reality.*Springer Science & Business Media

determine the position occupied within a space circumscribed relatively to the terrestrial globe. Currently besides the localization of the objects there are device that can detect information on dimensions that surround it. Sensors and transducers are able, if configured and integrated into digital systems, to encode digitally physical dimension such as temperature, brightness air quality and so on. However there are several devices that are doing so in our daily lives: parking sensors in our cars, wearable devices as smartwatch or smart clothing that monitor heart rate blood pressure and body temperature.[34] Moving from the private sphere to the industrial one we have other several sensors and device that monitor all the supply chain. Noteworthy lastly web cameras and IP cameras which add other structured and unstructured data. We are not talking only about photos and videos but more complex tasks as face recognition.[35] All these smart objects and sensors capable of collecting all kind of data, are integrated in a digital ecosystem that store all this information and use it in a second period. Above all the possible configurations of IoT what comes out is the crucial part of analyzing all this huge amount of structured and unstructured data. The collected information needs to be analyzed and support business strategies together with the machine updating in all the supply chain. Together with the spread of IoT even data is increasing, that's why now we big data it's an hot topic not only in the research field. Connected with big data comes cloud computing that allow to use in a flexible way computational and memorizing capabilities to store all the information. In this framework we finally insert the fundamental role of machine learning algorithm that analyze become essential in defining the strategic decision on machine and people. IoT is just the tip of the iceberg, they are the sensors that gather data in the real environment for this digital ecosystem, cloud computing technology allow then to store it(big data) and with machine learning validate patterns and insight from it. We can't discuss these topics in silos everything can be connected in a framework.

[34] https//www.wareable.com/smart-clothing
[35] S.Za, "*Internet of things, Persone organizzazioni e società 4.0*",Luiss University press,2018

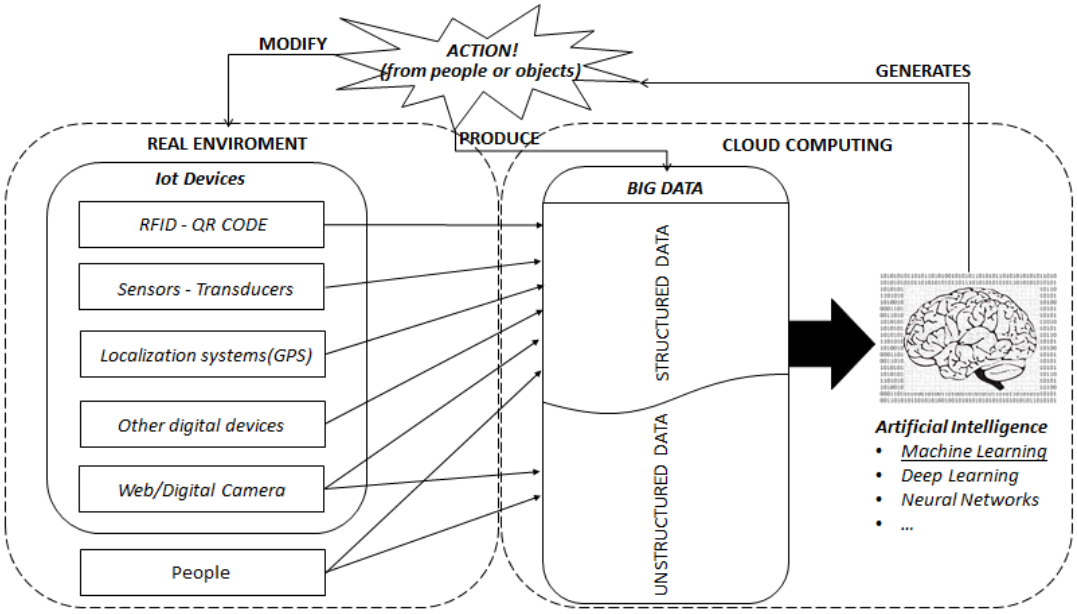

Figure 1.3 a Framework of the digital Ecosystem that incorporate Iot, Cloud Computing, Big Data, Artificial Intelligence and Machine Learning

In the first two paragraph we analyzed the technology behind artificial intelligence and machine learning in addition with Iot in this paragraph. However now we will try to go through the remain topics of this digital ecosystem framework, or else Cloud computing and Big data. When we talk about elaborate, store and memorize data thanks hardware and software resources spread in the network we are talking about cloud computing.[36] With cloud services is possible to have virtual computer capable of storing a certain amount of information, with capacity of transfer data and if needed well equipped with a good software suite. Indeed the system is customizable depending on the needs, increasing the computational ability and lowering then the storage capacity. The service, depending on these needs, is provided at a certain cost. Some common cloud examples are services such iCloud and Google drive, which they offer a virtual storage capacity (the "cloud") that can be used to backup files and share it. These are just some examples, but the main advantage is that companies can have computational resources in a flexible way without buy or do maintenance on a hardware, just have internet connection to access to the cloud. The digitalization of product and services (thanks even to cloud computing), the growth of the IoT devices, the increase of social media platforms have contributed to the production of

[36] http://www.kiteblue.it/cose-il-cloud/

huge amount of data. Big data is the marketing terminology to define this phenomenon, core central in the digital ecosystem framework as we described. The term "Big Data" first appeared in mid 1990s, introduced in tech circles, by the chief scientist of Silicon Graphics John Mashey, around the birth of the World Wide Web.[37] Authors agree that commonly data share four main characteristics: volume, velocity, variety and veracity; the so called 4V.[38] As concern volume and velocity we already defined with cloud solution the capabilities of collect store and immediate share this huge volume of data but to give a sense of the numbers we can discuss the results of the fifth edition of data never sleep related to 2017.[39] According to this report if we consider every 60 seconds data is recorded about: 250000$ of products bought on Amazon, 45000 Uber rides, 3.6 million of research on Google,450000 messages sent on Twitter , 150000 Skype Calls, 4 million YouTube video watched. This is just a small portion, but it connects to the concept of variety, so not only structured data such as numbers organized in a database, but lots of unstructured data like email, video, pictures audio and so on. However many sources of data describe an issue which coincide with the last big data characteristic, veracity. Indeed select the right sources and avoid the wrong one is crucial when managers develop their business strategies. On the other hand GrowthEnabler lately published an interesting report on IoT solutions. GrowthEnabler is a company founded in 2015 by ex-Gartner executives Aftab Malhotra and Rajeev Banduni has designed a series of algorithms that pretend to identify the world's most innovative and valuable startups from a wide range technologies, sectors, and locations. In this report they divided the principal sector of application of Iot in two macro areas: one relates to people(consumer segment) and one relate to companies(business segment).[40]

[37] Steve Lohr,"*The origins of "Big Data":An Etymological Detective Story*",New York Times, February 1,2013
[38] http://www.ibmbigdathub.com/infographic/four-vs-big-data
[39] https://www.domo.com/learn/data-never-sleeps-5
[40] https://www.growthenabler.com/flipbook/pdf/IOT%20Report.pdf

Consumer Segment	Business Segment
• Smart home • Wearable devices • Healthcare devices • Driverless Vehicles	• Smart city • Smart utilities & Energy • Healthcare • Iot Industrial • Proximity-based advertising

Figure 1.3 b Macro areas of Iot solution by GrowthEnabler

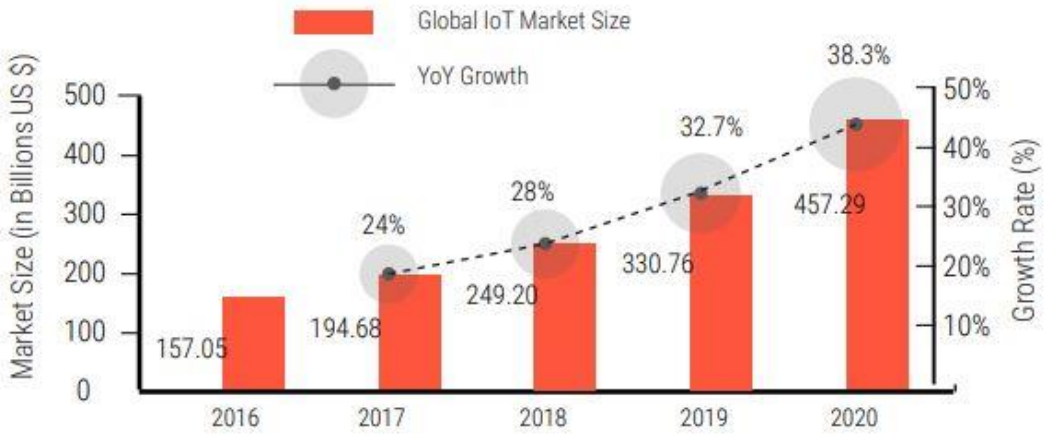

Figure 1.3 c IoT market size and growth forecast

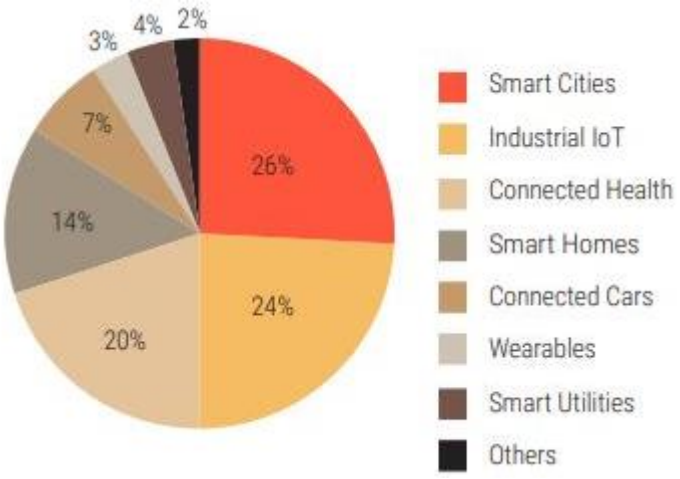

Figure 1.3 d Global IoT Market Share by Sub-Sector

On top of the Iot trends we find smart cities which is the evolution of internet of things in in public administration with 26% market share; followed by industrial IoT with 24% market share looking at the industry 4.0 phenomenon. With the term smart city we indicate an urban area that uses different types of sensors and devices for data collection, in order to support efficient and effective management. Usually data collected by sensors and devices around the specific urban area are integrated with those generated by citizens from their devices or other entities. These data are processed in real time to support and improve different functionalities or create new ones such as: monitoring and managing traffic in an intelligent way, as well as transportation systems, waste management, water supply networks, power plants, law enforcement, hospitals, schools, libraries, and other community services. This aims to improve the management of resources and the quality of services offered to citizens (such as punctuality of public transportation), in order to raise the general level of one's well-being (for example monitor the quality of air). For instance a case applied to traffic management in an intelligent manner is that of Queensland in Australia, with the aim of facilitating the passage of emergency vehicles. Fire trucks, ambulances and various emergency vehicles, if involved in rescue operations, always find green traffic lights along their route. The traffic lights are equipped with sensors able to detect the approach of the emergency vehicles and autonomously activate the green light to make the traffic flow. The system is the result of a project started in 2009 called "Emergency Vehicle Priority" EVP. The results are very satisfactory, in some cases intervention times were reduce up to 25%.[41] On the other hand industry 4.0 is a name recently coined in Germany in 2011 as part of a research project to emphasize a new evolutionary step in the industrial sector, identifying it as the fourth industrial revolution.[42]The fourth industrial revolution is a relatively young phenomenon and is mainly characterized by the integration and combination of four factors: the Internet of Things (IoT), cloud computing, cognitive computing and big data. CPS (cyber physical systems) are nothing else that the combination of these factors. In general, a CPS is a system composed of several elements distributed and

[41]http://statements.qld.gov.au/Statement/2017/8/31/emergency-vehicle-access-made-easier-thanks-to-new-traffic-technology

[42]M.Hermann,T.Pentek and B.Otto,*"Design Principles for Industrie 4.0 Scenarios",*2016,49th Hawaii International Conference on Systems Sciences(HICSS),Koloa,HI

connected through the network and are characterized by the fact that the digital component (cyber) and physical (physical) interact continuously.[43] Moreover the ability to use augmented reality features and the transfer of objects from the digital world to the physical world with the 3D printer should not be underestimated, because these two factors encourage interaction between the digital component and the physical component.[44] Smart industry is what is also called "Industry 4.0" , and is characterized by the combined use of all these technologies, with the aim of exploiting the potential of cyber-physical systems and efficiently controlling and managing the phases of the various processes. Through the IoT, cyber-physical systems communicate, interact and cooperate with the external environment as well as people. On the basis of the data collected, they are able to make decisions in real time and at a later stage support business strategy decision-making process performing different types of analysis.[45] Some examples of CPS are autonomous driving systems, drones, robotic systems, or even the smart grid (the combination of an information network and an electrical distribution network that allows the management of the electricity grid in intelligent ways)[46].For instance an Italian case in the energy sector is that of Enel green power for monitoring hydroelectric plants and regards preventive maintenance techniques. The possibility of predicting a malfunction and acting in advance helps to reduce costs significantly through the use of different sensors located all over the hydroelectric plant for detecting fundamental measures.[47]Information flows crate solutions can be used not only in support of managers decision making process (communication Machine to people) or even specific algorithms that can activate functionalities of other devices connected in the network (communication Machine to machine). A report published on MIT Sloan Management Review on a 8 years interviews to 1900 managers, business executives and analysts revealed interesting insights.[48]If we consider the statement related on the increasing of the amount of available data in companies, in 2017 the 77 % of respondents agreed with this trend. According to the capability of getting insights

[43] Khaitan,S.K.,& McCalley,J.D.(2014). Design Techniques and Applications of Cyberphysical Systems: A Survey. IEEE Systems Journal
[44]https://www.mckinsey.com/business-functions/operations/our-insights/manufacturings-next-act
[45] S.Za, "*Internet of things, Persone organizzazioni e società 4.0*",Luiss University press,2018
[46] https://it.wikipedia.org/wiki/Smart_grid
[47] https://www.enelgreenpower.com/stories/a/2017/IO/we-listen-to-the-voices-of-our-plants
[48] https://sloanreview.mit.edu/

from data to develop new business strategies in 2017, 49 % of the respondents managers declared that they daily do it to develop their business strategies.[49] This results are confirmed by another report published in 2017 from Harvard business review that gives deserve to IoT relevance for companies.[50] IoT plays a central role in the business transformation, but there is the need to manage all this data collected and exploit it in the best possible way. It essential for companies to a have proper data centric transversal business model to keep up with this digital era. The business model that perfectly integrates the digital ecosystem (IoT, Cloud Computing, Big Data, Artificial Intelligence and Machine Learning) is the platform, which will be in-depth analyzed in the second chapter. According to Cisco(worldwide leader in networking) by 2020 50 billion intelligent things will be connected to the internet, using microsensors on the network, everyday objects will become connected and intelligent and change dramatically our society.

[49] https://sloanreview.mit.edu/projects/using-analytics-to-improve-customer-engagement/
[50]https://hbr.org/sponsored/2017/0I/the-enterprise-lacks-a-big-data-strategy-for-iot-transformation

2. The new business model of the digital era

2.1 The Digital transformation is changing the major areas of business strategy

In this paragraph we will see how this digital environment is radically changing the constraints behind business strategies on the areas of: customers, competition, data and innovation. Digital technologies are redefining many principles behind business strategies and many old constraints and assumptions established before Internet need to be updated. When we talk about customers, companies have always used mass marketing tools always to induce them to buy as much as they can. With this market criterions customer were considered in a passive and aggregate way, their only role was to purchase or not, and companies just needed to identify and promote products or services suitable to the majority of them, always with efficiency of scale business model.

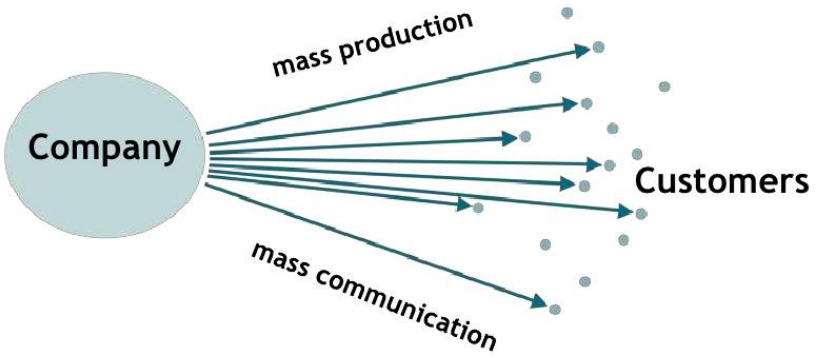

Figure 2.1 a Mass-Market model

The digital technologies collocated customers within a network where they interact in an active way in the market, with the companies, sharing and having access to much more information than before. In this virtual market network we can imagine customer as nodes, linked together digitally by various tools and devices, always connected, interacting and influencing with each other.

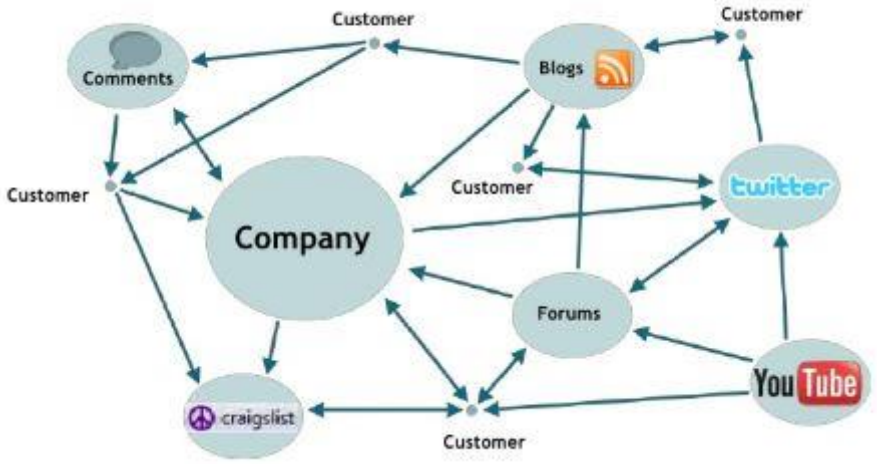

Figure 2.1 b Customer Network Model

Whit these new shapes markets are inevitably defined by customer networks, where companies needs to change their old role of just selling products and services. Indeed now firms need to engage with their customer network, understanding the interactions to meet their unmet needs. Nowadays every sector is facing this challenge of reshaping communications, products, or experience in order to add value to the business-customer relationship. Changing business strategies around customers it's a crucial step because networks are redefining the path to purchase. In addition to that customer are looking for integrated experience across all digital and physical touchpoints. Indeed an omnichannel approach is a multichannel strategy to sales that seeks to provide the customer with a seamless shopping experience whether the customer is shopping online from a desktop or mobile device, by telephone or in a retail physical store. What distinguishes the omnichannel customer experience from the multichannel customer experience is that there is true integration between channels on the back end.

If we analyze the new path to purchase we can clearly see this phenomenon:

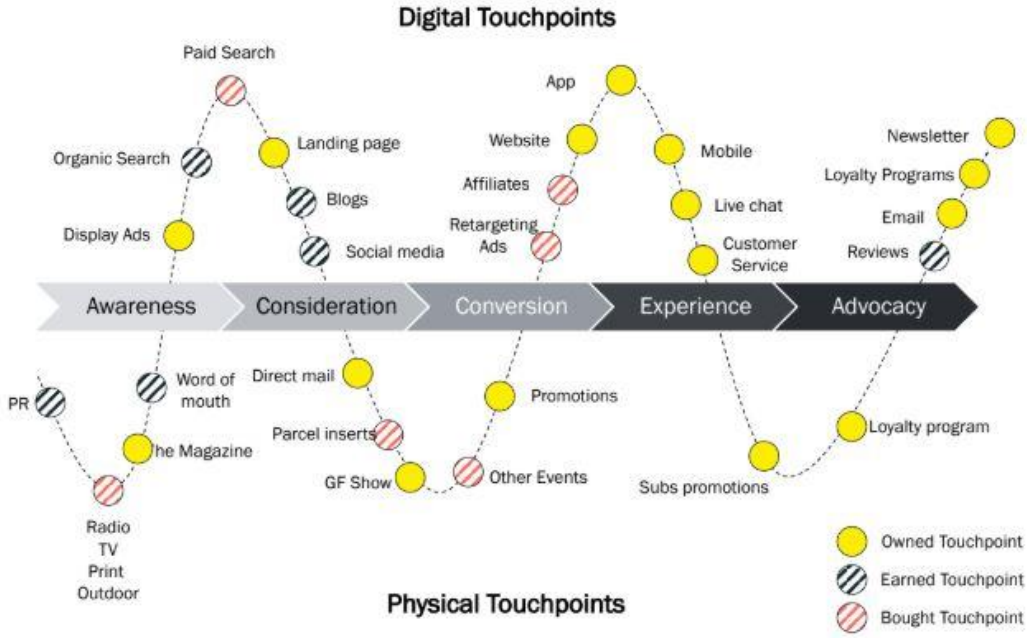

Figure 2.1 c The Demand Creation Path

Retailers used to be in control, but now the customer is 100% in control of when, where and from whom they buy and digital is enabling all this. So why does almost all of firms focus still goes on customer acquisition? According to Harvard business review a 5% increase in customer retention leads to a 25-95% increase in profit, so companies should implement their efforts in advocacy the last step of the path. Firms needs to engage, promote and inspire repeat customer to enter the stage of advocacy in order to contribute to the growth of the business. However at the same time should be present and drive the customer all over the path(for instance awareness with google AdWords tools, consideration implementing engaging social media campaigns ,conversion creating functional websites and app, experience both stores online and offline, and of course advocacy) only with a omnichannel strategy firms can succeed in the long period in this digital era. Relationship with individual customers are not the only one that are changing even the interactions between businesses are being similarly transformed. Competition is becoming more complex and interconnected. The focus is shifting because competition is happening more across industries and partners who count in profiting on each other, then less within industries and similar companies that try to replace each other. Indeed is having

positive feedbacks the logic of co-opetition a theory based on the use of insights gained from game theory to understand when it is better for competitors to work together. The aim consists in moving to a plus-sum game, a scenario in which the end result is more profitable when the competitors work together moving from a zero-sum game instead were the winner takes all and the loser is left empty-handed. This logic between business competitors is in the hope of mutually beneficial results otherwise winner takes all due to the network effects. Indeed we can agree on the fact that relationship with other companies have become networked and interconnected similarly to the relationship with customers described before. Both together, interaction with customers and businesses is producing a huge amount of data, that now can be recorded stored and analyzed in a short time and without high costs. As we discussed in chapter one, as sensors, networks, and computing become popular in different sectors, data will continue to grow and be available to businesses. The great challenge for firms is to treat data as an intangible asset that work as base for innovation and value creation. Develop a data strategy allow to test and optimize processes, learn and deliver more significant customer interactions, experiment and innovate on new products. Talking about innovation or else the process by which new ideas are developed, tested and brought to the market. In the past most of the decisions on launching of new products were based on basic market analysis and manager intuition and 95% of new innovation are always rejected by the market, so the cost of failure is high. In this scenario, digital approach allows very rapid experimentation through continuous data learning. With new sources of data firms can have customer feedbacks and validation on new ideas not only after the launch but all over the process, empowering R&D department to adjust the strategy on product during the way. In an economic environment were technology change as fast as people needs its crucial to have a data and customer centric business strategy. This attitude supported by the right technology in place can guarantee to continuously evaluate the business processes, identify changing in customer needs, understand which opportunities creates the base for innovation and consequently collaborate with the right partners keeping pression to the competitors in the market.[51]

[51] David L.Rogers.,"*The Digital transformation playbook",* Columbia University Press, New York,,2016.

2.2 The platform, the new business model of the digital era, framework and characteristic

In this paragraph we will clarify the platform business model, the one capable of integrate the digital ecosystem(that incorporate Iot, Cloud Computing, Big Data, Artificial Intelligence and Machine Learning) and a data customer centric business strategy described in previous paragraph. We will go through the origin of the platform theory and then understand the main characteristics of this model, figuring out why this model is the right one to face the current competition. In conclusion we will see the platform business model map with Facebook example. The origin of the idea of a platform as business model was designed by Jean-Charles Rochet and Nobel laureate Jean Tirole[52], together with Thomas Eisenmann, Geoffrey Parker, Marshall Van Alstyne founded using as starting point the two-side market theories.[53]Their hypothesis examines the case of a business that serve two different kind of customers dependent on each other, taking as variable pricing and competition. The results of the analysis showed that two kinds of customers dependent on each other have different price sensitivity and in efficient markets, one side support financially the other (For instance the credit cards transaction costs are covered by merchants for shoppers that use it their store). Authors extended the search boundaries and the two-sided markets theory turned out to have similar results in markets with more than two types of customers, bringing to the concept of multisided markets. In parallel even one of the starting variable changed, shifting from looking at the market dynamics(price in equilibrium with others) to focus more on core business and success factors of others. Considering the idea of a multi-sided market the business model that fit this idea of market is the multisided platform, or just platform. Businesses like Airbnb or Uber are perfect examples of the implementation of these economic theories. Therefore a shareable description of how we define a platform comes from the publication of Andrei Hagiu and Julian Wright. According to the two authors we can define a platform as business model that creates value by making

[52] Jean-Charles Rochet and Jean Tirole,*"Platform Competition in Two-Sided markets*",Journal of the European Economic Association,June 2003
[53] Thomas Eisenmann, Geoffrey Parker, Marshall Van Alstyne,*"Strategies for Two Sided Markets"*,Harvard Business Review, October 2006

easier a direct interaction between two or more different type of customers.[54] Going through the three main characteristics of a platform model we better clarify the definition given by the researchers. First of all a business model to be considered a platform needs necessarily to serve two or more distinct types of customers(for instance: software developers and consumers, buyers and sellers and so on).Bringing together different parties means contribute and receive different kinds of value. Secondly, the platform model allows a degree of independence or else direct interaction. For example in a platform like Amazon the two parties are free to create their own custom profile, set and negotiate pricing, and of course decide how to display and advertise their services or products. Lastly, is crucial for the platform growth, the interaction between parties must occur within the platform and needs to be facilitated by it. More the number of users increase the more value of the platform raise," network effects". If we would like to have a graphical representation of a business platform model a good analytical tool is the: "The Platform business model map". What is crucial to identify with this model is how all the parties exchange value among them to the strategy behind the platform business itself. As framework to have a benchmark we will take in example Facebook's business model displaying the various components.

[54] Andrei Hagiu and Julian Wright,"*Multi-Sided Platforms*",Harvard Business School,March 16,2015; Andrei Hagiu and Julian Wright,"*Marketplace or Re-seller?*"Harvard Business School,January 31,2014

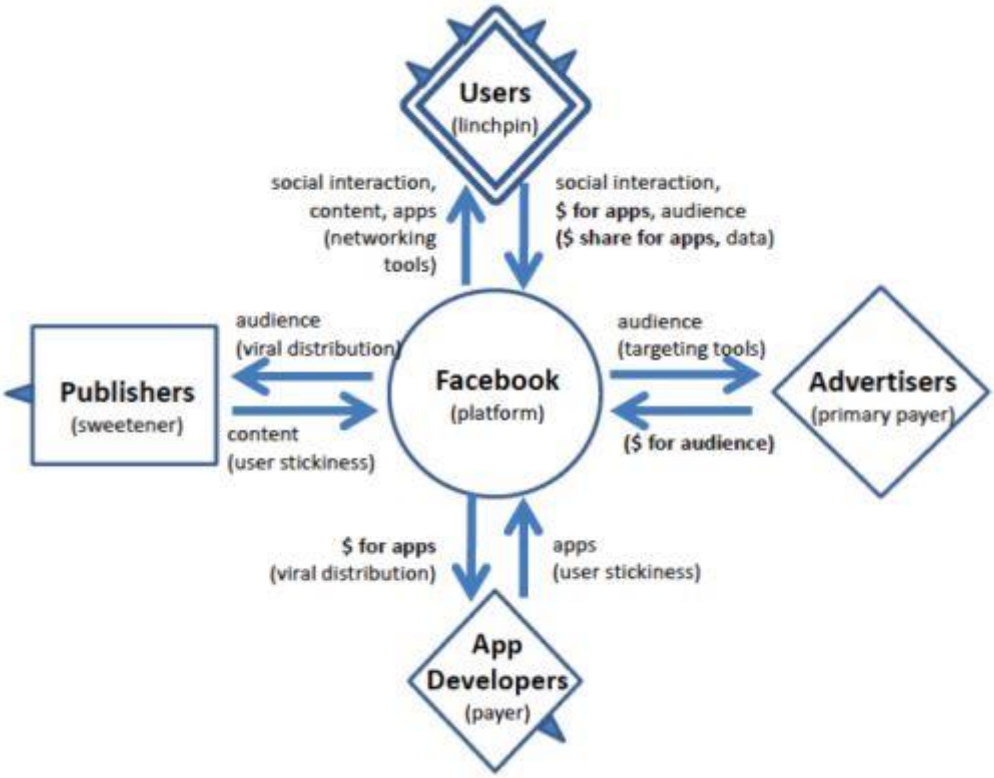

Figure 2.2 a the platform business model map: Facebook

If we consider the shape of the various part of the model:

- *Circle*: the platform
- *Diamonds*: the payers, customers that provides revenue to the platform
- *Rectangle*: the sweeteners, customers that provide no revenue but help to attract other valuable customers.
- *Spikes*: the number of other customers types that are attracted
- *Double borders*: the linchpin, the customer type with the most relevant network effect

Arrows instead indicate value exchange:

- Arrows in each direction show the value provided or received by each customer type.
- Value in boldface is monetary value

- Value in parentheses is provided by the platform itself or to the platform itself
- Value not in parentheses is passed through the platform and is provided to other customers

As we can see from this graphical representation, Facebook brings together for types of distinctive customers on its platform:

- social network users (they pay no fees, but they advocate other possible new users to join, allowing the platform to grow)
- advertisers (they are the primary source of profit of the platform)
- app developers
- new and content publisher(they provide no revenue, but mainly quality content for the platform and therefore for users)[55]

We have seen how platforms businesses relate with each other, there a significant shift from linear to networked business models. Indeed they try to build with new technologies networks were customers can interact with each other. As we have seen customers both provide and receive value rather than just simply paying for products and services received. The growing in the platform business model is guaranteed as more people interact and use it. Firms today are struggling to understand if undertake a platform business model strategy rather than a more traditional one, there is no right answer for everyone but in the next paragraph we will show the most common types of platforms with real businesses cases in order to have a clear picture of the market.

[55] David L.Rogers.,"*The Digital transformation playbook,The platform business model map: Facebook"* , Columbia University Press, New York,,2016.

2.3 The most important platform business models

In this paragraph we will go through the most relevant type of platforms business models: Advertising Platform, Cloud Platform, Industrial Platform economy 4.0, Product Platform and Lean Platform, with real business cases as example for each one. In the twenty-first century the technology needed to record and memorize data from simple business activities it turned to be cheap thanks to innovation. Even if in the first years of the century there was a lot of skepticism, new enormous quantities of potential data were available for companies. Properly implemented to optimize production processes, to provide solutions on consumer preferences, to control workers and of course to create and design new products and services. The problem of the capitals companies still valid today is that the old business models had not been particularly well designed to extract and use data. Their working method consisted of producing a good in a factory where most of the information was lost during the production process, then selling it without learning anything from the client's purchase behavior or the way the product was being used. The platforms have been inserted in this context for the internal need of firms to manipulate, extract and to analyze in an effective way the always larger quantities of data stored. Therefore platforms become intermediaries that bring together different users: customers, advertisers, service providers, manufacturers, suppliers and even physical objects. The initial attempt to build a model adapted to the digital age were represented by the advertising platform. With this kind of platforms revenues are generated from advertising space auctions to advertisers created through the extraction and analysis of data from users' online activities. Initially the platform needs to observe and record users' online activities. More users interact with a site, the more information can be collected and used. In order to guarantee more precise and in-depth analysis, that have more value for advertisers, while users navigate through internet they are monitored with cookies and other tools. Advertisers are less interested in unorganized data and more on data that gives them useful insights on potential consumers. Professional figures such as data scientists or the automated workforce of a machine learning algorithm play a crucial role in cleaning this huge number of users online traffic data. If we talk about advertising platforms business

models we cannot talk the first one, or else Google. Created in 1997 by Larry Page and Sergey Brin, Stanford University students at that time. Google was among the first to receive venture capital in 1998, followed by a bigger one in 1999, for $ 25 million. Initially, the smart search engine had collected data from his user's research ,using this data to improve the research itself and the service. The day after the dot-com bubble burst, Google found itself having to find a paid service without risking losing its customer base. At the end they began to use the search data together with cookies and other information to sell targeted advertising space through an increasingly automated auction system. In 2000 Google introduced AdWords becoming a company that produces revenue essentially from advertising placements. Today, Google and Facebook are almost completely dependent on advertising; in the first four months of 2016, 89% of Google's revenue and 96.6% of Facebook's revenue came from advertisers. If advertising platforms such as Google and Facebook have created the conditions for extracting and using massive amounts of data, emerging cloud platforms represent the step that consolidated the platform as a unique and powerful business model. The cloud platforms essentially allow the relocation of most of the information technology departments (IT) of each company. The analysis of the data, the storage of customer information, the maintenance of the servers of a company all this can be sent in the cloud. A clear example of this business model is represented by amazon web services (AWS). It was developed as an internal platform, in order to get the company's increasingly complex logistics. The platform framework built was huge and soon it was clear that the system it could also be rented to other companies. Indeed AWS rents: cloud computing services, including on-demand server services, computational capacity and storage, software development tools and operating systems along with applications readymade. Having the necessary infrastructure for every other type of industry is a position of huge market power nowadays that every area of the economy is increasingly investments in integration with digital layers. It is not then a coincidence that AWS is currently valued at around 70 billion dollars and it is the business of amazon that grows faster, with around 30 % margins and nearly 8 billion in revenues in 2015.[56]In the first few months of 2016 AWS created more earnings from the amazon core retail business.

[56] Asay,2015

[57] If Google and Facebook built the first data extraction platforms, Amazon built the first big cloud platform to lease companies an essential tool. As data collection, storage and analysis have become increasingly cheaper, more and more companies have tried to bring platforms into the traditional manufacturing industry. IoT in the industrial category is considered the most significant trial, the process is known as the fourth industrial revolution or economy 4.0. In the production and logistic processes thanks to sensors and trackers (such as RFID discussed in the previous chapter), all connected to each other through internet connections and able to communicate with assembly machines and other components without the guidance of workers or managers. All in a platform environment data on the position and status of these components are constantly shared with other elements making the production process more efficient, reducing costs and downtime. It is estimated that the integration of industrial platforms will optimize the industrial processes, ensuring a reduction in labor costs of 25%, a reduction in energy costs of 20% and maintenance costs of 40%.[58]The life cycle of a product can therefore be significantly reduced but there is a need to guarantee interoperability between components and industrial machines. It is in this context were industrial platforms play a crucial role working as core frameworks in connecting sensors and actuators, factories and suppliers, manufacturers and consumers of software and hardware. Companies like General Electric and Siemens along with tech names like Microsoft and Intel are pushing the development of industrial platforms. Siemens has spent 4 billion of euros to incorporate production capacity and build its own platform MindSphere industrial platform.[59] While General Electric has worked quickly to develop Predix which currently has revenues of $ 5 billion and is expected to triple by 2020.[60] However developments in Internet of Things and cloud computing have made possible a new type of platform. The product platforms and lean platforms are two different business models but with similar touchpoints. For example Uber and Zipcar both are platforms designed for consumers who want to rent a vehicle for a certain period of time. Although the two models are similar, they are significantly different. Zipcar owns

[57] McBride and Medhora, 2016
[58] Webb, 2015, Bughin, Chui, e Manyika,2015.
[59] Zaske,2015
[60] Miller,2015b

the vehicles it hires, and Uber do not, that's why we can stand that first is a product platform while the second is a lean platform because it outsources almost all the possible costs. But Uber is the largest taxi company in the world and does not own vehicles, and Airbnb is the largest provider of hospitality services and not owns any properties.[61] These virtual platforms even without assets and operating with a hyper delocalized model, workers are relocated, fixed capital is delocalized, maintenance costs are delocalized, and training is delocalized. The only assets controlled are the software platform and data analysis, this is the minimum necessary to control income. The platform, to sum up, is a new type of business model characterized by providing the necessary infrastructure to mediate between different user groups, using cross-strategies to attract different user groups and using an architecture which regulates the capabilities of the interaction network effects. All these features guarantee to platform business model to be perfectly suitable for data acquisition and managing. Forecasts estimate the platform sector will be worth around $ 225 billion by 2020 much more than IoT for consumers and cloud computing for businesses.[62]

[61] Goodwin,2015
[62] Waters,2016

3. Personal internship case with practical application of a CRM platform model with IoT integration

3.1 Healthcare and Technology

In this paragraph we will analyze the stage of the digitization process in the healthcare industry, trying to give a clear picture of an healthcare data framework that include: data gathered from traditional EMR sources integrated with CRM systems and IoT platforms including cloud computing. Competitiveness in the health industry is rapidly increasing. Controlling their costs, deal with managed care, increase their bottom lines and prove the worth of their programs are important issues for both for-profit no-profit care delivery corporations and health care entities. A major transformation started in 2009, with the adoption of electronic medical records (EMRs) in most healthcare entities. Securing every patient medical record electronically starting to become an important challenge in parallel with government regulations, providers, payers, and other medical organizations to guarantee long-term perspective for this innovation. Digitization of all patient's interactions through the business is still a complicated process and with the evolution of big data, physician will have access to mass records analysis to help them in better diagnosis, and this of course will guarantee an higher-quality healthcare service together with a customized experience. Indeed a consumer-driven healthcare strategy is forcing medical organizations to focus on CRM solutions and technologies to standardize processes and increase customer satisfaction. Patients do pay attention to customer service in health care. One in four has switched or considered switching doctors (26%) or hospitals or clinics (23%) because of negative customer service experiences, according to the research. More than half (52%) say they choose hospitals and clinics based on whether they believe employees understand their needs.[63]Healthcare CRM systems are integrated with patient records in order to facilitate the check-in process, patient care and patient billing. In recent years by integrating CRM and EMR systems, organizations are linking more relevant data

[63] http://www.crmforecast.com/healthcare.htm

and accessing pre-filtered results with more inclusive content. Medical staff are working only in one interface, receiving accurate patient records content in real time and avoiding duplicate data entry. Another growing field in healthcare industry is IoT indeed according to business insider, by 2020, 646 Million IoT devices are estimated to be used in the healthcare industry. [64]Connected healthcare devices can collect data for a better medical workflow automation, provide better analytics insights for disease management and improve patient health monitoring. Indeed thanks to continuous advancements the size and price of sensors and connected devices have significantly reduced. Research suggests that IoT implementations in healthcare will become part of our personal health by 2020, guaranteeing real-time diagnosis and treatment of several illnesses.[65]Cloud computing can also be implemented with IoT sensors to optimize the flow of patients, staff, equipment and medical supplies. The resulting insights can be used to help manage patient's feedbacks, continuing updates of personal medical records and enable telemedicine. Unparalleled access to analytics that collect, and process healthcare information are driving rapid changes in all the healthcare industry.

[64] https://www.growthenabler.com/flipbook/pdf/IOT%20Report.pdf
[65]www2.deloitte.com/content/dam/Deloitte/global/documents/life-sciences-health-care/gx-lshc-healthcare-and-life-sciences-predictions-2020.pdf

3.2 The Company

The company took it into account is the Toronto Clinic a corporate executive healthcare center settled in Toronto. They are the only clinic of that kind in Canada to provide physician managed integrative medical services; physicians support the appropriate use of both conventional and alternative medicine and work with a team of experts to ensure that all factors that influence health, wellness, and disease are taken into consideration. TTC provides corporate executive medical care focused on service excellence, physician managed integrative care and leveraging global leading practices in clinical care delivery.

The clinic differentiates itself from competitors with a value proposition focused on:

- *The Medical Team*: The Toronto clinic upends the traditional model of medicine and uses a unique research supported team approach to deliver an effective and integrated patient-centered support system provider.
- *Comprehensiveness*: The Clinic is known for its attention to detail, with a history of catching significant conditions that had previously gone undiagnosed through its thoughtful, thorough and comprehensive approach to patient care and precision medicine.
- *Unparalleled Access*: Corporate members have 24/7, uninterrupted access to a dedicated coach, an interdisciplinary team of providers for clinical care that follow the latest guidelines and support to navigate the public healthcare system.
- *Patient Outcomes*: The Toronto Clinic provides members direct access to cutting edge research and leading institutions around the world as the clinic fosters collaboration to pioneer new approaches to treat rare diseases.

The focus of this analysis is on the Corporate Membership which is the main holistic service offered; a comprehensive physical of 10 assessments comprised of the following services:

- Executive Medical,

- Cardiovascular Risk,
- Women's and Men's Health,
- Cancer Risk,
- Wellness Stress Assessment,
- Nutrition,
- Exercise Physiology,
- Life Coach,
- Naturopathic Assessment,
- Sports Medicine

The clinic has a fixed price of 10.000 $ for 10 assessment membership program their core service which in addition to the 10 steps include:

- 11 Monthly follow up calls
- 24/7 telephone assistance
- Four free walk in clinic follow up
- Extra Five free assessments

After the full 10 assessments check-up the team provide to the patient a year program to follow with several health goal to achieve. The physician will then assist the progression and improvements of the patient with 11 monthly follow up call and of course guarantee 24/7 assistance if necessary.

Going through numbers the clinic can count on:

- 119 active members (Figure 1)
- 9.5 staff members with an additional Physician Assistant (PA) to start:

- 2 Physicians, 1 Nurse Practitioner (NP), 3 PAs, 1 RN, 1 RPN, 1 Lab Tech, 0.5 Office Manager
- NP and PAs serve as the Lead Provider for members
- Approximately 50 members per Lead Provider in the current state

- 6 Consultants (Exercise Physiology, Naturopathic Medicine, Athlete's Care Practitioners (counted as one), Life Coach, Psychotherapy, and a Nutritionist)

Membership Type	Number of Members	Number of Discounted Members
Corporate	61	5
Spousal and Parental	25	8
Dependent Youth	4	0
Children	16	9
Unclassified	4	?
Non-Paying	9	9
Total	119	31

Figure 3.2 a Membership cluster

Taking in to consideration Figure 3.2 a we analyzed the membership base and divided into cluster as followed to have a better picture of the clinic patients.The clinic teams' mission is to keep their members healthy, energized, and productive by delivering personalized, preventive healthcare of the highest quality. As concern to technology in place the clinic use OSCAR, an open-source Electronic Medical Record (EMR) software that was first developed at McMaster University by Dr. David Chan. It is a cost-effective product that can help reduce practice management costs while also playing a big part in making health services more efficient. Because is open-source it is continuously enriched by contributions from OSCAR users and the Charter OSCAR Service Providers that support them

3.3 KPMG Mission

The clinic board was ready to authorize a clinic expansion with a new branch in Turks and Caicos Islands in the Caribbean. The board is composed entirely by medical staff so before undertaking this important decision they ask kpmg expertise to have a full consultancy analysis on the status of the clinic and on the real capabilities of this expansion. KPMG decide to operate with two well defined steps:

- STEP 1: Assessment of current operational capabilities Identifies areas for operational improvement to unlock capacity, including a review of process, technology and capability opportunities
- STEP 2: Improvement Roadmap Practical roadmap that TTC can take away to implement recommendations with a focus on expanding the membership business and the digitization process.

I was part of the strategic analytical team as intern, and I was totally involved in all STEP 1 of the analysis, as concern to STEP 2 which is still going today I was involved only in the begging with the formulation with the most important recommendations to implement.

3.4 Analysis Objectives

I oversaw as junior strategic analyst in KPMG task force the following objectives:

1) Building up our baseline understanding of the clinic members behavior and economics.

a. *Classify member interactions into 5-7 key groups.*

Oscar data on clinic members interactions were reorganized into color coded standard labels in a excel file and broken down into time spent, who performed the interaction, as well as how the service was performed.

b. *Create profiles of the member base*.

As there are, no current standardization processes in place to analyze the single interactions for every patient, new classifications were discussed with the staff, and will be used in the future; but we calculated a percentage of overall interactions during the year. The interactions have been divided into Membership Interactions and extra membership interactions.

c. *Estimate the economics of each member*.

We estimated average cost for each interaction type, based on average hourly rate and time spent per interaction. Afterwards we calculated an approximation of the true total time cost to serve each member for the annual membership program.

2)Understanding 'standards' in place and the unique value add of the Toronto Clinic in each major member interaction

According to this task, we interviewed the Toronto Clinic staff daily and answered the entire table of questions regarding the ten-assessment membership path. The aim is to describe each individual step in the assessment, then for each step document the key tools, and standards used to perform the step. We used the following template:

#	What is the activity	Why is it performed	Is there a specific standard of performance that the activity needs to be performed to	Are there any tools or documents that already lay out how this activity it to be performed	Who is accountable for performing this activity	What data is collected during the interaction	Who is it passed to and what is it used for	What tools or systems are used to capture the information	Are there any other comments about the activity?

Figure 3.4 a Template to understand standard in place

3) Scanning the market to understand growth areas / opportunities

We utilized the OECD web database to pull data on basic healthcare indicators and we went through the services offered by the major competitors.

3.5 Results

According to point one, *building up our baseline understanding of the clinic members behavior and economics* we went through the following findings:

Members interact with the clinic in a variety of mechanisms with each mechanism having a unique volume and time profile associated with it. (Figure 3.5 a)

- Follow up calls account for the clear majority of patient encounters
- Over 65% of encounter time is associated with follow up calls and CPx, with less than 5% being attributed to consultant visits

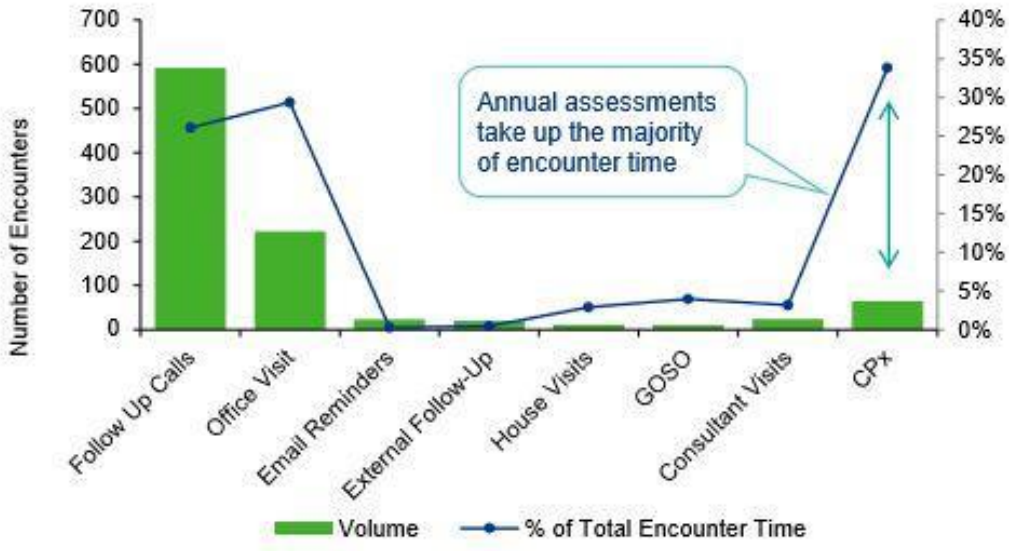

Figure 3.5 a Membership Interactions

Most members have 15 to 20 interactions per year, with 16% of members having over 20 interactions over that same time (Figure 3.5 b):

- Most members have 15 to 20 interactions per year
- 16% of members have more than 20 interactions per year
- 16 members have less than 5 interactions

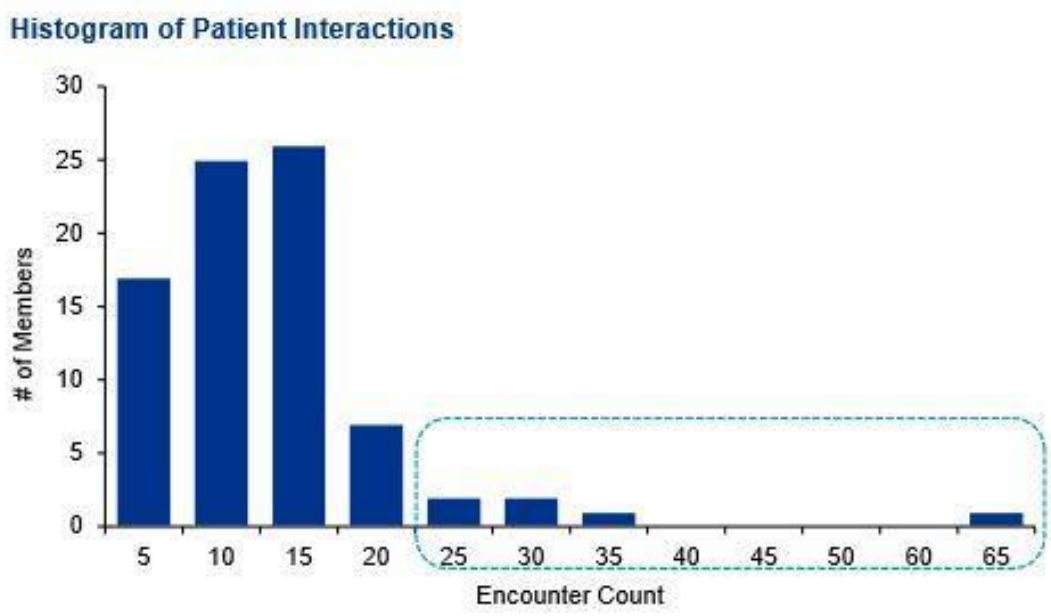

Figure 3.5 b Histogram findings of Membership Interactions

Then we deeply investigated and estimated the average cost for each interaction type, based on average hourly rate and time spent per interaction, we end it up with an approximation of the true total time cost to serve each member for the annual membership program assuming monthly fixed cost average expenses. (figure 3.5 c)

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Membership Variable Costs	
10 Assessment Variable Cost per Member	$912
Supplies	$257
Consultant Appointments	$655
Monthly Contribution Margin per Member	$491

Fixed Costs	To Assumptions
Aggregate Monthly Fixed Costs	$85,578

Figure 3.5 c Membership variable and fixed cost for service

Revenue driven by:

• Membership volume - The most important lever in profitable growth of TTC

• Third party sources such as rental agreements, profit sharing, and member service markups (eg. imaging)

• Extra clinic services - Actually cost money in the current state due to low activity volume and 5 free services given to members

Costs driven by:

• Overhead accounts for the majority of clinic costs with payroll being the largest component followed by rent and other overhead

• Minimal variable costs (medical supplies and records, plus the free assessments) are associated with TTC membership - Profitability will increase significantly with increased membership as a result

According to point two, *understanding 'standards' in place and the unique value add of the Toronto Clinic in each major member interaction*, the most important relevant findings were related to the staff time allocation. The comprehensive physical assessment is the cornerstone to the membership providing a holistic view of one's health:

Figure 3.5 d Ten Assessments service blueprint

Over 15 Hours of time commitment per Member resulting in scheduling complexity and contributing to patient non-compliance and under use of clinic-based consultants. Streamlining and standardizing the comprehensive assessment even from a digitalization of the huge paperwork over 1 or 2 days will be critical to alleviate scheduling challenges and member non-compliance.

Staff time allocation is largely dedicated to supporting administrative tasks rather than patient interactions. (Figure 3.5 e)

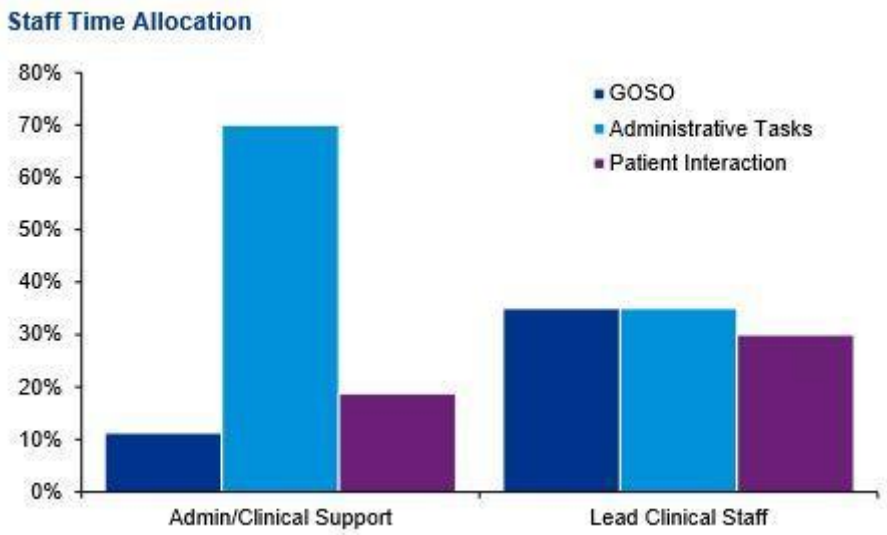

Figure 3.5 e Histogram staff time allocation

GOSO

• Includes all tasks related to serving GOSO patients including assessments, scheduling, and follow ups

Administrative Tasks

• Includes scheduling, OSCAR documentation, meetings, provider follow-up, reminders, and paperwork

Patient Interaction

• Includes any time spent talking or interacting with TTC members clinically

For clinical support staff over 70% of time is taken up by administrative tasks and 35% of time for lead clinical staff

This analysis is even more clearer and detailed in Figure 5 where we can observe exactly the week percentage of staff time allocation. Paperwork and Oscar documentation during a typical week take a lot of the staff time that in a growing prospective could be hard to handle without hiring other people.

	Staff Member	Time Allocation (% of week)								Notes
		GOSO Related Tasks	Scheduling	Clinical Patient Interaction	Provider Follow-Up	Patient Reminders	Paper Work	OSCAR Documentation	Other	
Clinical Staff	Clinical Director	10%	5%	40%	5%	5%	5%	20%	10%	Clinical notes taken directly in OSCAR could save double entry time
	GOSO Director	25%	5%	40%	5%	0%	0%	15%	10%	
	Physician Assistant	70%	0%	10%	0%	0%	0%	20%	0%	
Office Admin	Office Manager	0%	10%	20%	5%	5%	50%	10%	0%	50% of time dedicated to Athlete's Care
Back Office Admin	RN Medical Secretary	5%	40%	25%	10%	0%	0%	10%	10%	40% of time dedicated to Athlete's Care
	Lab Tech Medical Secretary	25%	35%	5%	20%	5%	5%	5%	0%	
	RPN Medical Secretary	15%	10%	25%	10%	10%	15%	10%	5%	40% of time dedicated to naturopath

Figure 3.5 f week % of staff time allocation

As concern point three, *scanning the market to understand growth areas / opportunities*. We utilized the OECD web database to pull data on: population size, net income distribution, Total Health Spending (US dollars/per capita) public and private, Doctor Consultation (Times per capita), Length of hospital stay(days per capita) which is an indicator of the quality of the hospitals and the care system, Pharmaceutical spending(total, % of health spending), Life expectancy at birth (Years), Deaths from cancer and diseases of the circulatory system (Per 100 000 persons) which are the most common causes of death especially in the Western world. We understood that according to the variables took it into account that the highest private healthcare spending is still concentrated in the US. Other indicators instead tell that EST European countries are the one with highest rate of death per

capita for the most common diseases and Asian countries have the highest doctor consultation rate per capita. Following the global market research and the offer format of the clinic (Corporate executive healthcare), we focused the research on the services offered by some of the larger world-class private healthcare providers in USA and Canada. In this case the Toronto Clinic not only offers all the major services of the major corporate executive healthcare providers but also as a unique service that has recently implemented, the GMC (Global Medical Consultancy). When one of the valued members is affected by rare or life altering medical conditions, he or she can access to this special service. The Toronto Clinic Team provides this service by creating a Task Force of clinicians and scientists from all over the world: the aim is to solve a complex clinical dilemma that significantly increases the chances of better outcomes and possibly even a cure.

3.6 Implementation of Digital Solutions

The analysis showed two main issues:

1)The time allocated from the staff is dedicated essentially to:

- Paper work related to track and proceed with payments
- Patients documentations after visit to input manually in Oscar EMR system
- Appointments set up remainder and file Sharing with patients

In order to handle to growth process that the clinic is facing and not increase the staff number we need to standardize the services, digitalize the payment method included the patient post visit documentation side and of course this system needs to cooperate with the already implemented Oscar EMR.

After several research a good cost-effective solution cloud platform model could be found with Xerox - Customer Payment & Relationship Management system. We customized Xerox CRM platform guaranteeing a solution to all the issues related to point one:

Paper work related to track and proceed with payments, with xerox infoflo:

- Membership management and collection of patient's monthly membership fees by automatically charging their corporate credit card every month. This need to only be setup once and the system will automatically charge every month with an integration with QuickBooks, so all payment information is accurately input in backend accounting software.
- Patient Portal: A unique part of our system is a secure patient portal which provides them with all information so that they don't need to call you and ask for this. It includes the following features:
    1. Invoices and Statements: All patients will be able to see all their paid invoices relating to their monthly memberships as well as other paid or unpaid invoices. As well they will be able to view statements with an opening and closing balance.

2. Online forms: patients will be able to fill out and view all forms relating to them.

- Generating reports (ex. lists of everyone that has not paid)
- Contracts, payments, member forms can all be sent over email and sent back with digital signatures

Patients documentations after visit to input manually in Oscar EMR system:

- Digitize the current word and pdf patient documents. These digital forms can be auto-populated with patient information and sent to them to be filled out with notifications and approvals. This will speed up the clinical assessments as well.

Appointments set up remainder and file Sharing with patients

- Collections letters can be automatically sent out
- Surveys on quality can be generated monthly therefore replacing their current use of survey monkey
- There can be various levels of user permissions for separate roles within the organization
- Emails are linked to every user on backend
- Automatic generation of contracts based on pre-set fields o Can give user permission of what is able to be changed and what is not on contracts

The quotation obtained from Xerox including all these steps as a final amount of 4113.23 $ divided as followed with Figure 3.6 a. An amount which is complete affordable by the clinic and could give several improvements in the long and short period.

Line Item	Price
InfoFlo Pay Setup	$306.15
InfoFlo Forms Setup	$687.79
InfoFlo Pay Sync	$152.31
InfoFlo CRM Setup	$496.16
Training	$496.16
Reporting	$75.39
Advanced Linking	$75.39
Outlook Sync	$75.39
Quickbooks Integration	$214.52
InfoFlo Support Package	$872.94
Base Total	$3,452.18
InfoFlo Forms & Pay Monthly Subscription	$125.13
12 Months Up Front	$1,357.16
36 Months Up Front	$3,971.12
60 Months Up Front	$6,369.23

Figure 3.6 a Xerox quotation

The silos effect is considered as one of the greatest challenges healthcare organizations are looking at. When we talk about population health as we saw from the company analysis we are bringing together different parties: multiple departments, data, resources, stakeholders, and decision makers that finds hard to cooperate in a managerial way. As a result patient journey tends to be very complex. Healthcare organizations needs to find a more unified approach to the business and as we saw with the Toronto clinic business case, digital transformation can become a strong partner, a pillar that together with services always ensure operational excellence.[66] Digital solutions such as CRM platforms represent a real opportunity to facilitate business processes and outcomes. International Data Corporation (IDC) a premier global provider of market intelligence, monitored a spending on public cloud computing solutions that in 2016 reached $70 billion, and forecasted that this number will triple over the next four to five years.[67] However it is important to have single unified infrastructure to make it faster and easier to integrate already existing systems integrating patient care with patient billing. A digital centralized operations

[66] "Designing Digital Organizations," MIT/Sloan, Center for Information Systems Research (May 2016)
[67] "Public Cloud Computing to Reach Nearly $70 Billion in 2015 Worldwide, According to IDC," IDC (July 21, 2015)

management of clinics it's going to impact control of patient access channels, keeping them in a precise network, and achieve economies of scale. By integrating CRM and EMR systems, healthcare companies are linking more relevant data and accessing pre-filtered results in one interface, avoiding duplicate data entry, and receiving accurate content in real time and deliver a better service to any patient or customer.

2) Second major issue that comes up from the analysis is to reduce the time of the majority of patient interaction, the *monthly follow up call* to check up the status of the 10-assessment program objectives. There are already several integrate telemedicine system that can include IoT and give real time data on the current status of the patients and facilitate the doctor with a faster analysis.

Because the clinic is planning to increase significantly the number of members its crucial to speed up the monthly follow up call for each member. We are talking about the most frequent interaction of the clinic (Over 65% of encounter time is associated with follow up calls as shown in Figure one) and is very important to give to the patient a better feedback (by using a hd screen view instead that a phone) and a faster way to record the clinical status and update the member profile (using IOT tools). According to some estimates, spending on the Healthcare IoT solutions will reach a staggering $1 trillion by 2025 and, hopefully, will set the stage for highly personalized, accessible, and on-time Healthcare services for everyone.

Kaa *— a leading IoT platform for state-of-the-art Medical IoT*

Kaa, as a leading open-source IoT platform, allows OEMs and healthcare system integrators to establish cross-device connectivity and implement smart features into medical devices and related software systems. Healthcare companies developing hardware or software products that have chosen to integrate Kaa's functionality into their products were able to achieve IoT goals faster and at little expense. Kaa's open-source feature set translates into verifiable reliability, scalability, and full ownership.

In order to initiate this important revolution the step should be taken one by one; first of all the implementation of telehealth & remote patient monitoring to speed up the monthly follow up process. Afterwards Connected medical devices with IOT.

Phase one, *telehealth & remote patient monitoring*

By utilizing the Kaa feature set, a finished product for clinical telemedicine and remote patient monitoring can be functional in a matter of weeks or even days. The final product can be integrated into a single EMR solution(In the Toronto Clinic case we can include it into Oscar). Kaa's open APIs and highly customizable server side allows creation of customized services and the ability to integrate with external telehealth systems to form a broad healthcare solution, which would enable the following:

- Connect any wearable or portable device to the cloud, pull and analyze collected patient data in real time
- Monitor patients at home using live video and audio streaming
- Monitor vital health indicators collected by portable devices such as smartphones and tablets
- Set intelligent emergency notifications sent to a physician or family
- Charts and diagram visualization based on data collected from health monitoring devices
- HIPAA-compliant authorization processes and data exchange

Phase two *Connected medical devices*

Kaa offers medical device manufacturers a set of ready to use tools that enable device remote access, interaction with other devices or systems, and tools for performing "smart" tasks. Kaa can be integrated with portable or stationary medical equipment, it can even fit into a tiny sensor. Once your device is connected Kaa will begin to monitor and collect any type of data generated by the device. The data can be

transmitted to the Kaa server for storage in a cloud computing system for analysis and additional processing.

- Data collection and real time data analysis
- Monitor device operation for faults and prevent malfunctions
- Remote control and device configuration
- Enable devices to send events and notifications to other devices
- Maintain an active device inventory and track assets
- Remote software/firmware updates[68]

The healthcare industry has been supporting for years the discussion of enabling long-distance healthcare, or better known, telemedicine. Nowadays the increase of the social use of video across our society, together with the affordability of web cameras, enabled telemedicine to become an hot topic in the healthcare professional field. A 2016 Reach Health study reports that two-thirds of healthcare professionals named telehealth or virtual care as a top priority, up 10 percent from the previous year.[69] If we go through how the several benefits, as we saw from Toronto clinic case, we realize why this topic has relevant priority on physicians. Structures will have shorter hospital stays and real time video patient monitoring will drastically reduce the need for medical interventions and home visit costs. Indeed medical providers can serve more patients, because video appointments provide a time-effective option for helping those who are managing a known condition, filtering some who might need to see a specialist, and for identifying those who should go immediately to the emergency room. Collecting data on patients will become easier with IoT devices and automated workflow management and analysis from health monitoring sensors will help doctors achieve a faster time to diagnosis, prescribing just in time, suitable medications. As result we will have faster access to care, quicker visits, better allocation of resources and improved management conditions. In the end the final the final proposal accepted from the board of the Toronto clinic is

[68] https://www.kaaiot.io/solutions/healthcare
[69] U.S. Telemedicine Industry Benchmark Survey (2016).

platform system, that is still today on implementation, that will include, data on medical records gathered from traditional EMR(Oscar) sources integrated with personal data from customer relationship management (Xerox CRM) system in addition with data from telemedicine system integrated with IoT devices (KAA)platform.

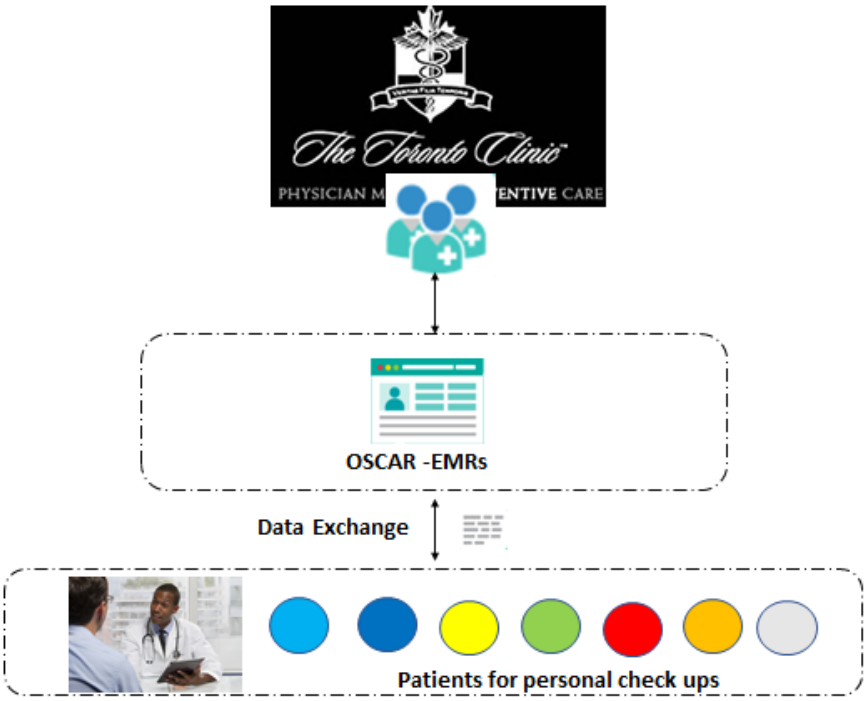

Figure 3.6 b Old platform business model of the Toronto Clinic

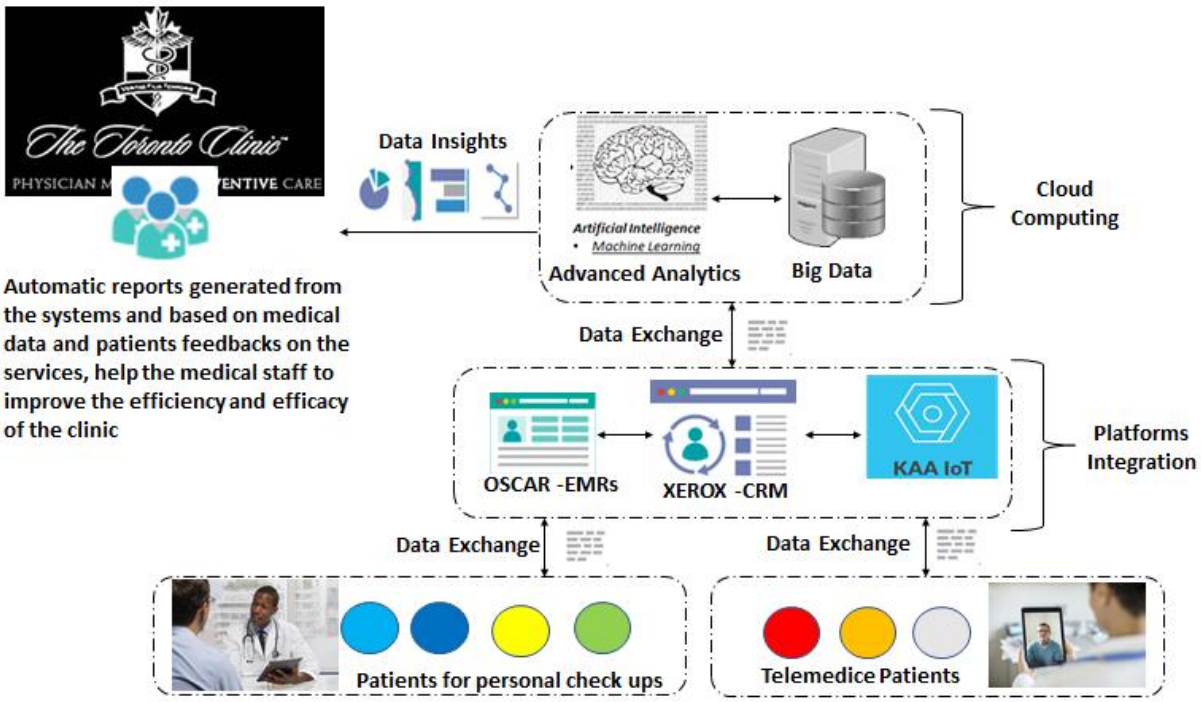

Figure 3.6 c New platform business model for the Toronto Clinic

The new platform business model will guarantee to patients both personal and telemedicine checkups. Physicians will have more information on the patients in one dashboard before the visit to have a better and real time clearer picture for the diagnosis thanks to the integration with CRM and KAA IoT. However new data will be recorded during visits and will generate, thanks to cloud computing, automatic reports based on updated medical charts and patient's feedbacks on the services, helping the medical staff to improve the efficiency and efficacy of the clinic services.

3.7 Cybersecurity drawbacks issues

In this paragraph we will try to understand the major drawback of a platform business model. Indeed the organization are going to handle a huge quantity of private data from their consumers and cybersecurity issues needs to be consider before implementing similar kind of model. Healthcare records are among the most hacked data in the world is considered four times more likely to be impacted by advanced malware than any other sector.[70]On the black market it is calculated, because of its potential for fraud, identity theft, and abuse, that medical data is worth 10 to 20 times more than credit card data.[71] The Ponemon Institute, an institute that conducts independent research on privacy, providing organizations insights on how to improve their data protection strategies, calculate that data violation cost the healthcare industry $6.2 billion per year. In another research, nearly 90 percent of the healthcare organizations surveyed had had a data violation in the last two years, and 45 percent had more than five data crimes in the same time period.[72]Indeed, healthcare, across the industry is seriously underestimating security issues. Moreover many of the dangerous data privacy violation in healthcare structures come from employee negligence and cause the most damages.[73] In this scenario internet of things grows and experts are worrying about the security of medical devices. Experts consider healthcare devices technologically advanced and able to make a great contribution for patients, but at the same time are considered vulnerable to malicious interference. For instance, in healthcare, any connected patient monitoring system or wearable device can present an open invitation for hackers to steal and share private and confidential information. Including anesthesia devices, medication infusion systems, and pacemakers all IoT devices are exposed to cyber-attacks, data-breach threats and identity theft vulnerability.[74] Although the number of privacy laws have

[70] "Healthcare Environmental Security Scan Report," HIMSS, Vol. 1 (March 2016).
[71] Your Medical Record Is Worth More to Hackers than Your Credit Card," by Caroline Humer and Jim Finkle, Reuters (Sept. 24, 2014).
[72] "Sixth Annual Benchmark Study on Privacy and Security of Healthcare Data," Ponemon Institute (May 2016).
[73] "Third Annual Data Breach Industry Forecast," Experian (2016).
[74] "Thousands of Critical Medical Devices Open to Attack," by Katie Dvorak, Fierce Healthcare (Sept. 30, 2015).

increased from the nineties, without considering the last General Data Protection Regulation, or GDPR, that have reviewed how businesses process and handle data in Europe, considered by experts an high stricted regulations, there is a lot that still needs to be done. Inadequate security of IoT devices and networks is the most pressing challenge faced by the IoT industry as it continues to compound the risk of data vulnerability for both businesses and individual consumers. At the same time, more than half of today's consumers, express themselves as willing to share personal data to improve care coordination, considering that privacy is still a major concern. In 2015, 52 percent of company respondents to a pwc consulting study said they have finally purchased cybersecurity insurance, a double-digit increase over the year before.[75]

[75] "The Global State of Information Security Survey," PriceWaterhouseCoopers (2016)

III CONCLUSION

The era of lean production has changed how we make business today, with just-in-time global supply chains asking for real time data on the state of inventories and integrated platform to have a better management of suppliers and better control outsourcing processes. If we collocate this dynamic framework to our country we have unfortunately a clear negative picture. The Digital Economy and Society Index 2018 (DESI) is a composite index that summarizes relevant indicators on Europe's digital performance and tracks the evolution of EU member states in digital competitiveness.

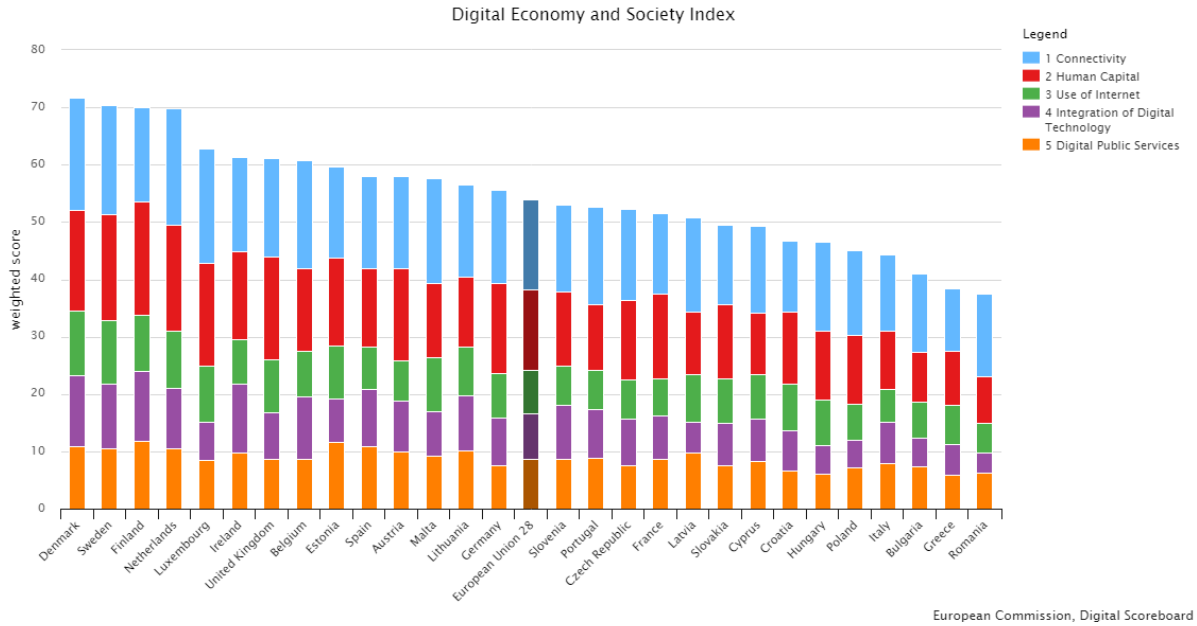

Figure a Digital European Scoreboard

The *key indicators* considered are:

1. Connectivity

The Connectivity dimension measures the deployment of broadband infrastructure and its quality. Access to fast and ultrafast broadband-enabled services is a necessary condition for competitiveness.

2. Human Capital/Digital skills

The Human Capital dimension measures the skills needed to take advantage of the possibilities offered by digital.

3. Use of Internet Services by citizens

The Use of Internet Services dimension accounts for a variety of online activities, such as the consumption of online content (videos, music, games, etc.) video calls as well as online shopping and banking.

4. Integration of Digital Technology by businesses

The Integration of Digital Technology dimension measures the digitization of businesses and e-commerce. By adopting digital technologies, businesses can enhance efficiency, reduce costs and better engage customers and business partners. Furthermore, the Internet as a sales outlet offers access to wider markets and potential for growth.

5. Digital Public Services

The Digital Public Services dimension measures the digitization of public services, focusing on eGovernment and eHealth. Modernization and digitization of public services can lead to efficiency gains for the public administration, citizens and businesses alike.

Denmark, Sweden, Finland, and the Netherlands have the most advanced digital economies in the EU followed by Luxembourg, Ireland, the UK, Belgium and Estonia. Romania, Greece and Italy have the lowest scores on the DESI.[76] The Italian business landscape is mainly composed of small and medium-sized family-run businesses that are reluctant to accept technology. In this digital era platforms comes out as the tool that allow to guide and control this fourth industrial revolution. The aim of this thesis, is to show from a practical business development point of view the several competitive advantages of adopting the platform business model that integrates the new tech solutions. Even in particular sector such as healthcare there

[76] https://ec.europa.eu/digital-single-market/en/desi

are so many possibility as we have seen. It is crucial for Italy to don’t miss the chance of bringing their companies in a 4.0 industrial revolution. Investing in Universities program to bring a new class of managers is the first step and tax deductions to companies that invest in these innovation is the base to build on. However what needs to change is the culture behind Italian entrepreneurs that need to see technology as an opportunity not as an enemy. The progress of digital technologies is associated with the complexities governance, security, integration of hold business models,standardisation issues, factors such as, budget constraints. These are all day-to-day market and competitor’s decision pressures, that needs to change business priorities. The hope is that my generation will undertake this challenge and help to digitize businesses in Italy scaling that European ranking as soon as possible.

IV APPRECIATIONS

I miei più sentiti ringraziamenti per questo lavoro di tesi magistrale vanno al professor Luigi Laura. Il quale ha permesso che mi avvicinassi alle materie trattate di machine learning e artificial intelligence. Ora queste materie da argomento didattico interessanti ai fini di tesi sono diventate anche passione professionale e per questo ringrazio di cuore la dedizione e l'ispirazione del professore. Il mio primo proposito era quello di abbandonare l'Italia come molti miei colleghi per avere una strada professionale più fortunata all'estero. Ora invece sono consapevole di voler dedicare la mia vita professionale alla digitalizzazione del mio paese seguendo la prima traccia lasciata dal professore e farmi carico di questa avvincente causa professionale. Con il lavoro duro, la costanza e la passione ogni traguardo è raggiungibile.

Ringrazio anche la mia famiglia che mi ha sostenuto in ogni mia scelta e mi ha permesso di raggiungere questo importante traguardo che porta con sé tante certezze e consapevolezze di un lungo percorso di crescita e di vita.

Infine ringrazio il team di kpmg e l'eccellente staff della Toronto Clinic che mi ha permesso di lavorare con tanto entusiasmo e coinvolgimento al progetto fin dal primo giorno.

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October 3rd, 2017

Re: Luca Lanni – Professional Reference

To Whom It May Concern,

This letter is in reference to Mr. Lanni's professional credentials and capabilities. I had the opportunity to work in partnership with Luca on a consulting engagement with a large private healthcare provider in Canada over the summer of 2017.

During my time working directly with Luca I found his analytical capacity, problem solving rigor, and client relationship management capabilities to be excellent. I would strongly support his candidacy for a position in Management Consulting, and would certainly look for an opportunity to work with him at some point in the future – should the occasion present itself.

Should you have any questions about his work performance, or the nature of the roles that he undertook, please do not hesitate to contact me directly.

Kind regards,

Andrew Dooner

Partner

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Short Summary

Digital technologies have significantly changed our economy, but most of all in how we think about data. According to the traditional way of making business, data was expensive to obtain, costly to store and utilized in organizational silos. Just managing data for companies required a huge IT system be purchased and maintained. Today, data is being generated at an unprecedented rate not just by companies but by everyone. IDC (International Data Corporation) estimates that by 2020, business transactions on the internet business-to-business and business-to-consumer will reach 450 billion per day. Consequently, one of the biggest challenge of the twenty-first century is turning this enormous amount of data we have into this valuable information. That's why the last years we have seen the rapid growth of new companies, born just to extract potential data from businesses and use it to optimize: industrial production processes, to provide indications to consumers preferences, to control workers and of course to create new products and services. However now with cloud-based system store and analyze data is becoming cheaper, promptly available and easy to use. This technological dynamic framework generated a new business model: “the Platform”, developed to satisfy this huge need of manipulate, extract and analyze in an efficient way data that companies are storing all over the value chain. This business model ended up expanding in all the economic sectors with many companies that integrate platforms as central assets; just to make examples: big tech companies (such as Google, Facebook and Amazon), start-ups (Airbnb, Uber), big industrial firms (General Electric, Siemens), agriculture giants (John Deere, Monsanto) just to title some of them. Digital technologies and the connected platforms business models are also forcing us to think differently about how we understand and create value for our customers. If electrification back in the industrial revolution was revolutionary because changed the fundamental constraints of manufacturing, the impact of digital it's even bigger because it changes the constraints under which practically every domain of business strategy operates. The aim of this thesis is to show from a practical business development point of view the several competitive advantages of adopting the platform business model that integrates the new tech solutions. Shifting the capitalistic mentality, from a profit-

oriented business to data-oriented business. The analyses will start by showing the most important digital technologies revolutions starting from: artificial intelligence. In first paragraph we tried to define artificial intelligence (AI) following the most important historical milestones. Historically the memorable event in AI that captured the public's imagination was the designing of the intelligent program, Deep Blue, which beat Garry Kasparov, the Russian world chess champion, in a six-game tournament in 1997. The program, was developed by some former Carnegie Mellon University researchers hired by IBM and was named after the company's corporate and color "Big Blue". In any case, this victory, received widespread attention about what it meant for human supremacy over machines. Chess game was not a casual choice for IBM researchers, because was considered a game of intellectual achievement likely to resist to any attempt to automatization. However the first use of the term "artificial intelligence "can be attributed to John McCarthy. He was assistant professor of mathematics at Dartmouth College in Hanover, New Hampshire, and can be considered the father of this discipline. In 1955 he described AI as the process "that of making a machine behave in a way that would be called intelligent if a human were so behaving". McCarty organized a summer conference in Dartmouth with colleagues that were deeply interested in symbolic logic, the branch of mathematics that that deals with representing concepts and statements as symbols, then defines various transformations to manipulate these symbols to reason deductively from hypotheses to conclusions or vice versa inductively from conclusion back to hypothesis. For instances "Socrates is a man" and "All men are mortal" you can formally derive the statement "Socrates is mortal". Placed in this historical context, Dartmouth conference could be seen as an attempt to expand the use of computer beyond crunching numbers and processing data to manipulating symbols. After the Dartmouth conference, interest in the AI field grew very quickly. Researcher started to work on different tasks, from proving theorems to playing games. Another important progression on the other hand took place around the 80s; a new class of systems, called at the time "expert systems" or "knowledge systems, "arose. The idea was to capture and duplicate scarce human expertise in a computable form, in the hope of making this capability available more widely and inexpensively. In general, symbolic reasoning is more appropriate for problems that

require abstract reasoning, while machine learning is better for situations that require sensory perception or extracting patterns from noisy data. It's all about models (i.e., representation), probability,statistics,optimization, and algorithms. AI today can be seen as a set of tools for computing a variety of useful classes of model types that represent information extracted from raw input data and use associated algorithms to "solve" specific tasks. This discipline however is generally divided into a number of subfields that require different tools or skills to solve many practical problems. The most prominent subfields of this discipline are: robotics, computer vision, speech recognition and natural language processing. One of the relevant accomplishment of modern AI is finding correlations between enough examples and discover relevant insights allowing the machine to solve problems at human level, with no deeper understanding or causal knowledge about a domain. Not all the subfields of AI proceed at the same pace, in part because they build on progress in other fields. Sometimes a new algorithm or new concept inspire significant progress, or some advance in computing, storage, networking, data availability or communication and leveraging advances in hardware and software opens the opportunity to develop new AI techniques. On the other hand machine learning instead is moving quickly because the data available for training in digital form is rapidly expanding. Artificial intelligence is giving companies the ability to match information about their products with the information of the prospective buyers giving them what they need at the moment they looking for it and in a format they are most likely to consume it effectively. Unfortunately, AI with the new tech advances is accelerating the substitution of capital for labor, income inequality is already a pressing societal issue, and it's going to get worse. In the second paragraph of the first chapter we discussed the machine learning paradigm. . This discipline was taken seriously by important researchers around the late 1980s and early 1990s, but it dates to at least 1943, when Warren McCulloch neurophysiologist and Walter Pitts mathematician, at the University of Chicago observed that a network of brain neurons could be modeled by, of all things, logical expressions. They discovered that there is a digital signaling in the brain despite the soft consistency and wet and gelatinous masses. According to their hypothesis the signaling seemed to be binary. After those studies and publications there was a new data centric approach to AI with several novel

computational techniques that seem to mimic certain aspects of human brain. The field of Machine Learning seeks to answer the question, “How can we build computer systems that automatically improve with experience, and what are the fundamental laws that govern all learning processes?. The learning issue is central in understanding the shifting of mentality on this discipline. Machine learning is programming computers to optimize a performance criterion using example data or experience. To get a feel of the innovativeness of the modern machine learning we should understand deeply the neural network approach. This theory is based on the brain structure or else a homogeneous mass of cells called neurons, which interconnect with each other through synapses that send and receive electrical or chemical signals. Neurons in an artificial neural network are organized into a series of layers. They simulate the behavior of neurons as individual elements in their programs, then develop techniques for connecting them up and studying the results. The neurons organized into a series of layers are connected at each level only to those at the level above or below them in the hierarchy. The interconnections are modeled as numeric weights and learning algorithms adjust the connection weights between neurons. On the application side you might think about training the artificial neural network in a “supervised learning” or “unsupervised learning “environment. Supervised learning is a type of machine learning where the model learns to generate the correct output for any input. The model is trained with data labeled by a supervisor who can provide the desired output for a given input. If the labels are numerical, then it is a regression problem; if the labels are categorical, then it is a classification problem. IDC (International Data Corporation) estimates that by 2020, business transactions on the internet business-to-business and business-to-consumer will reach 450 billion per day, and together with IoT technologies this number will even increase. Machine learning has already proven to be a reliable technology, experts consider it as the new AI because its application in different domains are increasing every day. The trend of developing methods that can automatically detect patterns in data, and then to use the uncovered patterns to predict future data or other outcomes of interest is central now in companies and has no limits of expansion. In the third paragraph we went through the description of the digital ecosystem collocating IoT in a framework together with artificial intelligence and machine

learning. Internet of things could be seen as network of interconnected objects able to collect and share information through internet. IoT is a hot topic nowadays thanks to the digital innovations and the several applications in different fields. Web had different growing phases that allowed users to better interact thanks to technologies such cloud and mobile computing. However the first time that the idea of connecting an object capable of transmit information relating to its activities came up around the 1980s. In 1982 at Carnegie Mellon University there was a coke vendor machine capable of sending real time data on the number of cans once they have reached the proper temperature. All these smart objects and sensors capable of collecting all kind of data, are integrated in a digital ecosystem that store all this information and use it in a second period. Above all the possible configurations of IoT what comes out is the crucial part of analyzing all this huge amount of structured and unstructured data. The collected information needs to be analyzed and support business strategies together with the machine updating in all the supply chain. Together with the spread of IoT even data is increasing, that's why now we big data it's an hot topic not only in the research field. Connected with big data comes cloud computing that allow to use in a flexible way computational and memorizing capabilities to store all the information. In this framework we finally insert the fundamental role of machine learning algorithm that analyze become essential in defining the strategic decision on machine and people. IoT is just the tip of the iceberg, they are the sensors that gather data in the real environment for this digital ecosystem, cloud computing technology allow then to store it(big data) and with machine learning validate patterns and insight from it. We can't discuss these topics in silos everything can be connected in a framework. If we consider the statement related on the increasing of the amount of available data in companies, in 2017 the 77 % of respondents agreed with this trend. According to the capability of getting insights from data to develop new business strategies in 2017, 49 % of the respondents' managers declared that they daily do it to develop their business strategies. This results are confirmed by another report published in 2017 from Harvard business review that gives deserve to IoT relevance for companies. IoT plays a central role in the business transformation, but there is the need to manage all this data collected and exploit it in the best possible way. It essential for companies to a have proper data centric transversal business

model to keep up with this digital era. The business model that perfectly integrates the digital ecosystem (IoT, Cloud Computing, Big Data, Artificial Intelligence and Machine Learning) is the platform, which will be in-depth analyzed in the second chapter. According to Cisco(worldwide leader in networking) by 2020 50 billion intelligent things will be connected to the internet, using microsensors on the network, everyday objects will become connected and intelligent and change drastically our society. All this new technology created a breeding ground that facilitated the analysis of data and the implementation of the platform model which integrates and maximize the value of all these new tech innovations. The platform model and the new digital drivers of the business strategic vision were then carefully explained in the second chapter. Indeed, the platform business model is the only one that can integrate the digital ecosystem together with a data customer centric business strategy and face the current competition. This digital environment is radically changing the constraints behind business strategies on the areas of: customers, competition, data and innovation. Digital technologies are redefining many principles behind business strategies and many old constraints and assumptions established before Internet need to be updated. Retailers used to be in control, but now the customer is 100% in control of when, where and from whom they buy and digital is enabling all this. So why does almost all of firms focus still goes on customer acquisition? According to Harvard business review a 5% increase in customer retention leads to a 25-95% increase in profit, so companies should implement their efforts in advocacy the last step of the path. Firms needs to engage, promote and inspire repeat customer to enter the stage of advocacy in order to contribute to the growth of the business. However at the same time should be present and drive the customer all over the path(for instance awareness with google AdWords tools, consideration implementing engaging social media campaigns ,conversion creating functional websites and app, experience both stores online and offline, and of course advocacy) only with a omnichannel strategy firms can succeed in the long period in this digital era. Relationship with individual customers are not the only one that are changing even the interactions between businesses are being similarly transformed. Competition is becoming more complex and interconnected. The focus is shifting because competition is happening more across industries and

partners who count in profiting on each other, then less within industries and similar companies that try to replace each other. With new sources of data firms can have customer feedbacks and validation on new ideas not only after the launch but all over the process, empowering R&D department to adjust the strategy on product during the way. In an economic environment were technology change as fast as people needs its crucial to have a data and customer centric business strategy. This attitude supported by the right technology in place can guarantee to continuously evaluate the business processes, identify changing in customer needs, understand which opportunities creates the base for innovation and consequently collaborate with the right partners keeping pression to the competitors in the market. In the second paragraph we clarified the platform business model, the one capable of integrate the digital ecosystem(that incorporate Iot, Cloud Computing, Big Data, Artificial Intelligence and Machine Learning) and a data customer centric business strategy described in previous paragraph. Therefore a shareable description of how we define a platform comes from the publication of Andrei Hagiu and Julian Wright. According to the two authors we can define a platform as business model that creates value by making easier a direct interaction between two or more different type of customers. . Going through the three main characteristics of a platform model we better clarify the definition given by the researchers. First of all a business model to be considered a platform needs necessarily to serve two or more distinct types of customers(for instance: software developers and consumers, buyers and sellers and so on).Bringing together different parties means contribute and receive different kinds of value. Secondly, the platform model allows a degree of independence or else direct interaction. Lastly, is crucial for the platform growth, the interaction between parties must occur within the platform and needs to be facilitated by it. More the number of users increase the more value of the platform raise," network effects". We have seen how platforms businesses relate with each other, there a significant shift from linear to networked business models. Indeed they try to build with new technologies networks were customers can interact with each other. As we have seen customers both provide and receive value rather than just simply paying for products and services received. The growing in the platform business model is guaranteed as more people interact and use it. Firms today are struggling to understand if undertake a

platform business model strategy rather than a more traditional one, there is no right answer for everyone. Later we went through the different type of platforms business models (*Advertising Platform, Cloud Platform, Industrial Platform economy 4.0, Product Platform and Lean Platform*) with real business cases. . Even if in the first years of the century there was a lot of skepticism, new enormous quantities of potential data were available for companies. Properly implemented to optimize production processes, to provide solutions on consumer preferences, to control workers and of course to create and design new products and services. The problem of the capitals companies still valid today is that the old business models had not been particularly well designed to extract and use data. Their working method consisted of producing a good in a factory where most of the information was lost during the production process, then selling it without learning anything from the client's purchase behavior or the way the product was being used. The platforms have been inserted in this context for the internal need of firms to manipulate, extract and to analyze in an effective way the always larger quantities of data stored. Therefore platforms become intermediaries that bring together different users: customers, advertisers, service providers, manufacturers, suppliers and even physical objects. The platform, to sum up, is a new type of business model characterized by providing the necessary infrastructure to mediate between different user groups, using cross-strategies to attract different user groups and using an architecture which regulates the capabilities of the interaction network effects. All these features guarantee to platform business model to be perfectly suitable for data acquisition and managing. Forecasts estimate the platform sector will be worth around $ 225 billion by 2020 much more than IoT for consumers and cloud computing for businesses. In last chapter instead, we showed a full implementation of a platform model together with the new technologies of internet of things in an healthcare business case directed followed by me during my internship with KPMG team in Toronto. The platform model will have healthcare data framework that include: data gathered from traditional EMR sources integrated with CRM system and IoT platforms including cloud computing. in the healthcare industry. Competitiveness in the health industry is rapidly increasing. Controlling their costs, deal with managed care, increase their bottom lines and prove the worth of their programs are important issues for both for-

profit no-profit care delivery corporations and health care entities. IoT indeed according to business insider, by 2020, 646 Million IoT devices are estimated to be used in the healthcare industry. Connected healthcare devices can collect data for a better medical workflow automation, provide better analytics insights for disease management and improve patient health monitoring. Indeed thanks to continuous advancements the size and price of sensors and connected devices have significantly reduced. Research suggests that IoT implementations in healthcare will become part of our personal health by 2020, guaranteeing real-time diagnosis and treatment of several illnesses. Cloud computing can also be implemented with IoT sensors to optimize the flow of patients, staff, equipment and medical supplies. The resulting insights can be used to help manage patient's feedbacks, continuing updates of personal medical records and enable telemedicine. Unparalleled access to analytics that collect, and process healthcare information are driving rapid changes in all the healthcare industry. The company took it into account as key thesis study for the analysis is the Toronto Clinic a corporate executive healthcare center settled in Toronto. They are the only clinic of that kind in Canada to provide physician managed integrative medical services; physicians support the appropriate use of both conventional and alternative medicine and work with a team of experts to ensure that all factors that influence health, wellness, and disease are taken into consideration. TTC provides corporate executive medical care focused on service excellence, physician managed integrative care and leveraging global leading practices in clinical care delivery.

The analysis showed two main issues;

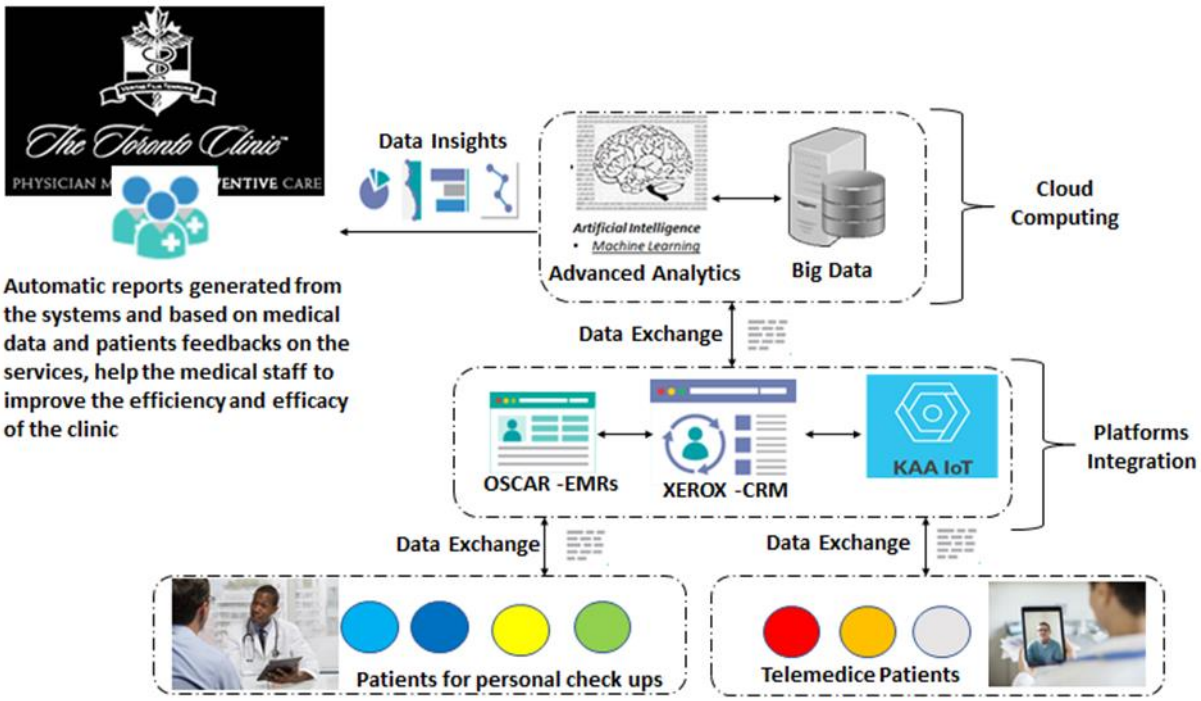
Firstly that the time allocated from the staff is dedicated essentially to:

- Paper work related to track and proceed with payments
- Patients documentations after visit to input manually in Oscar EMR system
- Appointments set up remainder and file Sharing with patients

In order to handle to growth process that the clinic is facing and not increase the staff number we need to standardize the services, digitalize the payment method included the patient post visit documentation side and of course this system needs to cooperate

with the already implemented Oscar EMR. The silos effect is considered as one of the greatest challenges healthcare organizations are looking at. When we talk about population health as we saw from the company analysis we are bringing together different parties: multiple departments, data, resources, stakeholders, and decision makers that finds hard to cooperate in a managerial way. As a result patient journey tends to be very complex. Healthcare organizations needs to find a more unified approach to the business and as we saw with the Toronto clinic business case, digital transformation can become a strong partner, a pillar that together with services always ensure operational excellence. Digital solutions such as CRM platforms represent a real opportunity to facilitate business processes and outcomes. International Data Corporation (IDC) a premier global provider of market intelligence, monitored a spending on public cloud computing solutions that in 2016 reached $70 billion, and forecasted that this number will triple over the next four to five years. However it is important to have single unified infrastructure to make it faster and easier to integrate already existing systems integrating patient care with patient billing. A digital centralized operations management of clinics it's going to impact control of patient access channels, keeping them in a precise network, and achieve economies of scale. By integrating CRM and EMR systems, healthcare companies are linking more relevant data and accessing pre-filtered results in one interface, avoiding duplicate data entry, and receiving accurate content in real time by delivering a better service. Second major issue that comes up from the analysis of the clinic is to reduce the time of the majority of patient interaction, the monthly follow up call to check up the status of the 10-assessment program objectives. There are already several integrate telemedicine system that can include IoT and give real time data on the current status of the patients and facilitate the doctor with a faster analysis. Because the clinic is planning to increase significantly the number of members its crucial to speed up the monthly follow up call for each member. We are talking about the most frequent interaction of the clinic (Over 65% of encounter time is associated with follow up calls as shown in Figure one) and is very important to give to the patient a better feedback (by using a hd screen view instead that a phone) and a faster way to record the clinical status and update the member profile (using IOT tools). The healthcare industry has been supporting for years the discussion of

enabling long-distance healthcare, or better known, telemedicine. Nowadays the increase of the social use of video across our society, together with the affordability of web cameras, enabled telemedicine to become an hot topic in the healthcare professional field. A 2016 Reach Health study reports that two-thirds of healthcare professionals named telehealth or virtual care as a top priority, up 10 percent from the previous year.If we go through how the several benefits, as we saw from Toronto clinic case, we realize why this topic has relevant priority on physicians. Structures will have shorter hospital stays and real time video patient monitoring will drastically reduce the need for medical interventions and home visit costs. Indeed medical providers can serve more patients, because video appointments provide a time-effective option for helping those who are managing a known condition, filtering some who might need to see a specialist, and for identifying those who should go immediately to the emergency room. Collecting data on patients will become easier with IoT devices and automated workflow management and analysis from health monitoring sensors will help doctors achieve a faster time to diagnosis, prescribing just in time, suitable medications. As result we will have faster access to care, quicker visits, better allocation of resources and improved management conditions. In the end the final the final proposal accepted from the board of the Toronto clinic is platform system, that is still today on implementation, that will include, data on medical records gathered from traditional EMR(Oscar) sources integrated with personal data from customer relationship management (Xerox CRM) system in addition with data from telemedicine system integrated with IoT devices (KAA)platform. The new platform business model will guarantee to patients both personal and telemedicine checkups. Physicians will have more information on the patients in one dashboard before the visit to have a better and real time clearer picture for the diagnosis thanks to the integration with CRM and KAA IoT. However new data will be recorded during visits and will generate, thanks to cloud computing, automatic reports based on updated medical charts and patient’s feedbacks on the services, helping the medical staff to improve the efficiency and efficacy of the clinic services.



A drawback to the Toronto clinic proposal could be found in the privacy issue Although the number of privacy laws have increased from the nineties, without considering the last General Data Protection Regulation, or GDPR, that have reviewed how businesses process and handle data in Europe, considered by experts an high stricted regulations, there is a lot that still needs to be done. Inadequate security of IoT devices and networks is the most pressing challenge faced by the IoT industry as it continues to compound the risk of data vulnerability for both businesses and individual consumers. At the same time, more than half of today's consumers, express themselves as willing to share personal data to improve care coordination, considering that privacy is still a major concern. In 2015, 52 percent of company respondents to a pwc consulting study said they have finally purchased cybersecurity insurance, a double-digit increase over the year before. In conclusion we can stands that the era of lean production has changed how we make business today, with just-in-time global supply chains asking for real time data on the state of inventories and integrated platform to have a better management of suppliers and better control outsourcing processes. If we collocate this dynamic framework to our country we

have unfortunately a clear negative picture. The Digital Economy and Society Index 2018 (DESI) is a composite index that summarizes relevant indicators on Europe's digital performance and tracks the evolution of EU member states in digital competitiveness. Denmark, Sweden, Finland, and the Netherlands have the most advanced digital economies in the EU followed by Luxembourg, Ireland, the UK, Belgium and Estonia. Romania, Greece and Italy have the lowest scores on the DESI. The Italian business landscape is mainly composed of small and medium-sized family-run businesses that are reluctant to accept technology. In this digital era platforms comes out as the tool that allow to guide and control this fourth industrial revolution. The aim of this thesis, is to show from a practical business development point of view the several competitive advantages of adopting the platform business model that integrates the new tech solutions. Even in particular sector such as healthcare there are so many possibility as we have seen. It is crucial for Italy to don't miss the chance of bringing their companies in a 4.0 industrial revolution. Investing in Universities program to bring a new class of managers is the first step and tax deductions to companies that invest in these innovation is the base to build on. However what needs to change is the culture behind Italian entrepreneurs that need to see technology as an opportunity not as an enemy. The progress of digital technologies is associated with the complexities governance, security, integration of hold business models,standardisation issues, factors such as, budget constraints. These are all day-to-day market and competitor's decision pressures, that needs to change business priorities. The hope is that my generation will undertake this challenge and help to digitize businesses in Italy scaling that European ranking as soon as possible.