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How companies are optimizing their Supply Chain thanks to the new usage of Big Data?

Bachelor thesis presented by

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Thanks

I would like to thank all the people who encouraged me and everybody who have helped me in this journey.

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Acronym and Abbreviation Index

APS: Advanced Planning System

BtoB: Business to Business

BtoC: Business to Customer

CMI: Co-Managed Inventory

CPR: Capacity Requirement Planning

EDI: Electronic Data Interchange

GPS: Global Positioning System

IT: Information Technology

MRP: Material Requirement Planning

MRP: Material Requirement Planning

MRP2: Manufacturing Resource Planning

NSA: National Security Agency

PGP: Pretty Good Privacy

SMI: Supplier Managed Inventory

TMS: Transportation Management System

TOR: The Onion Router

VMI: Vendor Management Inventory

WMS: Warehouse Management System

Summary and Keywords

Abstract:

Competition between companies is harder every day especially since the crisis. Being the one offering the greatest product at the best price is not sufficient. Nowadays, companies have to get the right information. Indeed, if somehow a company manage to get information about a place and a time where customers are going be, then they have won. The information is valuable, Big Data is information. If an organisation manages to implement information that exploits big data then they have a competitive advantage.

Big data is like a diamond in the rough. You have to work on it, analyse it, and mix it with your internal database and it will give you precious information that can be used in your decision making process.

This technology can go along with supply chain management. Big data is not a crystal bowl but it can bring accurate information about future needs for production into a company. The analyses made out of big data will give forecast that will help to manage the stocks into the organisation warehouse. It will bring also knowledge for delivery regarding external factors.

In this document you will discover some other ways of using big data. Also, even if Big data is new, There is already studies that are showing its impact on a company business from different perspectives.

So if you were looking for investing in a promising system for your company, you will probably find some useful ideas. Enjoy the reading.

Keywords:

Information, Supply Chain, Logistics, Warehouse Big Data, Database, Information System, Alpha, Decision Making

Methodology and Interest of the study

I chose to use many online resources because it is the most up to date information available on this subject that is changing every day. All of those websites have been chose carefully and are (on different levels) reliable.

This thesis will have a focus on big data and the information system. I chose to right my thesis this way because I want to learn from this experience and I am assuming that you, reading this document, don't need a whole course on supply chain management.

In order to have actual, reliable information to discuss I have interviewed a person working at Alpha Canada about the implementation their new information systems.

The interest of this document is to develop at the maximum the possibilities and usage of big data and to see its application to the supply chain area trough information systems.

Introduction

Big brother is watching you. This sentence is the beginning of big data. What we call Big Brother is a surveillance system and big data use this system deeper and apply it to companies for a profit purpose.

The subject of this study is to show the possible implementations of Big Data into a company in a way that those possibilities can optimise its supply chain. The thesis is going to focus especially on big data and the information systems that are used to manage the supply chain.

New technologies enable an increased management within a company. There are "wars" in every sector in order to have the most efficient technology, the most up to date system or machine that leads to a strong competitive advantage. The first company which manage to handle a new technology in the first place has the opportunity to create a new competitive advantage because this company will be the first to us it. Almost everybody remembers who the first person that went into space (Youri Gagarin) or walked on the Moon (Neil Armstrong) was. But a few can name who the second person was (respectively: Alan Shepard and Buzz Aldrin). This shows if necessary, that people remembers the first event, action, company etc that does something new.

This is why companies want to be first in having a promising technology. Big data is one of them. If your company is the first to predict an event then you will have more capacities and possibilities to turn this event into an advantage. For instance when the virus Zika appeared in South America, the demand of mosquito repellent OFF! manufactured by SC Johnson increased by 6000% in Brazil. The company tried to take advantage of the increasing demand but instead had to deal with it and faced many problems into its international supply chain. If this company had predicted this increase, maybe they would have been able to satisfy the demand.[1]

[1] GT Nexus. (12th May 2016). *Supply Chain : les 5 Grandes Tendances du moment.* [ONLINE] Available at: http://www.gtnexus.fr/ressources/articles/supply-chain-les-5-grandes-tendances-du-moment?utm_campaign=2016&utm_medium=EMEASOCIAL&utm_source=LI&utm_content=DIRECT [Last Accessed 20/05/2016].

In an interview of Joi ITO from the Massachusetts Institute of Technology Media Lab, he said: "*Before, what we did was we thought of things and then we wrote it down and that became knowledge. Big Data is kind of the opposite; you have a pile of data that is knowledge until you start looking at it and noticing: well maybe if you shifted this way this turns into this interesting piece of information*.[2]

In a near future every object on earth will produce data. We already know about computers, phones even printers are sending information that is stored in the Cloud. Soon this Cloud will include data from our house, our car, our wash Machin… But all this information is meaningless until someone adds some interpretation of it and turns it into valuable information. Possibilities are endless. Results can be used for healthcare prevention or turned into a marketing perspective or employed in a supply chain management.

Also the Police can use it, like in the city of Memphis in Tennessee which is in the top 10 of cities in the United State of America (USA) with the number of crime committed. They use this technology to predict crimes, thanks to algorithms, and send police patrols in high risk crime areas.[3]

This study will show the current usage of big data in different domains such as marketing, sales or supply chain. Then, focusing on the information systems in the supply chain, it will show in detail the benefits of implementing such system. Ironically, data on this specific subject is not really big as this concept and this technology have been created just a few years ago.

As previously said big data is new but what aren't new are information systems. The modern form of information system has been created at the same time as computers. I think we can say that computers have been created for this purpose in order to deal with data and structure it. Before computers data inside a company was hand-written (or printed since the invention of printer in1452 or typed on a typewriter since 1714).[4] For

[2] YouTube. (25th February 2016) *The Human Face of Big Data* [ONLINE] Available at: https://www.youtube.com/watch?v=r6v15Z60eUI [Last Accessed 05/03/2016].
[3] YouTube. (2nd December 2014) *Reportage spécial investigation: Big Data* [ONLINE] Available at: https://www.youtube.com/watch?v=R-1tEh4jTE0 [Last Accessed 05/03/2016].
[4] Histoire de la Machine à Ecrire. (2016). *Histoire de la machine à écrire : Origine à nos jours.* [ONLINE] Available at : http://www.collection-machineaecrire-campiche-hermes.ch/historique.htm#chrono [Last Accessed 05/03/2016].

centuries, since ancient history, companies kept their data in book in order to have a record of their activities. It was the beginning of accounting.

This thesis has the purpose to find out to find out elements that will improve information systems inside a supply chain with the usage of big data. It implies that big data can improve it. So this document will show the ways that big data can be use in the supply chain in order to create an added value to a company. The hypothesis we will seek to answer is if this is a profitable situation.

Through the different parts of this thesis, we are going to analyse in detail the concept of big data and its different aspects. As big data is new, companies start using it, but just a few are successful. Also, we are going to review supply chain management and its different information systems in order to have a state overview of the domain.

PART 1 Big Data and Information Systems

Chapter 1 – The Big Data

Big data is a concept that became "popular" a few years ago in 2012.[5] There are many different definitions of big data from many different reliable sources. Here are two pertinent definitions:

IBM says that: *"Big data is being generated by everything around us at all times. Every digital process and social media exchange produces it. Systems, sensors and mobile devices transmit it. Big data is arriving from multiple sources at an alarming velocity, volume and variety. To extract meaningful value from big data, you need optimal processing power, analytics capabilities and skills."*[6]

On SAP website, they define it as: *"Big Data is the ocean of information we swim in every day – vast zetabytes of data flowing from our computers, mobile devices, and machine sensors. With the right solutions, organizations can dive into all that data and gain valuable insights that were previously unimaginable."*[7]

Both definitions are complementary. We can say that big data is coming from everywhere and as long as you can exploit this huge amount of data, you can have an advantage. This concept can also be defined through different dimensions. We all know the 4Ps in Marketing (Place, Promotion, Price and Product) in which you can add People, Process… Big data has the same concept; there are 3 basic dimensions which are: Volume, Velocity and Variety[8]. But it is not totally complete so SAS defines it with 2 other words: Variability and Complexity[9]; IBM includes Veracity and Value[10]; probably soon, some other variables are going to be included.

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[5] Definitions Marketing. (11th January 2016). *Definition: Big data* [ONLINE]. Available at http://www.definitions-marketing.com/definition/big-data/ [Last Accessed 21/05/2016].
[6] IBM. (2016). *What is Big Data?*. [ONLINE]. Available at http://www.ibm.com/big-data/us/en/ [Last Accessed 21/05/2016].
[7] SAP. (2016). *Big Data.* [ONLINE]. Available at: http://go.sap.com/solution/big-data.html [Last Accessed 21/05/2016].
[8] Gartner. (2016). *IT Glossary: Big Data*. [ONLINE]. Available at: http://www.gartner.com/it-glossary/big-data/ [Last Accessed 21/05/2016].
[9] SAS. (2016). *What is Big Data?*. [ONLINE]. Available at: http://www.sas.com/en_ph/insights/big-data/what-is-big-data.html [Last Accessed 21/05/2016].

Dimension	Explanation
Variety	Data can come from everything that is connect to a network, internet. It can be structured information as well as unstructured or even semi-structured data.
Velocity	This is about the ability to react almost in real time to "live" information. In terms of service quality, it is important to make decisions thanks to up to date information.
Volume	The data might come from inside as well as outside the company. The quantity of information created from those two sources is unbelievable. According to a 2012 SAS research, only 30% of that information is valuable. About 40 Zettabytes of data are going to be created within the next 4 years.
Value	It defines the ability to create value. This is essential, because if you can't extract useful information then you will not have valuable information that you can use.
Veracity	1 out of 3 decision maker in companies do not believe in the information they get in order to make a decision
Variability	In addition to all the previous characteristics, variability is the fact that a huge amount of data can be created on day and the next day almost no (interesting) data can be created
Complexity	As the amount of data is enormous and is coming from multiple source, the ability to make them match, in order to get pertinent information is almost impossible to have
…	Some other characteristics are defined by other organizations. It always depends on

Chart 1 – The Vs in Big Data [11]&[12]&[13]

Now we have defined what is big data we are going to go deeper and analyse the information and its usages.

[10] IBM. (19th March 2015). *Why only one of the 5 Vs of big data really matters*. [ONLINE]. Available at: http://www.ibmbigdatahub.com/blog/why-only-one-5-vs-big-data-really-matters [Last Accessed 21/05/2016].
[11] SAS. (2016). *What is Big Data?*. [ONLINE]. Available at: http://www.sas.com/en_ph/insights/big-data/what-is-big-data.html [Last Accessed 21/05/2016].
[12] IBM. (19th March 2015). *Why only one of the 5 Vs of big data really matters*. [ONLINE]. Available at: http://www.ibmbigdatahub.com/blog/why-only-one-5-vs-big-data-really-matters [Last Accessed 21/05/2016].
[13] Calais, C. (March 2014) Big Data Big brother will help you. *Supply Chain Magazine.* N°82. Pages 56 to 60.

I – The Information

As previously said, information is coming from different sources in different forma. They can either be internal or external and structured information (mostly coming from internal source) or unstructured information.

The problem once you have all this data available is to make them match in order to have useful information to make the right decision at the right time.

A - Where the information is coming from

Worldwide, companies have access to their own database and can also have access to data which is not directly inside their systems. So we can sort two different sources of data: Internal and External.

1 – Internal Data

There is data in every industry and every company can create its own data. This is called internal data. Then the company can either chose to use or not this information depending on its ability and its willingness to use it. Because internal data is always available but a company doesn't always have the capacity, money or time that is needed.

Often it will come from the operational level because people working there are entering the data in the company's system. They are the link between the company and the customer - it can be Business to Business (BtoB) as well as Business to Consumer (BtoC).[14]

Inside the BtoB relation, many companies are using Electronic Data Interchange (EDI). This system is a data sharing process that sends information directly through internet from the first company to the second one. This can upload documentation or update a file, a booking or anything else that has been pre-configured into the second company's information system. It can works in both ways.

[14] Calais, C. (March 2014) Big Data Big brother will help you. *Supply Chain Magazine.* N°82. Pages 56 to 60.

This internal channel of communication provides structured data (e.g., spreadsheet, database…). We can also call it "record" as per the International Standard's definition: "*Information created, received, and maintained as evidence and information by an organization or person*"[15].

This data is part of big data. But it is just a small part of it as it is a record of what happened in the past and only about customers and suppliers that a company already had. It is a state of the events inside the organization that helps managers and directors to make decisions. They are creating previsions based on past events. Unfortunately this way of taking decisions won't always work as it includes only internal data. The fact is that to take relevant decisions a company has to include external data from outside the company. It means data from potential customers as well as political or climatic information. It can include hundreds of other variables as you will read in the next part of this section about the Intercontinental Hotel Group.

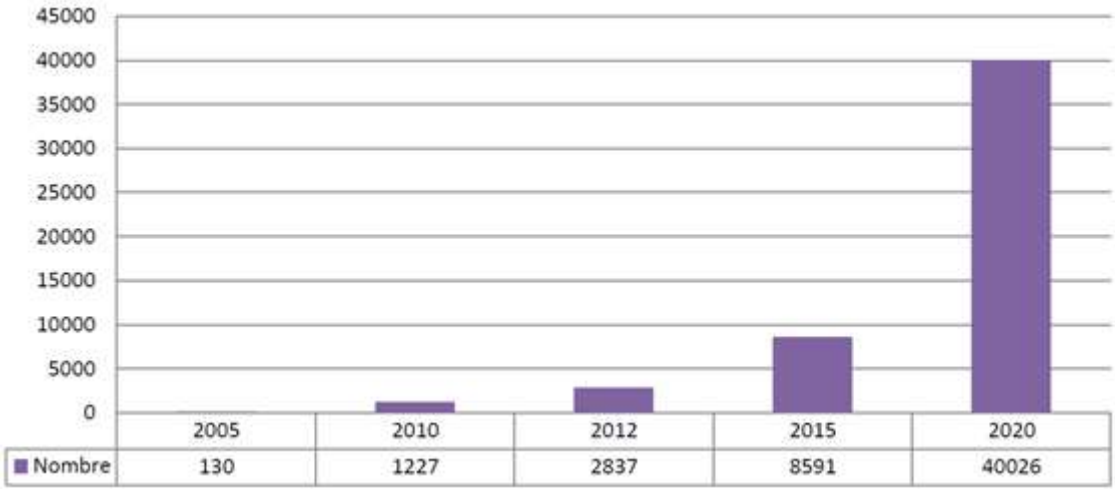
2 – External Data

Every time you are on the internet you create data. It means when you click on a hyperlink, visit a website page, send an e-mail to someone, watch an online video, click on an advertisement, connect to your Global Positioning System (GPS) or even when you close a page in your internet browser you are creating data. This is called external data or Digital Data Streams.[16]

Digital Data Stream (or DDS) is the flow of information that can be used in real-time. We can define it as an equivalent of big data without the interpretation of the information that are produced.

As you can see in the Graph 1 the production of data in the world is growing really fast every year.

[15] International Standard. (15th September 2001). *Information and Documentation – Record Management.* ISO 15489-1. Article 3.15. Page 3.
[16] Pigni, F., Piccoli, G. and Watson, R. (1st April 2016) *Digital Data Streams: Creating Value From The Real-Time Flow Of Big Data.* California Management Review



Graph 1 – Forecast of data production from 2005 to 2020 (in Exabyte)[17]

When you go on the internet, there are three types of website; the ones which require payment to access the content, the ones which are free and also the ones called "freemium" websites ("Freemium" is a free website with premium accounts that you have to pay for. Skype has 1.2% of its users that are paying a fee for a premium account).[18] But in reality, almost all of the "free" websites are extracting data from your visit and create value of it (they will sell it or use it for their own profit).[19] It can be your name, your gender, your location, your interest, your marital situation…

There are 3 different stages in Digital Data Stream:

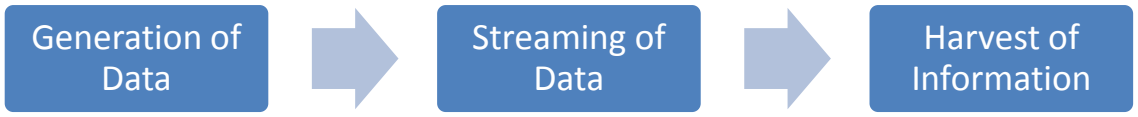


Figure 1 – Stages of DDS

The identification of those three stages has been made in 2013 in the University of Minnesota review.

[17] Komputer. (20th January 2015) *Big Data - jak świat radzi sobie z ogromnymi ilościami danych.* [ONLINE]. Available at: http://www.komputerswiat.pl/jak-to-dziala/2015/01/ciekawostki-o-big-data.aspx [Last Accessed 15/03/2016].
[18] My-Business-Plan. (2016). *Décryptage du modèle Freemium: comment ça marche ?*. [ONLINE]. Available at: http://www.my-business-plan.fr/modele-freemium [Last Accessed 15/03/2016].
[19] YouTube. (25th February 2016) *The Human Face of Big Data* [ONLINE] Available at: https://www.youtube.com/watch?v=r6v15Z60eUI [Last Accessed 05/03/2016].

The first stage *Generation of data* represents the creation of the data. This occurs when someone gives (deliberately or not) information by going on a website or connecting to a GPS. Everything you do is personal information that some others are extracting from the usage of their service. When you go on the internet, the website you visit will have information about your navigation but not only. Indeed, in an investigation made by *Spécial Investigation* in 2014, they visit during one hour 17 different websites and they figured out that 272 other websites spied their navigation.

The second stage called *Streaming of Data* occurs almost at the same time as the first stage. That is why big data is a process that allows a real time decision making. This stage is characterised by the differentiation of kinds of data extracted. It might be the technology you use, the nature of the content, the source of your connection (personal or from a company) and the legality of the data extracted (legal purpose will be more detailed further away in this thesis).

The last stage is the *Harvest of information*. This step is the collection of data (all of it or just a part) in which a context is added in order to create information.

Those three steps represent the creation of the information and how it is brought into an organisation.[20]

An organisation which, in addition of the data already available inside, has access to external sources of data might be in position of predicting future events, future sales, future profit… with more accuracy. The main problem with external data is that it is unstructured; it means that it is useless information unless your company has the capacity to analyse a massive amount of data that in real time. This investment in terms of money is huge. As you will read in the second part, an implementation of a successful information system can cost millions of euros.

B - The interpretation of the information

In order to be profitable, a company has to sell a product or a service. This will create value. It is usual that a customer has to spend time, in order to compare or find the product that match his/her need/want. Then big data can be used in order to increase the

[20] Pigni, F., Piccoli, G. (March 2013). *Harvesting External Data: The Potential of Digital Data Streams.* MIS Quarterly Executive. University of California. Pages 53 to 64.

willingness of a potential customer to buy a product or service.[21] To make it happen, companies are using software and hardware that are analysing Digital Data Stream (DDS). We call them information system.

An information system is: "A combination of hardware, software, infrastructure and trained personnel organized to facilitate planning, control, coordination, and decision making in an organization."[22] Those information systems are made to analyze and share information inside companies from internal or external or internal & external sources. It depends on what they want and also on what companies are willing to spend time and money on.

For instance, the Intercontinental Hotel Group owns not less than 4600 luxury hotels around the world. Every time a consumer book a room, the person has to provide information to the hotel. Once it is entered in the database, the Intercontinental Hotel Group can have access to that information. In 2013 the group was using 50 variables to make decisions, now the company uses not less than 650 different variables to make the most accurate decision.[23]

In the Figure 3, we can see the creation of the data, as previously explained from both internal and external sources, and also the process of value creation. After the harvest, companies have a huge amount of information structured and unstructured information coming in real time. The challenge at this stage is to analyse those information in order to generate reliable and valuable information. Inside companies, the California Management review identified 4 different framework components that are working together in order to transform "raw material" into value. Those four components are: Mindset, Skillset, Dataset and Toolset. [24]

We can define Mindset as the willingness for a company to invest in this technology and use DDS in order to make data-driver decision. So this component is the first one

[21] Pigni, F., Piccoli, G. (March 2013). *Harvesting External Data: The Potential of Digital Data Streams*. MIS Quarterly Executive. University of California. Pages 53 to 64.
[22] Business Dictionnary. (2016). *Information System.* [ONLINE]. Available at: http://www.businessdictionary.com/definition/information-system.html. [Last Accessed 05/03/2016].
[23] Van Rijmenam, M. (2014). *Think Bigger : Developing a Successful Big Data Strategy for Your Business*. New York: AMACOM
[24] Pigni, F., Piccoli, G. and Watson, R. (1st April 2016) *Digital Data Streams: Creating Value From The Real-Time Flow Of Big Data*. California Management Review

and the most important. Implementing a DDS strategy is a long and heavy process that creates business opportunities.

Skillset is a notion that represents the ability for a firm to mobilise its knowledge and resources in order to make value out of the data collected. DDS is a constant flow of data provided in real time so companies have to sort them measure and do an interpretation of them. Without interpretation it is like doing a market research and not analyse the results once they are structured in an excel sheet or another system. Companies have to "mix" their knowledge and the information provided in order to make strategic data-driven decisions that are pertinent and reliable to them and for their future. You will see the relation in the Figure 2.

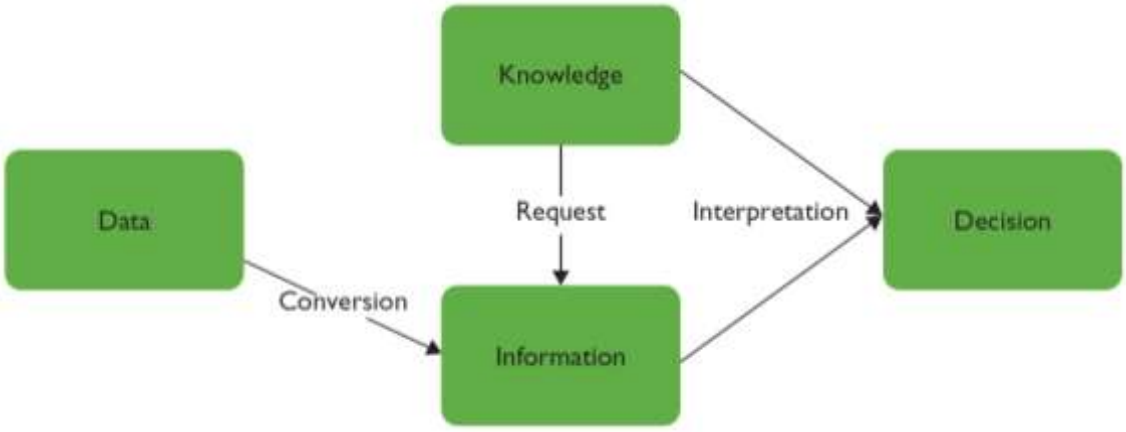


Figure 2 – Relationship between Data, Information and Knowledge[25]

Earlier, we defined big data with three main Vs: Variety, Velocity and Volume. Those three Vs are important to define Dataset. Because this component aims to define the capacity for a company to identify the data needed into the mass of data collected in real time. A firm can choose to use some DDS for a specific service while another department of the company is using different data from DDS. It can also come from the decision to create a new service. The usage of big data will be explained with more details later in this document.

Then the Toolset component is related to the previous ones as it defines the ability for an organisation to use a suitable system in order to harvest the data from external

[25] Pigni, F., Piccoli, G. and Watson, R. (1st April 2016) *Digital Data Streams: Creating Value from the Real-Time Flow of Big Data.* California Management Review

sources. It represents the software and hardware that use a company to operate with live data.

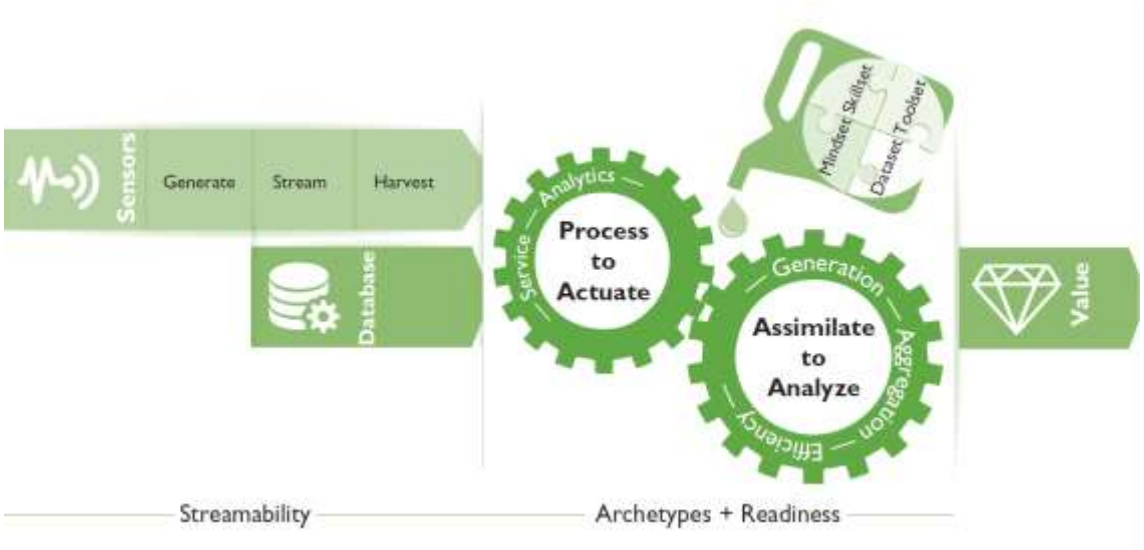


Figure 3 – View of the DDS Data Processing Framework[26]

All of this process is done thanks to the sources of data. Once this DDS comes to the company information system and is mixed (or not depending on the information the firm is looking for) it is analysed. At this stage the difficulty is to find out a way to show the right information – the one you are looking for – and the more accurate at the right time. An efficient information system is then needed. But it can be a totally different one from one company to another.

In this first part we have seen the two sources of information that are providing data to companies as well as the way to process and create information out of it. Once the information is available and ready for usage it is up to the organisation to choose why and what are they going to use that information for.

II – The usage of Big Data

The main objective of a company is to make profit. In order to do it, the organisation has to offer a product or a service that matches the consumer needs. To match those requirements, a company many use the data and information that are available for it. In fact, according to the Harvard Business review from October 2012, "*Companies in the*

[26] Pigni, F., Piccoli, G. and Watson, R. (1st April 2016) *Digital Data Streams: Creating Value From The Real-Time Flow Of Big Data.* California Management Review

top third of their industry in the use of data-driven decision making were, on average, 5% more productive and 6% more profitable than their competitors".[27] That could represent millions of dollars.

A –Why using Big Data

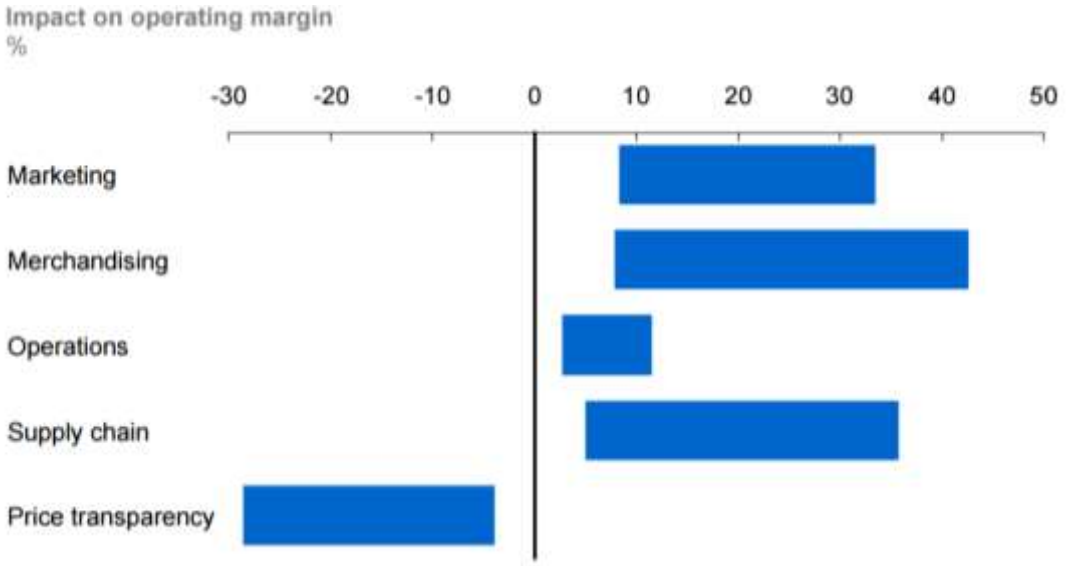
Big data is currently used in many sectors in every industry. As you can see in the Graph 2, the usage of big data has different impact depending levers that a company has. This chart from McKinsey Global Institute analysis has been produced in June 2011. We can clearly see that Marketing, Merchandising and Supply Chain are the 3 most profitable functions if they use big data. For this analyse, McKinsey Global Institute used different levers in each function in order to establish those results:[28]

Marketing:
- Cross-selling
- Location based marketing
- In-store behavior analysis
- Customer micro-segmentation
- Sentiment analysis
- Enhancing the multichannel consumer experience

Merchandising:
- Assortment optimization
- Pricing optimization
- Placement and design optimization

Supply Chain:
- Inventory management
- Distribution and logistics optimization
- Informing supplier negotiations

[27] McAfee, A. and Brynjolfsson, E. (1st October 2012) *Big Data: The Management Revolution* Harvard Business Review
[28] McKinsey Global Institute. (June 2011). *Big data: The next frontier for innovation, competition, and productivity*. McKinsey & Company



Graph 2 – The functions that impact on firms operating margin[29]

In December 2013, Amazon has registered a patent on predictive delivery. With this system, a good that a consumer is going to order would be already in the closest hub from this person even before it was ordered. In order to do it, Amazon applies many variables from big data such as previous orders, historical of research, the time that the potential consumer's mouth is on a specific product… Thanks to it, Amazon is able to reduce its delivery time and then make a sell because the consumer will not have to wait the "normal" time to get its purchase.[30]

Amazon is not the only company that use big data. Indeed according to an MIS Quarterly Executive article from 2013, 25 other companies are quoted. We can find popular companies such as Booking.com, Groupon, Netflix, TomTom and (of course) Google Trends. What is different between all those companies is the way they are using big data. [31]

They are five main purpose of using big data which are: DDS Generation, DDS Aggregation, Service, Efficiency or Analytics. Those are called Archetypes and a

[29] McKinsey Global Institute. (June 2011). *Big data: The next frontier for innovation, competition, and productivity*. McKinsey & Company
[30] Calais, C. (March 2014) Big Data Big brother will help you. *Supply Chain Magazine.* N°82. Pages 56 to 60.
[31] Pigni, F., Piccoli, G. (March 2013). *Harvesting External Data: The Potential of Digital Data Streams*. MIS Quarterly Executive. University of California. Pages 53 to 64.

company can either choose to use one or more of them, they are not exclusives and can be combined. [32]

The Digital Data Stream Generation is a way that an organisation creates information and data out of the usage of its service. Once information has been collected, they can use it, sell it or provide it to other companies with partnership or freely. This last strategy has been adopted by a travel organisation called TrpIt. What they do is to collect information about a trip that a customer plans to do and share the itinerary with other companies which are using it as DDS.[33] So companies using this archetype are creating value and might make money out of it.

The second archetype called Digital Data Stream Aggregation is a simple process. We can define it as the harvest of data and the transformation into information. Once the organisation has created structured information from the DDS it will provide them to third parties.

The third one is Value. This allows the implementation of a new service that is provided thanks to the usage of DDS. For instance Uber, an application where a customer can order a private driver, is using this archetype to provide real-time positioning of its drivers to its customers.

The Efficiency archetype is uses DDS to provide information to its customers. We can take the example of the application Waze (a Google application). This mobile application is a GPS that provides itinerary to its users. Also in addition to the basic function of a GPS, it provides a real time traffic overview and calculates the best itinerary regarding the current traffic. This is possible because Waze collect geographical information of its users (and also from Google Maps users) to provide the most accurate state about the traffic. So a person using it will receive information about the itinerary and also will create data that are sent and directly analysed.

The last identified archetype is Analytics. This is the extension of the DDS Aggregation archetype. If DDS Aggregation collects data and provides it to third-parties, the Analytics go further and in addition to collect and structure the data, organisations using

[32] Pigni, F., Piccoli, G. (March 2013). *Harvesting External Data: The Potential of Digital Data Streams*. MIS Quarterly Executive. University of California. Pages 53 to 64.
[33] Applegate, M., Piccoli, G. and Brohman, K. (October 2008). *The Traveler's Agent.* Harvard Business School Case.

this archetype are dealing with the information and converting them into usable information that other companies can exploit. They are analysing information for others.

We have seen that big data was useful in some functions of companies and also the ways that an organisation can exploit and use big data. [34] On a different note, the problem with DDS and more largely with big data is the privacy.

B – Information and Privacy

In June 6th 2013, American press revealed to the world the existence of a National Security Agency (NSA) program called PRISM. It was a spying information system that was using big data in order to collect and analyse personal data about everyone connected to internet on the planet. The program was harvesting data from internet provider, online social networks or personal computer manufacturers as you can see in the Figure 4.

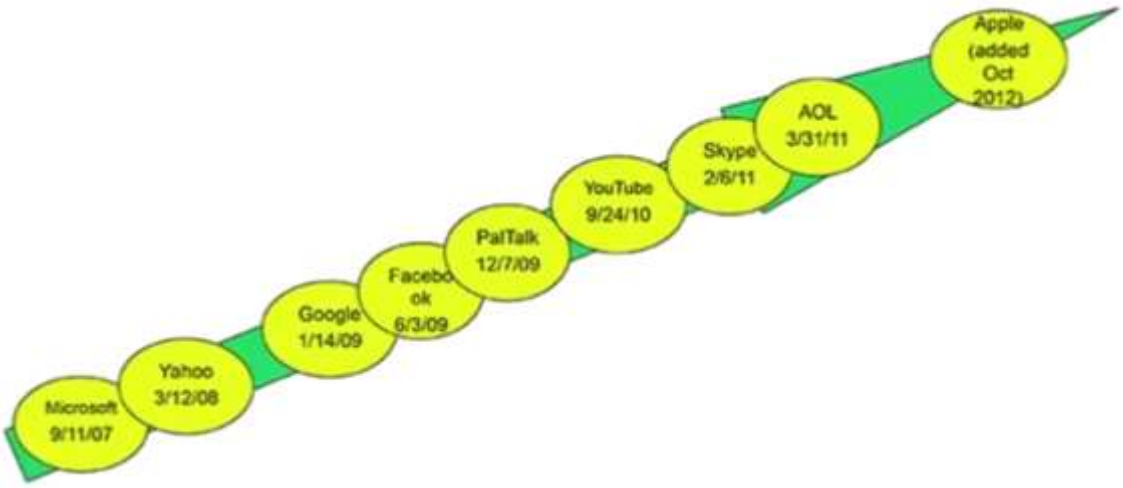


Figure 4 – Dates when PRISM program began to collect data from providers[35]

The problem with big data is to find the border between privacy and public usage. The scandal with the NSA showed that someone you don't know can access you private data and use them. The challenge for companies is to find the limit between providing a service that match all of your needs and not being intrusive.

[34] Pigni, F., Piccoli, G. (March 2013). *Harvesting External Data: The Potential of Digital Data Streams*. MIS Quarterly Executive. University of California. Pages 53 to 64.
[35] YouTube. (23rd October 2013). *Stop Watching Us: The Video*. [ONLINE]. Available at: https://www.youtube.com/watch?v=aGmiw_rrNxk [Last Accessed 15/03/2016]. Electronic Frontier Foundation.

In order to protect your data from an "industrial" usage, some experts recommend using encryption software such as PGP (Pretty Good Privacy) or software that is hiding you identity and allow you to go on the internet anonymously like TOR (The Onion Router). Those systems don't allow harvest of data from your navigation.[36]

In this first chapter we have seen the different sources that companies are using such as internal and external data in order to exploit them. We have also explained the different usage the can do out of the collected data: DDS Generation, DDS Aggregation, Service, Efficiency and Analytics. And to finish we have, briefly seen the danger that represent the production of data regarding the privacy of world citizens.

[36] Le Figaro. Ronfaut, L. (6th June 2014). *De Prism à Tor, les dix noms du scandale de la NSA*. [ONLINE]. Available at: http://www.lefigaro.fr/secteur/high-tech/2014/06/06/32001-20140606ARTFIG00093-de-prism-a-tor-les-dix-noms-du-scandale-de-la-nsa.php. [Last Accessed 15/03/2016].

Chapter 2 – Information Systems

Since the beginning of this thesis we are talking about data and information its usage. Now we are going to analyse more in detail the treatment of it thanks to the Information Systems.

First we can define an information system as: "*A combination of hardware, software, infrastructure and trained personnel organized to facilitate planning, control, coordination, and decision making in an organization.*"[37]

I – The solutions brought by the information systems

Nowadays, organisations are dependent regarding their information systems. I can't find any company not using software in order to manage their data. As you can see in the Figure 5, the software (or hardware) that an organisation is using, can manage database and telecommunication thanks to computers. It is the link with the organisation.

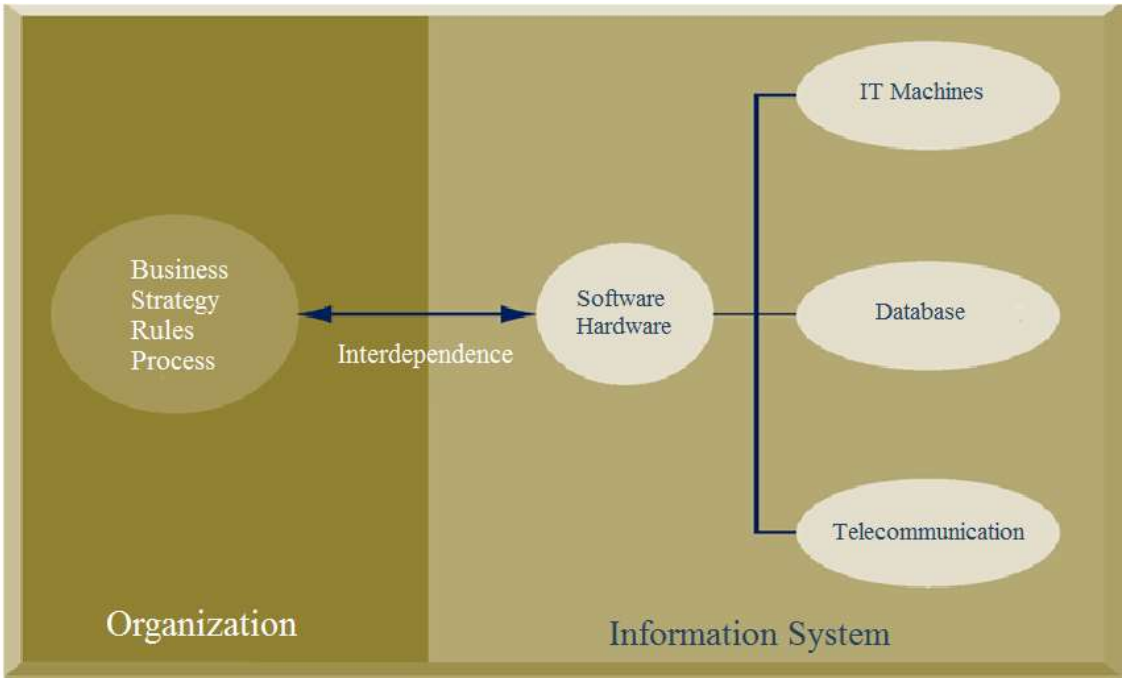


Figure 5 – Interdependence between Organisation and Information System[38]

[37] Business Dictionnary. (2016). *Information System.* [ONLINE]. Available at: http://www.businessdictionary.com/definition/information-system.html. [Last Accessed 05/03/2016].
[38] Lavallee, J. and Perras, D. (2006). *La Gestion de L'Entreprise Numérique.* ERPI. Sherbrooke University.

A – Historic of the Information Systems

Since the middle of the 20th century a computer transaction between two different companies was batched. It means that every specific amount of time (might be a day, a week, a month…), the company was sending and receiving data to/from suppliers and customers. This process last for decades because the servers were not enough powerful to share data and structure it into the targeted mainframes of a company directly. Nowadays, processors are super powerful and can deal with huge amount of data in "live" in order to have reliable information available inside a company.[39]

Since technologies have been invented, every organisation is investing. In order to stay in the "race" and being competitive, having an up to date system is important. Today, investments in it have never been so important and the U.S Department of Commerce estimates that information system investments represent 34% of the total investment in 2004 in the USA.

In the meantime, in the U.S. between 1999 and 2014, the sales of software have been increased by 32.29% (see Graph 2). It means that companies in North America have increased their expenditure in software by one third in fifteen years. I don't have more up to date data but what we can say is that expenditures decreased 2 years in 2008 and 2009 because of the world crisis. Otherwise, companies are spending between 2% and 3% more each year. This market in USA represented 15,961.70 billion of American dollars in 2014. [40]

The Federal Reserve Bank of USA estimated that the investments done between 1995 and 2000 in information technologies have reduced the inflation by 0.5% to 1% each year. The challenge now is for companies to figure out if yes or not, investing in an expensive information system is a good decision which going to be successful and profitable. [41]

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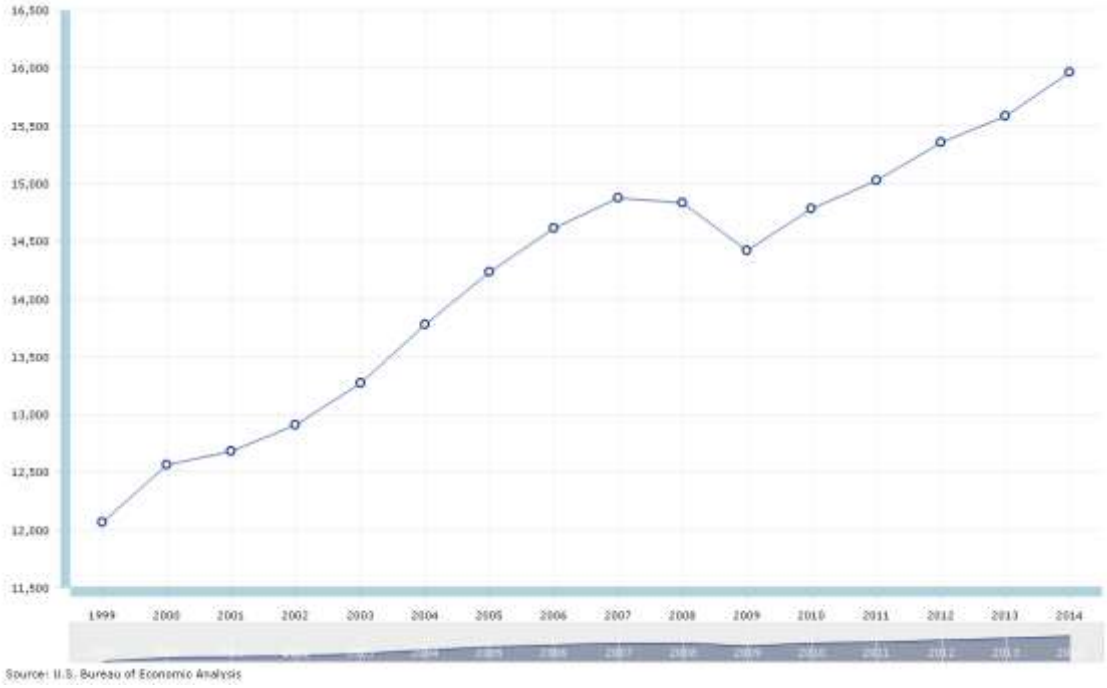
[39] Pigni, F., Piccoli, G. and Watson, R. (1st April 2016) *Digital Data Streams: Creating Value From The Real-Time Flow Of Big Data.* California Management Review

[40] Bureau of Economic Analysis. (5th August 2015). *National Data - Table 9.3U. Gross Domestic Product and Final Sales of Software*. [ONLINE]. Available at: http://www.bea.gov/iTable/iTable.cfm?reqid=12&step=3&isuri=1&1203=2077#reqid=12&step=3&isuri=1&1203=2077. [Last Accessed 05/03/2016].

[41] Lavallee, J. and Perras, D. (2006). *La Gestion de L'Entreprise Numérique.* ERPI. Sherbrooke University.



Graph 3 – Gross Domestic Final Sales of Software between 1999 and 2014 (in billions of dollars) in the USA[42]

B – The usage of information technologies

Nowadays, technology of the information is common. It creates innovation and innovating systems that are going every day further. The advantage from an information system is not the information system itself but the way an organisation is using it. The more developed is the information system inside an organisation the more difficult to copy it is. In other words, if you have implemented a system that gives you a competitive advantage, you won't want you competitor to handle it. [43]

I think we can say that every registered company has, at least one information system. It can be a system that cost millions to a company to develop or just Excel sheets. Indeed an Excel sheet is an information system because you create records of your sales,

[42] Bureau of Economic Analysis. (5th August 2015). *National Data - Table 9.3U. Gross Domestic Product and Final Sales of Software.* [ONLINE]. Available at: http://www.bea.gov/iTable/iTable.cfm?reqid=12&step=3&isuri=1&1203=2077#reqid=12&step=3&isuri=1&1203=2077. [Last Accessed 05/03/2016].

[43] Lavallee, J. and Perras, D. (2006). *La Gestion de L'Entreprise Numérique.* ERPI. Sherbrooke University.

purchases, waiting time, production time... All of those records are creating and improving the company's database.

II – The different information systems

We can distinguish 4 different types of information systems that are used by organisations world wild. All of them are collecting data and exploit them (it is the main purpose of information systems). Those four different systems are as follow: [44]

- Treatment transactions system;
- Management information system;
- Decision making system aid;
- Information system for administration.

At an operational level, the treatment transaction system helps employees to do their daily work. It creates record of all the operations that are done. We can say that it creates the database of the company. It helps and also executes (with advanced systems) automatically and generates documentation used by operational functions. It can be used in human resources as well as marketing, finance or even for dealing with customers and suppliers.

The second type, management information system, is working on a macro level of the organisation. When the treatment transaction system deals with each document or files individually, the management information system is summarizing them. It means that it creates reports, models and analyses.

An information system can also be really helpful in the decision making process. That is why one type of information system is called Decision making system aid. This defines a system that takes record and also allows doing simulations and analyses with special reports.

Finally the Information system for administration is a system that uses two of the previous systems: Treatment transactions system and Management information system.

[44] Lavallee, J. and Perras, D. (2006). *La Gestion de L'Entreprise Numérique.* ERPI. Sherbrooke University.

It can also include external data such as big data. This is only used at the top management level of an organisation.

III – The different application and usage of Information Systems

Like explained in the previous chapter about the big data, information systems are used in different functions within an organisation. Here we are going to see four of them (the most essentials). Not necessarily all of them are present in a company and not all functions are using an information system but many (especially worldwide organisations) are using information systems at all the levels and for all the functions of the corporation. [45]

A - Marketing

On the first place, we can identify Marketing. This function is directly related the sales especially in the domain of software managing this information. Indeed using this technology will enable the utilisation of data and information from market researches. Those can be internal as well as external of the company. There is no difference from the moment that data is entered into the organisation's database. Once done, a market research can be used for a marketing purpose as well as other functions within a company.

From the exploitation of the information available into the corporate's information system, the company can encourage the conception of new products. Thanks to this system a company will be more able to design new products that match requirements of customers and potential customers.

Another important point is the establishment of prices policies. With the record of previous selling prices, competitors prices, market researches… a company will be able to offer competitive prices to customers. Without this system finding the right selling price is much complicated and the risks are highly increased. Using an information system is making possible the prediction of sales and this is important on a strategic level.

[45] Lavallee, J. and Perras, D. (2006). *La Gestion de L'Entreprise Numérique.* ERPI. Sherbrooke University.

When we talk about marketing indubitably we think of promotion. Indeed the promotion of a product will be affected by an information system. It permits to keep a record of the promotion. Thanks to it reports and analysis will be done in order to figure out if the promotion was done well and affected the sales.

B – Manufacture and Production

In the industrial domain, information systems are essential assets it allows a tracking of every product produced. It will keep a record of all the consumptions that are done. It is useful on all the organisation's levels from the operation to the strategic through the management.

In order to know the quantity to be produced, a company needs to know the sales forecast. This will affect every part of the supply chain. Indeed all the purchases of materials are done regarding the future consumption. The operation's management and delivery are then more efficient.

It also affects the inventory management. Thank to information systems, in a few minutes, or even minutes, someone working in an organisation can tell the exact number of finish product in the warehouse and the quantity of raw materials. But where information system is really useful is when you create stock alerts. This alarm will tell you when to make an order to your supplier regarding your future sales, your stock and the waiting time from your supplier to your manufacture.

C – Finance and Accounting

Information systems are used in finance and accounting for a few reasons. As for manufacture and production, information systems intervene in operations, management and strategic levels.

It is use for budget management, keeping records of the expenses and the incomes. Also this technology enable to calculate production cost in order to know from which selling price a company is making a profit. Invoices edition and the follow up on invoices are done by this system. It saves time and money for the organisation using it.

D – Human resources

If material resources can be managed by information systems, so does the human resources. It intervenes from the formation of the employees to the forecast of future needs.

Managing employees' files, recruitment work conditions… All of this is possible easily with information systems. Many others functionalities are used by human resources such as salary and contracts.

To summarize, we can say that information systems are used for many purpose at all the levels of an organisation, from completing daily tasks to the establishment of strategies. Every information system can either be created for a specific function in order to be used only in a specific way or it can be a really complete system that shares information with all the departments of a corporation.

Conclusion – Part 1

In this part we have seen in detail the usage of big data and its application. As explained in the first chapter about big data, it requires an advanced information system in order to be operational. In the second chapter we have detailed the usages of such technology.

Big data and information system have been now defined. Going forward, we are going to see a practical case of the usage of information system into a worldwide freight forwarding company and also what are the advantages of using big data into the supply chain area.

PART 2 Present and Future in Supply Chain's Information Systems

In this part we are going to have an overview of a real multinational freight forwarding company's information system. Then we will see the combination of: Information System, Big Data and Supply Chain Management.

Chapter 1 - Real case analyse – Alpha

In this chapter we are going to analyse the information system of a company involved in thousands customers' supply chain. Unfortunately, this thesis isn't under a confidential agreement so the name of the company has been replaced by Alpha.

I – Alpha a worldwide freight forwarding company

This company has more than a century of existence and develop its activities more and more every years.

A – History, facts and services about the company

This firm has been created in Bremen in Germany in the 19th century. This company has been created by August Kuehne and Friedrich Nagel. Worldwide this company earn recognition for excellence services. In a 2015 ranking Alpha was the first ocean freight forwarder in the world.[46]

With more than a 200 locations inside more than a hundred countries, Alpha is "everywhere". To summarize, they are in Africa, Asia Pacific, Europe, Middle East and North – South – Central Americas.

The group Alpha owns many other subsidiaries which are providing annex services. BETA is the insurance broker company, so when a customer asks for insurance Alpha directly offers BETA's services. The freight forwarding company is also using one of

[46] Transport Topics News. (13th April 2015). *Top Ocean Freight Forwarders and Airfreight Forwarders*. [ONLINE]. Available at: http://www.ttnews.com/articles/basetemplate.aspx?storyid=37893. [Last Accessed 05/03/2016].

its companies for editing sea waybills. A sea waybill is a mandatory document when sending a shipment overseas. The firm called Blue Anchor Line is specialised and only do provide this document. But it does not work only for Alpha.

Inside Alpha, we count seven business units that are delivering services to customers. We can find Sea Logistics, Air Logistics, Contract Logistics, Integrated Logistics, Overland, Insurance Brokerage and finally Real Estate.

1 – Sea Freight and Air Freight

Alpha provides services in ocean freight as well as air freight. It is the link between a supplier and its customer anywhere in the world. If your company needs to send goods on the others side of the world and is not able to handle it, Alpha do it for you with from A to Z., from picking up the shipment at the warehouse to the final delivery on another continent through the customs clearance.

The incoterm used doesn't matter as long as your customer and your company agreed on the terms of the shipping. From the quotation to the delivery, Alpha will guide you and can also offer you help with the travel insurance with BETA. [47][48]

2 - Contract Logistics

In line with the priorities of the Focus Plan, 6 Focus Services have been selected based on careful research and analysis carried out by our global expert communities. The 6 focus services that have been identified are Production Logistics, Spare Parts Logistics, Distribution, eCommerce, Co-packing, and Advanced Warehousing. In terms of defining the focus services then the following considerations have been applied:

- Business potential and scalability of existing Alpha solutions in Contract Logistics,
- Portfolio per each Focus Service defined with scalable 'service components',
- Identified exemplary operational sites,
- Mapped out key IS scope and gaps,

[47] Alpha. (2016). *Sea Freight at Alpha*. [ONLINE]. Available at: http://Alphaet.int.Alpha/bu/sea/. [Last Accessed 05/03/2016]. From Internal ALPHA Documentation.
[48] Alpha. (2016). *Air Freight at Alpha.* [ONLINE]. Available at: http://Alphaet.int.Alpha/bu/air/. [Last Accessed 05/03/2016]. From Internal ALPHA Documentation.

- Identified market trends and customer needs,
- Identified the USP (unique selling point) of the Alpha service offering.[49]

3 – Integrated Logistics

The mission of this business unit is to create supply chains driven by lean, agile and demand. The Integrated Logistics provides managed services tailored to meet customer challenges, with an emphasis on simplifying supply chain complexity; reducing inventory and logistics costs while maximizing service levels. Integrating these improvement solutions with collaborative concepts into a cohesive model creates a competitive advantage for our customers in the marketplace.

At Alpha, Integrated Logistics can be define as an end-to-end management, covering several service modes across several geographies/regions, providing additional value, based on a customer contract. [50]

4 – Overland

As well as sea freight and air freight, Alpha will offer you a complete service for you delivery using train or trucks. Alpha will go along with customer's company in order to define the needs and requirement of the delivery.

With thousands of trucks around the world, Alpha has solutions for your deliveries 365 days per year.[51]

5 – Insurance brokerage

Established by Alpha, BETA is a fully owned subsidiary of the Alpha Group. Since 1972 it has been BETA's core competence to support Alpha as well as external companies in the design and building of cost-effective insurance programs.

BETA is an independent commercial insurance broking firm specializing in the provision of risk management and insurance solutions, products and services. Its

[49] Alpha. (2016). *Contract Logistics at Alpha*. [ONLINE]. Available at: http://Alphaet.int.Alpha/bu/cl/. [Last Accessed 05/03/2016]. From Internal ALPHA Documentation.
[50] Alpha. (2016). *Integrated Logistics at Alpha*. [ONLINE]. Available at: http://Alphaet.int.Alpha/bu/il/. [Last Accessed 05/03/2016]. From Internal ALPHA Documentation.
[51] Alpha. (2016). *Overland at Alpha*. [ONLINE]. Available at: http://Alphaet.int.Alpha/bu/ol/. [Last Accessed 05/03/2016]. From Internal ALPHA Documentation.

network of offices spans 30 countries from where BETA deploys insurance, claims and risk management specialists serving customers in all industry sectors throughout all the major economies. [52]

6 – Real Estate

The Alpha Business Unit Real Estate is the most strategic one. It provides worldwide active support in the development, planning and realization of new facilities as well as the leasing of new facilities, the renewal of contracts and sales of individual projects.

The leasehold project support focuses primarily on the selection of best suitable investors or developers and the subsequent negotiations, contract management and technical supervising.

Other activities are the constant monitoring of the global real estate markets and benchmarking, the conduction of real estate due diligences and an active portfolio management of the ALPHA freehold Real Estate assets.

For some time, the strategy has been to focus on the development of green warehouses and reduce CO2. [53]

To sum up we can say that Alpha provide services and solution for all the supply chain all around the world. Every year the company develops its offers in order to match new customers' needs.

B – Functions – how does it work

II – Information systems at Alpha – Research analysis

In order to have an overview of how works an implementation of an information system, I have interviewed on May 10th 2016 Carolin Schindler, the Operation Excellence Manager at Alpha Canada Ltd.

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[52] Alpha. (2016). *Insurance Brokerage at Alpha.* [ONLINE]. Available at: http://Alphaet.int.Alpha/bu/insurance_brokerage/. [Last Accessed 05/03/2016]. From Internal ALPHA Documentation.

[53] Alpha. (2016). *Real Estate at Alpha.* [ONLINE]. Available at: http://alphaet.int.alpha/bu/real_estate/. [Last Accessed 05/03/2016]. From Internal ALPHA Documentation.

Before being in this position, she moved from Germany to Canada where she was in charge of implementing the new information systems in Canada for the past years.

The chance I had for this interview was that information systems at Alpha are currently being changed worldwide.

You can find in the Annex the transcript of the interview.

A – How the implementation works

Alpha is a company which make a point of honour to use its own information systems since its creation in 1890. Many companies are using SAP systems which are well known and with some adjustment, relatively easy to implement into a company. But using this kind of system was not relevant for Alpha. Furthermore, using a system from another company means relying on this provider.

It took about ten years from the first idea of this brand new system and a team of ten people to develop it. In order to make it matches all the requirements of each countries the developing team had many meeting with managers from all around the world, then the team was able to amend the system and make it effective.

Basically, Alpha developed one main information system called SALog and three other systems (BPA, Acon New and QT). SALog includes two separate systems that are working the same ways; the only difference in one is for sea logistic (called SeaLog) and the other one is for air logistic (called SaLog). The Information Technology (IT) team chose to split them because of the number of files; indeed there are thousands of active files at the same time so in order to make the system faster they designed it this way.

Developing those systems represent a cost, about 60 million euros. At the beginning of June 2016, there was in Canada an event in order to celebrate the one year of SALog successful implementation. During an informal discussion I had, the Toronto office manager advised me that a return on investment is expected in about fifteen years. But this is not really important, because thank to those new information systems, Alpha is about five years ahead of competitors.

At the end of the conception, the systems were tested in Ireland in 2014. Then the implementation started in all the Alpha Offices, country by country (see Annex for Implementation Schedule). The test was successful and it is really important because as it represents millions of euros invested, a failure would have been devastating. We all have in mind the example of DHL which tried to develop a system but it didn't worked and costed a huge amount of money to the German firm.

Before and after implementing a new system, employees have to be properly trained. It represents an investment of time and money. At Alpha the training last for three days and since there are periodically new training sessions. There was a transition to go from the previous system to the new one. This transition last for one to two months. Then Alpha noticed that the productivity dropped by around 20%. Employees' productivity is now back to the level zero (before the implementation) and according to the forecasts, it will continue to grow until being 20% more efficient in about one and a half year.

B – How the system works

SALog is a Material Requirement Planning (MRP) that gives access to files, shipments in order to treat them, create the documentation needed and also send EDI to suppliers. Acon New and QT (Quotation Tool) are also MRPs that are used respectively for invoicing and Quotes. BPA (Business Advanced Planning) is a different system because it is an Advanced Planning System (APS). This system works jointly with SALog. It gives tasks to operators, makes alerts when and task has not been completed and is overdue. All of those systems are linked. For instance when a quote done on QT is approved it will create the file on SALog, BPA will tell the operator what is required to do and then the quote will be invoiced by Acon New regarding the quotation.

SALog as a Friendly interface and is more easy to use. You can see the differences between the two systems without even using them. The Figure 6 was the previous system called CIEL and in the Figure 7 the new one: SeaLog & BPA (in the top left corner)

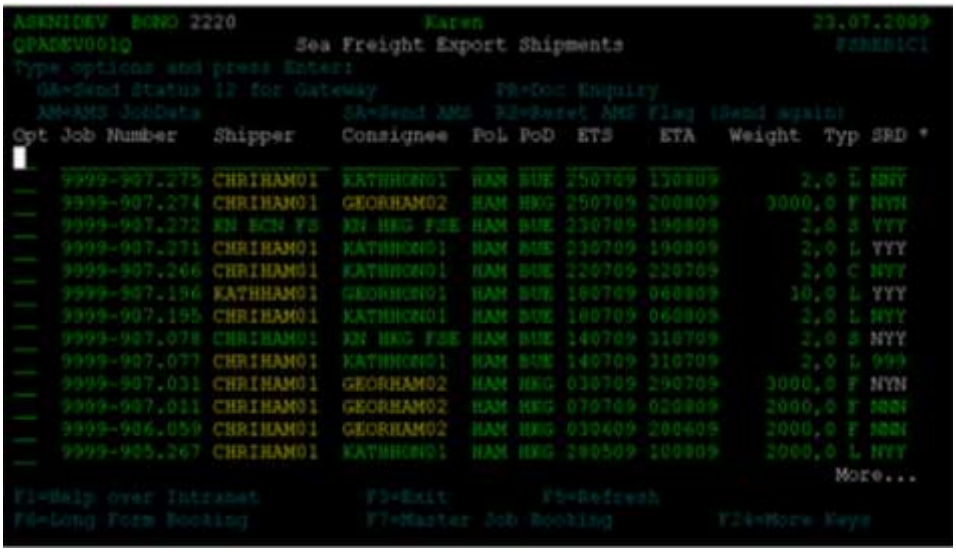

Figure 6 – Old Alpha's information system – CIEL

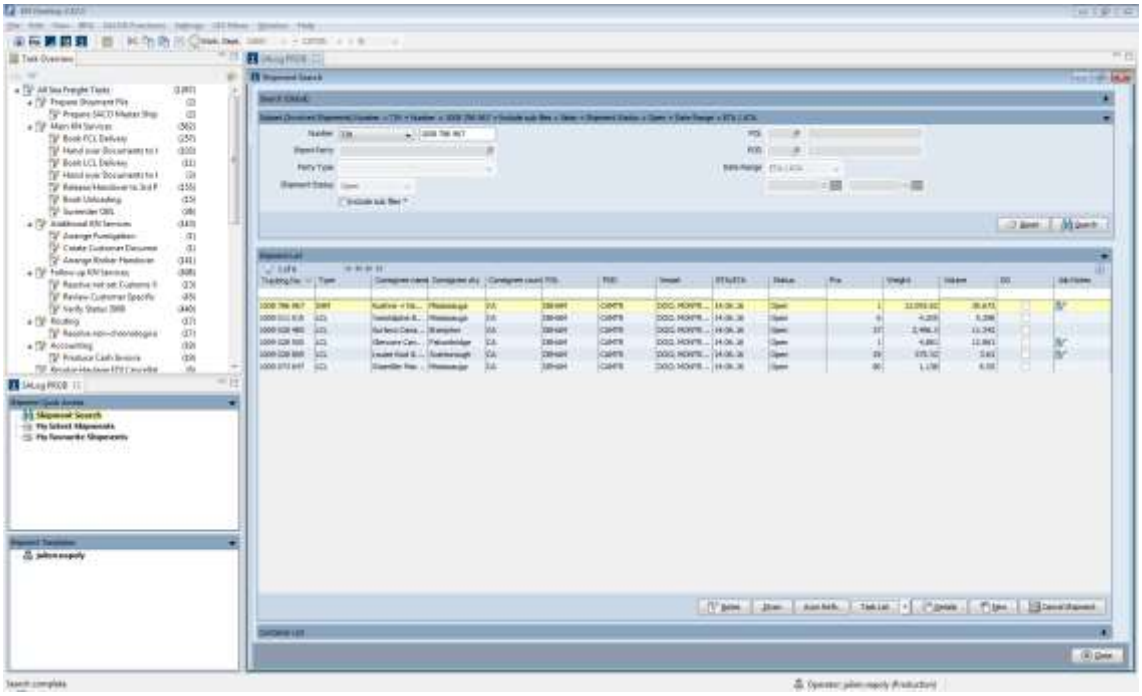

Figure 7 – New Alpha's information systems – SeaLog & BPA

In this chapter we have seen the procedure to implement an information system (or in that case more than one) in a worldwide company. This example didn't show the relation with big data so now we are going to analyse the effects of information systems using big data implemented for the supply chain management of an organisation.

Chapter 2 – The combination of information systems and big data in the supply chain

In this chapter we are going to see if the hypothesis that an information system using big data implemented in order to manage a company supply chain is profitable.

Big data is a technology that gains ground every year. In France, a study made by the Club Decision DSI show the difference between 2015 and 2016 regarding the big data (see Graph 3). This study has been made in April and May 2016 and the answers came from 318 persons working for big French companies (with at least 300 employees until more than 5000). Those persons are decision makers in information systems from different working areas such as services, distribution, healthcare, public sector, bank…[54]

This study shows an increase in the interest of big data. Indeed the number of companies who are studding it and think of implementing it increased by 11 points within a year (+39.29%). This number is constantly increasing and not even in France. Every company in the world will want it.[55] It is like the ascent of Facebook which had in January 2004 1 million members and a year after the company counted 12 million[56] in order to reach today 1.654 billion of users.[57] This example might be a little extreme but shows how a new revolutionary concept can be fast to be adopted by people. We also can see the same thing with personal computers. In fact, at the beginning of 1980 there were "only" 1 million personal computer that have been sold and 6 month later the number was 30 million. That is why, if the concept of big data continue to grow, within a few years, all the competitive company are going to use it.[58] It is especially true for the supply chain area.[59]

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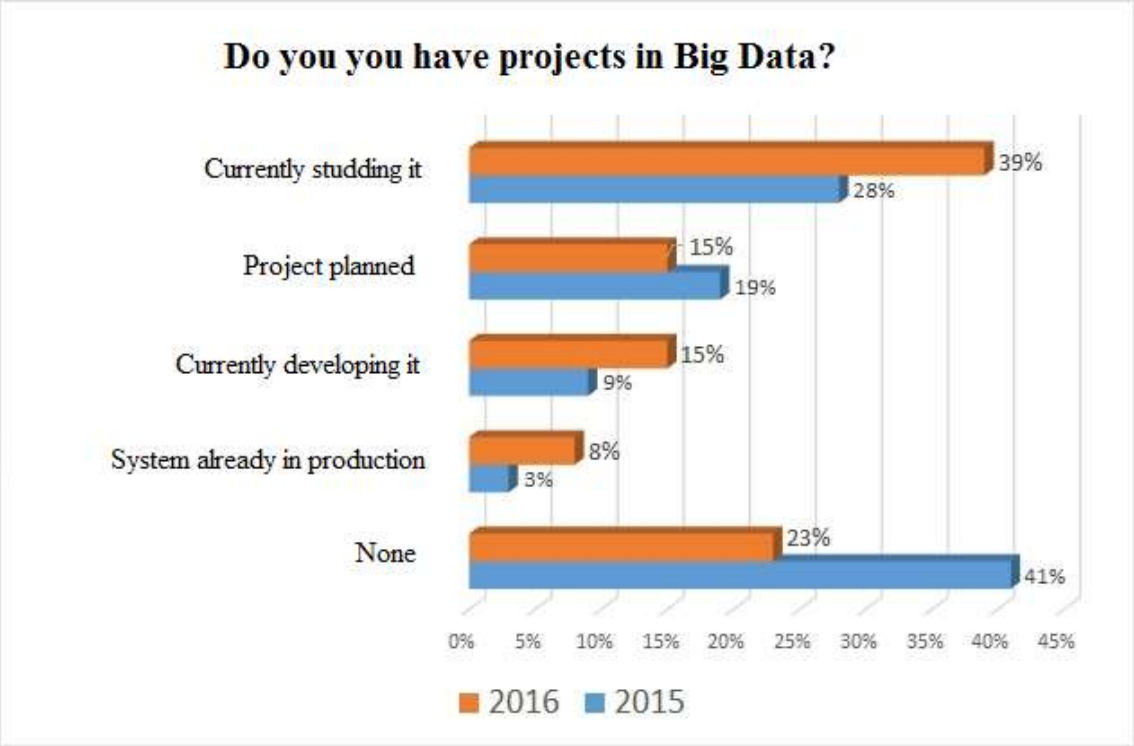
[54] Club Decision DSI (24th May 2016). *De plus en plus de DSI français attirés par le Big Data*. [ONLINE]. Available at: http://www.clubdecisiondsi.fr/de-plus-plus-de-dsi-francais-attires-big-data/ [Last Accessed 25/05/2016].
[55] Pigni, F., Piccoli, G. and Watson, R. (1st April 2016). *Digital Data Streams: Creating Value From The Real-Time Flow Of Big Data.* California Management Review
[56] Aussitôt. (5th January 2016). *La fabuleuse histoire de Facebook.* [ONLINE]. Available at: http://www.aussitot.fr/facebook/la-fabuleuse-histoire-facebook.html [Last Accessed 25/05/2016].
[57] Fredouelle, A. (31st March 2016). *Nombre d'utilisateurs de Facebook dans le monde* [ONLINE]. Available at: http://www.journaldunet.com/ebusiness/le-net/1125265-nombre-d-utilisateurs-de-facebook-dans-le-monde/ [Last Accessed 25/05/2016].
[58] Pigni, F., Piccoli, G. and Watson, R. (1st April 2016). *Digital Data Streams: Creating Value From The Real-Time Flow Of Big Data.* California Management Review
[59] Sanders, R.N. (1st April 2016). *How to Use Big Data to Drive Your Supply Chain* California Management Review



Graph 4 – The progression of Big Data in France between 2015 and 2016[60]

I – Supply Chain's information system

A company producing or selling goods can either request services from a specialized company in order to manage its supply chain or do it itself. There are also companies working in logistics, warehousing, consultancy… that are using those kinds of specialized systems. Depending on their willingness and ability, an organisation can choose to create its own system (as Alpha) or to buy a system. In this second solution the software itself represents about 20% of the investment and 80% is dedicated for the training, the updates, IT materials…[61]

In the previous chapter we talked about supply chain's information systems with MRP and APS. In addition, there are other types of information system specialised for supply chain that exist such as Capacity Requirement Planning (CRP), the Manufacturing

[60] Crochet-Damais, A. (24th May 2016) *Les DSI français se tournent en masse vers le Big Data*. [ONLINE]. Available at: http://www.journaldunet.com/solutions/dsi/1178727-les-dsi-francais-mettent-le-cap-sur-le-big-data/ [Last Accessed 25/05/2016].
[61] Ruel, S. (December 2016). *Systèmes d'Information de la Logistique*. Sup de Co la Rochelle. BBA International 4th year.

Resource Planning (MRP2) and Enterprise Resource Planning. They are complementary and work together.

We can represent them as in the following Figure 8.

Figure 8 – The forecast systems in Supply Chain

The APS is the most complete system for a company. But on a different level of information and forecasting, we have the Collaborative Planning Forecasting and Replenishment (CPFR). It defines a system of sharing information with partners. This concept has been created in the 90s' and it was used mainly by retailers. This collaborative system allows companies to share their information about futures expected sales with their suppliers. This reduces the bullwhip effect, so the costs (logistics and storage) and the opportunity cost because of the out of stock.

In the same idea of sharing information with partners, we can find another system called Sharing Replenishment Management (SRM). In this system we can sort three different types which are:

- Vendor Management Inventory (VMI)
- Supplier Managed Inventory (SMI)
- Co-Managed Inventory (CMI)

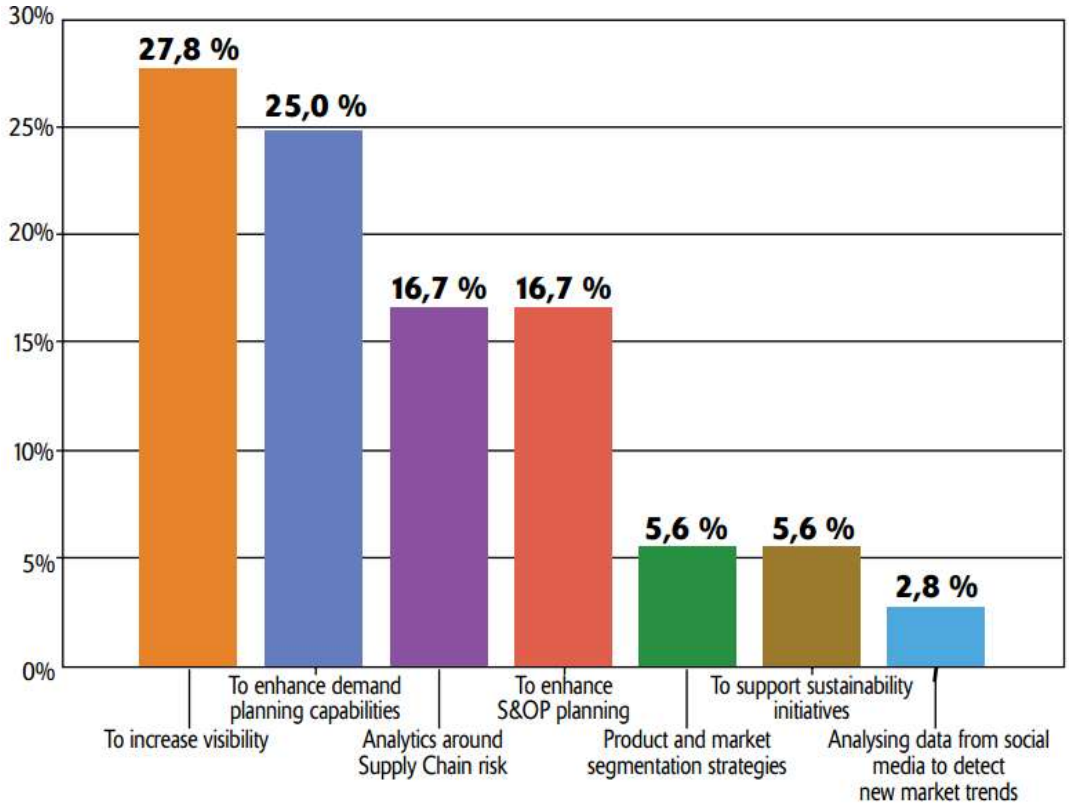
Using a VMI system means that it is the vendor of finish products that is managing its retailer's stock and replenishment. An SMI system works almost the same way; the manufacturer inventory is managed directly by its raw material's supplier. And finally the CMI works like a VMI but the difference is that the retailer has to approve the replenishment before making the delivery. [62]

[62] Ruel, S. (December 2016). *Systèmes d'Information de la Logistique*. Sup de Co la Rochelle. BBA International 4th year.

II Cost Reduction and efficiency – Benefit – Big data & supply chain

The whole point of investing into a company is to get return on the investment made. As seen before, information systems can cost millions of euros to be implemented. That is why a company should be able to exploit it a make profit out of it. The risk with the usage of big data is to drown into to much information. Today, supply chain's information systems are showing their limits. APS can't handle zetabytes of data because their conception was done in the way that regarding previous sales the APS was providing sales forecast. So it was a system based on past events, but big data is real-time, otherwise the data collected are obsolete. In order to face it, the first challenge is to create an APS able to manage all the flow of data.[63]

Once the implementation is done, we will often see a return on investment on a long term bases as it is shown in the Graph 4. This will also depend on some characteristic about your company such as: is it a multinational or a SMC (Small and Medium Company); the way you use it (if your company is able to manage it efficiently);…



Graph 4 – Greatest ROI on Big Data in the Supply Chain

[63] Polge, C. (October 2014). *Quelles prévisions et planifications pour demain ?*. Supply Chain Magazine. N°88. Pages 74 to 82.

A – Logistics costs

Transportation Management System (TMS) are information systems that are used in logistics. They are important because this is the system that allows a tracking and it can also design the best way to use like ORION (a UPS system). This technology uses data analytics. [64]

Analytics applications are the future. Using big data involve using analytical tools otherwise it is just a huge mountain growing permanently. The application of this technology in logistics is useful as it can reduce delivery time regarding current traffic or the weather or any other parameter that a company would judge pertinent. So if the delivery time it shorter, the service can be sold at a higher price, there are no additional charges because of delays, there might be less gas consumed during the transportation… [65]

Every company can find its own way to make this system valuable.

B – Warehousing costs

Warehouse Management System (WMS) are information systems that are used in warehouses, in order to manage efficiently the stock of goods. Analytical tools can be even more used for a WMS than TMS. Indeed storage costs are important and reducing the stock at the retail store or at the warehouse is a risky challenge because too much stock means more money spent in it and if the stock is not sufficient, the company can become out of stock and miss one or more sells.

With the usage of big data, the sales forecast allows a company to keep it stocks at minimum because all the future sells are predicted. As the alert stock is much lower the company will be able to work on just-in-time. [66]

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[64] Polge, C. (October 2014). *Quelles prévisions et planifications pour demain ?*. Supply Chain Magazine. N°88. Pages 74 to 82.
[65] Sandler, N. (Spring 2016). *How to use Big Data to Drive Your Supply Chain*. University of California. Vol.28, N°3.
[66] Polge, C. (January 2007). *Prévision et Planification : Un Mariage de Raison.* Supply Chain Magazine. N°11. Pages 40 to 50.

Unfortunately we don't have actual data about a successful company using big data, to be presented in here. But in the meantime the explanations confirm my hypotheses regarding the profitability of the implementation of this system. But the initial investment is high and requires savoir-faire in order to exploit it and make money out of it.

Conclusion – Part 2

In this part we have seen Alpha's services and its new information systems' implementation. Changing an information system within a worldwide company is not an easy process. It takes time, money and there is a loss of productivity right after the implementation because even if it is easier to use than the previous system it permits to do complex operations.

We also have been through the different types of information systems that are used in the supply chain. Not all of the existing types are listed but the main ones are presented. And this part ended with a general overview of the impact on supply chain of big data. It shown that this initial investment might by heavy but the gain (the money saved) is even more important after a few years.

CONCLUSION

Technologies are changing every day. Once Bill Gates said that, in order to be up to data all the time with computer's technology, a person would have to buy a new computer every 6 months. So technologies are being updated constantly and if a company wants to stay in the race and being competitive, it should upgrade its information systems.

The first part of this research focused on big data. This concept is revolutionary because it means that companies are able to change their operations within a few minutes in order to match real time data analysis. The beauty of this technology is that it assists in the decision making process. So maybe in a few decades, CEOs are going to be obsolete and all the decisions will be made by a computer, an artificial intelligence. Then the research was dedicated to information systems. As explained all the functions inside a company needs to have an access. But there are three different levels: Strategic, Managerial and operational.

In order to have an example we used a real company case to analyse the implementation of an information system. And I think we can say it was well prepared, and they did it right. Since, Alpha invested in software companies.

This thesis has one major limit, the lack of data. I mean for the research part that would have been better to have other companies' interview. Unfortunately all the companies I have tried to contact refused interview because this kind of information is strategic and they don't want to be used against them.

Final we have seen the advantage against competitor and also the profit that can generate an information system using big data implemented for a supply chain management purpose.

The creation of Internet initiated a revolution. It was used to take information, now it is used to give information (Social Medias, GPS…) and those are collected. Since a few years those data are being exploited in order to improve companies offers. But this might not stop there. So what would be the next step?

Annexes

Annex 1: Confidential Agreement

Annex 2: Alpha Implementation Schedule

Annex 1: Confidential agreement

Groupe Sup de Co La Rochelle

CERTIFICAT DE CONFIDENTIALITE

Je soussignée, Caroline HERMET, Directrice du Programme BBA La Rochelle (International Management) certifie que le mémoire de fin d'études de **Monsieur Julien NAPOLY** sera traité par l'école en toute confidentialité.

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Conformément à cette disposition, les deux exemplaires remis par l'étudiant lui seront retournés après correction.

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Fait pour servir et valoir ce que de droit,
A La Rochelle, le 29 Avril 2016

Caroline HERMET
Directrice BBA La Rochelle

Julien NAPOLY
Etudiant BBA La Rochelle

Annex 2: Alpha Implementation Schedule

Region	déc-14	janv-15	févr-15	mars-15	avr-15	mai-15	juin-15	juil-15	août-15	sept-15	oct-15	nov-15
Western Europe	Ireland	Luxembourg	Marocco	Malta	Norway	Portugal	Belgium			La Reunion Denmark Switzerland	France Netherlands	Finland Sweden Spain
North Asia		Macao					Taiwan					Hong Kong
South Asia			Philippines	Bangladesh	Vietnam	Thailand		Pakistan	Japan	Korea Myanmar Singapore	Khambodia Malaysia Indonesia	India
Eastern Europe			Slovenia	Latvia Slovakia	Serbia Ukraine	Belarus	Romania Bosnia-Herzegovina	Lithuania Sakhalin	Hungary Macedonia	Estonia Greece	Albania	Russia Austria Croatia
Middle East + Africa					Bahrain Qatar	Kuwait Mauritius Lebanon	Egypt		UAE Iraq	Uganda Oman Tanzania	Turkey Kenya	Namibia Jordan
South America			Nicaragua	Uruguay	Chile	Ecuador	Honduras	Bolivia	Panama	Argentina	Guatemala Costa Rica	Salvador Trinidad& Tobago
North America						Canada		Mexico				

Region	déc-15	janv-16	févr-16	mars-16	avr-16	mai-16	juin-16	juil-16	août-16	sept-16	oct-16	nov-16
Western Europe	Italy		UK									Germany
North Asia						China						
South Asia	Sri Lanka	Maldives	Australia		N.Zealand							
Eastern Europe	Bulgaria	Poland	Czech Republic Cyprus									
Middle East + Africa		Saudi Arabia	South Africa Mozambique	Israel	Angola							
South America	Cuba Peru		Colombia		Brazil		Venezuela Barbados		Dominican Republic			
North America											United States	

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Bibliography

Articles:

- Applegate, M., Piccoli, G. and Brohman, K. (October 2008). *The Traveler's Agent.* Harvard Business School Case.
- Calais, C. (March 2014) Big Data Big brother will help you. *Supply Chain Magazine.* N°82. Pages 56 to 60.
- International Standard. (15th September 2001). *Information and Documentation – Record Management.* ISO 15489-1. Article 3.15. Page 3.
- Lavallee, J. and Perras, D. (2006). *La Gestion de L'Entreprise Numérique.* ERPI. Sherbrooke University.
- McAfee, A. and Brynjolfsson, E. (1st October 2012) *Big Data: The Management Revolution* Harvard Business Review
- McKinsey Global Institute. (June 2011). Big data: The next frontier for innovation, competition, and productivity. McKinsey & Company
- Pigni, F., Piccoli, G. (March 2013). *Harvesting External Data: The Potential of Digital Data Streams.* MIS Quarterly Executive. University of California. Pages 53 to 64.
- Pigni, F., Piccoli, G. and Watson, R. (1st April 2016) *Digital Data Streams: Creating Value From The Real-Time Flow Of Big Data.* California Management Review
- Polge, C. (October 2014). *Quelles prévisions et planifications pour demain ?.* Supply Chain Magazine. N°88. Pages 74 to 82.
- Ruel, S. (December 2016). *Systèmes d'Information de la Logistique.* Sup de Co la Rochelle. BBA International 4th year.
- Sandler, N. (Spring 2016). *How to use Big Data to Drive Your Supply Chain.* University of California. Vol.28, N°3.
- Van Rijmenam, M. (2014). *Think Bigger : Developing a Successful Big Data Strategy for Your Business*. New York: AMACOM

WebSites:

Aussitôt. (5th January 2016). La fabuleuse histoire de Facebook. [ONLINE]. Available at: http://www.aussitot.fr/facebook/la-fabuleuse-histoire-facebook.html [Last Accessed 25/05/2016

Bureau of Economic Analysis. (5th August 2015). National Data - Table 9.3U. Gross Domestic Product and Final Sales of Software. [ONLINE]. Available at: http://www.bea.gov/iTable/iTable.cfm?reqid=12&step=3&isuri=1&1203=2077#reqid=12&step=3&isuri=1&1203=2077. [Last Accessed 05/03/2016].

Business Dictionnary. (2016). Information System. [ONLINE]. Available at: http://www.businessdictionary.com/definition/information-system.html. [Last Accessed 05/03/2016].

Club Decision DSI (24th May 2016). De plus en plus de DSI français attirés par le Big Data. [ONLINE]. Available at: http://www.clubdecisiondsi.fr/de-plus-plus-de-dsi-francais-attires-big-data/ [Last Accessed 25/05/2016].

Crochet-Damais, A. (24th May 2016) Les DSI français se tournent en masse vers le Big Data. [ONLINE]. Available at: http://www.journaldunet.com/solutions/dsi/1178727-les-dsi-francais-mettent-le-cap-sur-le-big-data/ [Last Accessed 25/05/2016].

Definitions Marketing. (11th January 2016). Definition: Big data [ONLINE]. Available at http://www.definitions-marketing.com/definition/big-data/ [Last Accessed 21/05/2016].

Fredouelle, A. (31st March 2016). Nombre d'utilisateurs de Facebook dans le monde [ONLINE]. Available at: http://www.journaldunet.com/ebusiness/le-net/1125265-nombre-d-utilisateurs-de-facebook-dans-le-monde/ [Last Accessed 25/05/2016].

Gartner. (2016). IT Glossary: Big Data. [ONLINE]. Available at: http://www.gartner.com/it-glossary/big-data/ [Last Accessed 21/05/2016].

GT Nexus. (12th May 2016). Supply Chain : les 5 Grandes Tendances du moment. [ONLINE] Available at: http://www.gtnexus.fr/ressources/articles/supply-chain-les-5-grandes-tendances-du-moment?utm_campaign=2016&utm_medium=EMEASOCIAL&utm_source=LI&utm_content=DIRECT [Last Accessed 20/05/2016].

Histoire de la Machine à Ecrire. (2016). Histoire de la machine à écrire : Origine à nos jours. [ONLINE] Available at : http://www.collection-machineaecrire-campiche-hermes.ch/historique.htm#chrono [Last Accessed 05/03/2016].

IBM. (19th March 2015). Why only one of the 5 Vs of big data really matters. [ONLINE]. Available at: http://www.ibmbigdatahub.com/blog/why-only-one-5-vs-big-data-really-matters [Last Accessed 21/05/2016].

IBM. (2016). What is Big Data?. [ONLINE]. Available at http://www.ibm.com/big-data/us/en/ [Last Accessed 21/05/2016].

Komputer. (20th January 2015) Big Data - jak świat radzi sobie z ogromnymi ilościami danych. [ONLINE]. Available at: http://www.komputerswiat.pl/jak-to-dziala/2015/01/ciekawostki-o-big-data.aspx [Last Accessed 15/03/2016].

Alpha. (2016). Air Freight at Alpha. [ONLINE]. Available at: http://Alphaet.int.Alpha/bu/air/. [Last Accessed 05/03/2016]. From Internal ALPHA Documentation.

Alpha. (2016). Contract Logistics at Alpha. [ONLINE]. Available at: http://Alphaet.int.Alpha/bu/cl/. [Last Accessed 05/03/2016]. From Internal ALPHA Documentation.

Alpha. (2016). Insurance Brokerage at Alpha. [ONLINE]. Available at: http://Alphaet.int.Alpha/bu/insurance_brokerage/. [Last Accessed 05/03/2016]. From Internal ALPHA Documentation.

Alpha. (2016). Integrated Logistics at Alpha. [ONLINE]. Available at: http://Alphaet.int.Alpha/bu/il/. [Last Accessed 05/03/2016]. From Internal ALPHA Documentation.

Alpha. (2016). Overland at Alpha. [ONLINE]. Available at: http://Alphaet.int.Alpha/bu/ol/. [Last Accessed 05/03/2016]. From Internal ALPHA Documentation.

Alpha. (2016). Real Estate at Alpha. [ONLINE]. Available at: http://Alphaet.int.Alpha/bu/real_estate/. [Last Accessed 05/03/2016]. From Internal ALPHA Documentation.

Alpha. (2016). Sea Freight at Alpha. [ONLINE]. Available at: http://Alphaet.int.Alpha/bu/sea/. [Last Accessed 05/03/2016]. From Internal ALPHA Documentation

Le Figaro. Ronfaut, L. (6th June 2014). De Prism à Tor, les dix noms du scandale de la NSA. [ONLINE]. Available at: http://www.lefigaro.fr/secteur/high-tech/2014/06/06/32001-20140606ARTFIG00093-de-prism-a-tor-les-dix-noms-du-scandale-de-la-nsa.php. [Last Accessed 15/03/2016].

My-Business-Plan. (2016). Décryptage du modèle Freemium: comment ça marche ?. [ONLINE]. Available at: http://www.my-business-plan.fr/modele-freemium [Last Accessed 15/03/2016].

SAP. (2016). Big Data. [ONLINE]. Available at: http://go.sap.com/solution/big-data.html [Last Accessed 21/05/2016].

SAS. (2016). What is Big Data?. [ONLINE]. Available at: http://www.sas.com/en_ph/insights/big-data/what-is-big-data.html [Last Accessed 21/05/2016].

Transport Topics News. (13th April 2015). Top Ocean Freight Forwarders and Airfreight Forwarders. [ONLINE]. Available at: http://www.ttnews.com/articles/basetemplate.aspx?storyid=37893. [Last Accessed 05/03/2016].

YouTube. (23rd October 2013). Stop Watching Us: The Video. [ONLINE]. Available at: https://www.youtube.com/watch?v=aGmiw_rrNxk [Last Accessed 15/03/2016]. Electronic Frontier Foundation

YouTube. (25th February 2016) The Human Face of Big Data [ONLINE] Available at: https://www.youtube.com/watch?v=r6v15Z60eUI [Last Accessed 05/03/2016].

YouTube. (2nd December 2014) Reportage spécial investigation: Big Data [ONLINE] Available at: https://www.youtube.com/watch?v=R-1tEh4jTE0 [Last Accessed 05/03/2016].